COMPETENCY BASED EDUCATION

KENYA CERTIFICATE OF BASIC EDUCATION
SENIOR SCHOOL CURRICULUM

CBE Notes

INFORMATION COMMUNICATION TECHNOLOGY NOTES

Grade 11



MADE BY COMPETENT TEACHERS FOR LEARNING
Spirit Of Excellence

COMPETENCE GROUP



SUB-STRAND 1.1: IMPACT OF ICT ON SOCIETY

1.0 INTRODUCTION TO ICT AND SOCIETY

Information and Communication Technology (ICT) has become an important part of modern society. It influences how people communicate, learn, conduct business, access healthcare, receive government services and participate in national development.

In Kenya, ICT has transformed many activities, including mobile banking, online learning, agricultural information services, electronic commerce, digital government services and communication.

For example:

- Farmers use mobile phones to access agricultural information, weather forecasts and market prices.
- Teachers and learners use digital platforms to access educational resources.
- Businesses use computers to manage stock, communicate with customers and process payments.
- Hospitals use digital systems to store patient information and support medical consultations.
- Citizens use online government platforms to access various public services.

However, ICT also presents challenges such as cybercrime, online fraud, misinformation, unemployment caused by automation, privacy violations and excessive dependence on digital devices.

It is therefore important for learners to understand both the positive and negative effects of ICT on individuals, organisations and society.

1.1 MEANING AND DEFINITION OF ICT

Definition of ICT

Information and Communication Technology (ICT) refers to the use of digital technologies, electronic devices, computer systems, communication networks and software to collect, process, store, retrieve, transmit and share information.

ICT combines two major concepts:

A. Information Technology (IT)

Information Technology refers to the use of computers, software and digital systems to process, store, retrieve and manage information.

Examples:

1. Using computers to prepare documents.
2. Using databases to store school records.
3. Using accounting software to manage business transactions.
4. Using computers to analyse examination results.
5. Using digital systems to manage hospital records.

B. Communication Technology

Communication Technology refers to the tools, systems and networks used to transmit and exchange information between individuals, organisations and communities.

Examples:

1. Mobile phones.
2. Internet services.
3. Electronic mail.
4. Video conferencing platforms.
5. Radio and television broadcasting.
6. Social media platforms.

Relationship between IT and communication technology

Information Technology processes and manages information, while communication technology enables the information to be transmitted and shared. Together, they make it possible for people to communicate and access information efficiently.

1.2 COMPONENTS OF ICT

ICT consists of several interconnected components that work together to support information processing and communication.

A. Hardware

Hardware refers to the physical components of a computer or ICT system that can be seen and touched.

Examples:

- Computers and laptops.

- Smartphones and tablets.
- Printers and scanners.
- Servers.
- Routers and modems.
- Projectors.
- Storage devices.

Explanation: Hardware provides the physical equipment required to enter, process, store and display information.

B. Software

Software refers to the programs and instructions that direct computer hardware to perform specific tasks.

Examples:

- Microsoft Word.
- Microsoft Excel.
- Operating systems such as Windows and Linux.
- Web browsers.
- Accounting applications.
- Educational applications.

Explanation: Software enables users to perform activities such as preparing documents, analysing information, communicating and managing business operations.

C. Data

Data refers to raw facts and figures that can be processed into meaningful information.

Examples:

- Learners' examination scores.
- Names of employees.
- Business sales records.
- Hospital patient details.
- Agricultural production figures.

Explanation: Data is entered into ICT systems and processed to produce useful information for decision-making.

D. Peopleware

Peopleware refers to the human beings who operate, manage, develop and maintain ICT systems.

Examples:

- Computer users.
- ICT technicians.
- Software developers.

- Network administrators.
- Data analysts.
- Teachers and learners.

Explanation: Peopleware is important because ICT systems require human input, supervision, maintenance and responsible use.

E. Procedures

Procedures are the rules, instructions and steps followed when operating ICT systems.

Examples:

1. Procedures for logging into a computer system.
2. Steps for backing up information.
3. Rules for accessing school computer laboratories.
4. Procedures for protecting passwords.
5. Guidelines for handling confidential information.

F. Communication networks

Communication networks are systems that connect computers and other digital devices to enable information sharing.

Examples:

- Local Area Networks (LANs).
- Wide Area Networks (WANs).
- Wireless networks (Wi-Fi).
- Mobile communication networks.
- The Internet.

1.3 MEANING OF SOCIETY

Definition

Society refers to a group of people who live together within a particular geographical area or community and interact through shared institutions, relationships, values, rules and activities.

Examples of societies in Kenya include:

- School communities.
- Rural communities.
- Urban communities.
- Business communities.
- Professional communities.
- National communities.

Relationship between ICT and society

ICT and society influence each other in several ways.

1. Society uses ICT to solve everyday problems.
2. ICT changes how people interact and communicate.
3. Society influences the development of new technologies through its needs.
4. ICT creates new employment and business opportunities.
5. ICT influences cultural practices and social relationships.
6. Society establishes laws and regulations to guide the responsible use of ICT.

Example: The increasing need for convenient financial services in Kenya has encouraged the development and use of mobile money services.

1.4 IMPACT OF ICT ON SOCIETY

Definition of impact of ICT on society

The impact of ICT on society refers to the changes, effects or influence that information and communication technologies bring to individuals, organisations and communities.

These changes may be positive or negative depending on how ICT is developed, accessed and used.

ICT has transformed various sectors, including:

1. Education.
2. Communication.
3. Health.
4. Agriculture.
5. Business and commerce.
6. Banking and finance.
7. Government administration.
8. Transportation.
9. Employment.
10. Entertainment and culture.
11. Security.
12. Environmental management.

1.5 POSITIVE IMPACTS OF ICT ON INDIVIDUALS

Individuals are people who use ICT in their daily lives for communication, learning, entertainment, employment and accessing services.

ICT has improved the quality of life of individuals in several ways.

A. Improved communication

ICT has made communication faster, easier and more convenient.

Explanation:

People can communicate with friends, relatives, teachers and colleagues regardless of their geographical locations.

Communication can take place through text messages, voice calls, emails and video conferencing.

Examples:

1. A learner in Narok can communicate with a teacher in Nairobi through an online learning platform.
2. Family members living in different counties can communicate through video calls.
3. Businesses can communicate with customers through social media.
4. Employees can attend online meetings without travelling.

Benefits:

- Saves time.
- Reduces communication costs.
- Promotes social relationships.
- Enables international communication.
- Supports remote working.

B. Improved access to information

ICT enables individuals to access information from different sources within a short period.

Explanation:

The Internet provides access to educational materials, news, research publications, government information and other useful resources.

Examples:

- Learners access digital textbooks and revision materials.
- Farmers obtain weather forecasts.
- Job seekers search for employment opportunities.
- Citizens access public information through government websites.

Benefits:

1. Promotes lifelong learning.
2. Improves knowledge and understanding.
3. Supports informed decision-making.
4. Encourages independent research.
5. Increases awareness of current events.

C. Improved educational opportunities

ICT has expanded access to education through digital learning resources and online learning platforms.

Explanation:

Learners can access educational materials using computers, tablets and smartphones. Teachers can also use multimedia resources to explain difficult concepts.

Examples in Kenya:

- Learners access digital learning materials.

- Teachers prepare electronic teaching notes.
- Students participate in online discussions.
- Learners use educational videos to understand scientific concepts.

Benefits:

- Supports self-directed learning.
- Makes learning more interactive.
- Provides access to additional learning resources.
- Supports learners with different learning needs.
- Encourages creativity and digital literacy.

D. Increased employment opportunities

ICT has created new forms of employment in different sectors of the economy.

Explanation:

Individuals can earn a living by providing digital services, developing software, managing online businesses and offering technical support.

Examples:

1. Software development.
2. Graphic design.
3. Website development.
4. Digital marketing.
5. Data analysis.
6. Computer repair and maintenance.
7. Online content development.
8. Network administration.

Benefits:

- Promotes self-employment.
- Creates opportunities for young people.
- Supports remote working.
- Encourages entrepreneurship.
- Opens international employment opportunities.

E. Improved access to financial services

ICT has made financial transactions more convenient through digital financial services.

Explanation:

Individuals can transfer money, pay bills, purchase goods and access certain banking services using mobile phones and computers.



Examples:

- Sending money through mobile money services.
- Paying electricity bills electronically.
- Purchasing goods using digital payments.
- Checking bank account balances using mobile banking.
- Receiving salaries through electronic transfers.

Benefits:

1. Saves time.
2. Reduces the need to carry cash.
3. Supports financial inclusion.
4. Makes transactions more convenient.
5. Supports small-scale businesses.

F. Improved healthcare access

ICT has improved access to health information and medical services.

Explanation:

Digital technologies enable patients and medical professionals to communicate, manage medical records and access health information.

Examples:

- Telemedicine consultations.
- Electronic medical records.
- Digital appointment systems.
- Medical information websites.
- Computer-assisted medical diagnosis.

Benefits:

- Improves management of patient information.
- Supports communication between medical professionals.
- Saves time when accessing certain services.
- Improves medical record management.
- Supports access to medical advice in remote areas.

G. Improved access to entertainment

ICT provides individuals with different forms of digital entertainment.

Examples:

1. Watching educational and entertainment videos.
2. Listening to digital music.
3. Playing computer games.
4. Reading electronic books.
5. Watching online television programmes.
6. Participating in online creative activities.

Benefits:

- Provides relaxation.
- Supports creativity.
- Promotes cultural exchange.
- Provides educational entertainment.
- Creates opportunities for digital content development.

H. Improved personal organisation and productivity

ICT enables individuals to organise their daily activities more effectively.

Examples:

- Using digital calendars to manage appointments.
- Using spreadsheets to prepare personal budgets.

- Using reminder applications to manage tasks.
- Using navigation applications to identify routes.
- Storing documents electronically.

Benefits:

- Improves time management.
- Reduces paperwork.
- Increases efficiency.
- Minimises errors in record keeping.
- Supports personal planning.

1.6 NEGATIVE IMPACTS OF ICT ON INDIVIDUALS

Although ICT provides many benefits, its inappropriate or excessive use may negatively affect individuals.

A. ICT addiction and overdependence

This refers to excessive or uncontrolled use of digital devices and online platforms that interferes with normal daily activities.

Examples:

- Spending excessive time on social media.
- Constantly checking mobile phone notifications.
- Spending too much time playing digital games.
- Depending entirely on online information without critical evaluation.

Effects:

1. Reduced concentration.
2. Poor time management.
3. Interference with academic activities.
4. Reduced participation in physical and social activities.
5. Difficulty maintaining a balanced daily routine.

B. Health problems

Prolonged or inappropriate use of ICT devices may contribute to physical and psychological health challenges.

Examples of possible problems include:

1. **Eye strain:** Long periods of looking at screens may cause tiredness, dryness and discomfort in the eyes.

2. **Poor posture:** Sitting incorrectly while using computers may contribute to back, shoulder and neck discomfort.

3. **Sleep disturbances:** Using digital devices late at night may interfere with normal sleeping patterns.

4. **Physical inactivity:** Excessive sitting while using digital devices may reduce participation in physical activities.

5. **Mental health challenges:** Cyberbullying, online pressure and excessive social media use may contribute to stress and emotional difficulties.

Ways of promoting healthy ICT use:

- Taking regular screen breaks.
- Maintaining proper sitting posture.
- Using devices in well-lit environments.
- Balancing screen time with physical activities.
- Maintaining appropriate sleeping routines.
- Seeking assistance when experiencing online harassment.

C. Loss of privacy

Privacy refers to an individual's ability to control access to personal information.

ICT may expose personal information when users share sensitive details carelessly or when systems are accessed without permission.

Examples:

- Sharing personal photographs with strangers.
- Publishing private information on social media.
- Using weak passwords.
- Sharing confidential documents publicly.
- Allowing unauthorised applications to access personal information.

Effects:

1. Exposure of personal information.
2. Identity theft.
3. Unwanted communication.
4. Financial losses.
5. Damage to personal reputation.

D. Cybercrime and online fraud

Cybercrime refers to illegal activities carried out using computers, digital devices or communication networks.

Examples:

- Phishing.
- Identity theft.
- Online financial fraud.
- Unauthorised access to computer systems.
- Online impersonation.
- Distribution of malicious software.

Effects:

- Financial losses.
- Loss of personal information.
- Emotional distress.
- Damage to reputation.
- Reduced trust in digital services.

E. Social isolation

Social isolation occurs when individuals have limited meaningful interaction with other people.

Explanation:

Excessive use of digital devices may reduce face-to-face interaction with family members, friends and members of the community.

Effects:

1. Reduced participation in community activities.
2. Weakened interpersonal relationships.
3. Reduced family interaction.
4. Poor development of some communication skills.
5. Increased dependence on virtual relationships.

F. Exposure to inappropriate content

The Internet contains information that may be unsuitable for some users.

Examples:

- Hate speech.
- Violent content.
- Misleading information.
- Online harassment.
- Age-inappropriate material.

Effects:

- Negative influence on behaviour.
- Emotional distress.
- Development of harmful attitudes.
- Misunderstanding of social issues.
- Exposure to online manipulation.

G. Misinformation and disinformation

Misinformation refers to false or inaccurate information shared without necessarily intending to deceive.

Disinformation refers to false information deliberately created or shared to mislead people.

Examples:

- False information about public health.
- Fake examination announcements.
- Misleading financial investment claims.
- Fabricated news reports.
- False information about government services.

Effects:

1. Misleading decision-making.
2. Creating unnecessary fear.
3. Damaging reputations.
4. Encouraging conflict.
5. Reducing public trust in information sources.

H. Financial exploitation

Some individuals may lose money through unsafe online transactions.

Examples:

- Fake online shops.
- Fraudulent investment opportunities.
- Impersonation of legitimate businesses.
- Fake job advertisements requiring suspicious payments.

Prevention:

- Verify sellers before making payments.
- Use trusted payment channels.
- Avoid sharing mobile money PINs.
- Check official websites.
- Report suspicious activities.

1.7 POSITIVE IMPACTS OF ICT ON ORGANISATIONS

Definition of an organisation

An organisation is a structured group of people working together to achieve specific objectives.

Examples in Kenya include:

- Schools.
- Hospitals.
- Banks.
- Government institutions.
- Manufacturing companies.

- Supermarkets.
- Non-governmental organisations.
- Agricultural cooperatives.

ICT has improved the performance of organisations in the following ways.

A. Improved efficiency and productivity

ICT enables organisations to perform tasks more quickly and accurately.

Explanation:

Computers and specialised software automate routine tasks, reducing the time and effort required to complete organisational activities.

Examples:

1. Schools use digital systems to manage learner records.
2. Banks use computer systems to process transactions.
3. Hospitals use electronic systems to manage patient records.
4. Supermarkets use point-of-sale systems to process purchases.
5. Factories use automated equipment in production.

Benefits:

- Saves time.
- Reduces repetitive manual work.
- Improves output.
- Minimises human errors.
- Supports efficient use of resources.

B. Improved record keeping

ICT enables organisations to store, retrieve and update information electronically.

Examples:

- Schools maintain digital examination records.
- Hospitals maintain electronic patient records.
- Businesses store customer information.
- Banks maintain electronic transaction records.
- Government institutions maintain digital databases.

Benefits:

1. Easier retrieval of information.
2. Reduced use of physical storage space.
3. Improved organisation of records.
4. Easier updating of information.

5. Supports informed decision-making.

C. Reduced operational costs

ICT may reduce the amount of money organisations spend on daily operations.

Examples:

- Conducting online meetings instead of travelling.
- Using electronic documents to reduce printing costs.
- Using digital communication instead of expensive postal services.
- Automating repetitive administrative tasks.
- Using electronic payment systems.

Explanation: Organisations can use digital systems to reduce unnecessary expenses and improve resource management.

D. Improved customer service

ICT enables organisations to communicate with customers and respond to their needs more efficiently.

Examples:

1. Banks provide mobile banking services.
2. Supermarkets use electronic payment systems.
3. Schools communicate with parents through digital platforms.
4. Businesses receive customer enquiries through email.
5. Service providers use online support systems.

Benefits:

- Faster response to enquiries.
- Improved customer satisfaction.
- Easier communication.
- Convenient access to services.
- Improved customer relationships.

E. Improved decision-making

ICT enables organisations to analyse large amounts of information and use the results to make decisions.

Examples:

- A supermarket analyses sales records to determine popular products.
- A school analyses examination results to identify learning gaps.
- A hospital analyses patient records to plan services.
- A business analyses customer feedback to improve products.

Benefits:

1. Promotes evidence-based decisions.

2. Helps identify trends.
3. Supports planning.
4. Improves resource allocation.
5. Reduces uncertainty.

F. Improved marketing and advertising

ICT provides organisations with digital platforms for promoting goods and services.

Examples:

- Advertising products through social media.
- Creating business websites.
- Sending promotional emails.
- Publishing digital catalogues.
- Using online marketplaces.

Benefits:

- Reaches a wider market.
- Reduces some advertising costs.
- Enables targeted advertising.
- Improves communication with customers.
- Supports business growth.

G. Improved collaboration and teamwork

ICT enables employees in different locations to work together.

Examples:

- Sharing documents through cloud platforms.
- Conducting virtual meetings.
- Using project management applications.
- Collaborating through online workspaces.

Benefits:

1. Encourages teamwork.
2. Supports remote working.
3. Improves information sharing.
4. Reduces communication delays.
5. Supports completion of projects.

H. Improved security and monitoring

Organisations use ICT systems to protect their property, information and operations.

Examples:

- CCTV surveillance.
- Electronic access control.
- Computerised alarm systems.
- Network security systems.
- Digital attendance systems.

Benefits:

- Improves monitoring.
- Helps protect organisational property.
- Supports access control.
- Helps maintain records of activities.
- Improves information security.

1.8 NEGATIVE IMPACTS OF ICT ON ORGANISATIONS

A. High installation and maintenance costs

ICT systems require financial investment.

Examples of expenses include:

1. Purchasing computers.
2. Buying licensed software.
3. Installing Internet connections.
4. Paying ICT technicians.
5. Maintaining computer networks.
6. Replacing outdated equipment.

Explanation: Small organisations may find it difficult to meet these expenses, particularly when financial resources are limited.

B. Cybersecurity threats

Organisations face security risks when using interconnected digital systems.

Examples:

- Hacking.
- Phishing attacks.
- Ransomware.
- Data breaches.
- Unauthorised access.

Effects:

- Loss of confidential information.
- Financial losses.

- Disruption of services.
- Damage to organisational reputation.
- Loss of customer confidence.

C. Job displacement through automation

Automation refers to the use of technology to perform tasks that were previously completed manually.

Explanation:

Some organisations introduce automated systems to increase productivity and reduce repetitive manual work. As a result, certain job roles may become unnecessary or change significantly.

Examples:

- Automated ticketing systems.
- Self-service checkout systems.
- Computerised record management.
- Automated manufacturing processes.

Effects:

1. Reduction in demand for certain traditional jobs.
2. Need for employees to acquire new skills.
3. Increased unemployment risks in some occupations.
4. Changes in workplace responsibilities.

However, ICT also creates new employment opportunities in areas such as software development, cybersecurity and data analysis.

D. System failure and downtime

System downtime refers to a period when a computer system or network is unavailable or unable to perform its intended functions.

Causes include:

- Hardware failure.
- Software errors.
- Power interruptions.
- Network problems.
- Cyberattacks.

Effects:

1. Delayed service delivery.
2. Reduced productivity.
3. Loss of business opportunities.
4. Customer dissatisfaction.
5. Disruption of operations.

E. Dependence on technology

Some organisations become overly dependent on digital systems.

Explanation:

When important operations depend entirely on ICT, a system failure may affect the entire organisation.

For example, a supermarket may experience difficulties processing payments when its electronic payment system becomes unavailable.

F. Loss of confidential information

Organisations collect and store sensitive information belonging to employees, customers and other stakeholders.

If this information is not properly protected, it may be accessed or disclosed without authorisation.

Examples:

- Employee salary information.
- Customer financial details.
- School learner records.
- Medical records.
- Business financial statements.

G. Rapid technological obsolescence

Technological obsolescence refers to a situation where ICT equipment or software becomes outdated and less suitable for current needs.

Effects:

1. Frequent replacement costs.
2. Increased maintenance expenses.
3. Compatibility problems.
4. Reduced system performance.
5. Need for continuous employee training.

H. Resistance to technological change

Some employees may be unwilling or unable to adopt new ICT systems.

Possible reasons:

- Lack of digital skills.
- Fear of job changes.
- Inadequate training.
- Poor communication during implementation.
- Preference for traditional methods.

Effects: This may slow down the adoption of ICT and reduce the expected benefits.

1.9 POSITIVE IMPACTS OF ICT ON THE WIDER SOCIETY

Society refers to the wider population and communities that interact and share resources, institutions and responsibilities.

ICT has contributed to national development in several ways.

A. Economic development

ICT contributes to economic growth by supporting trade, innovation, productivity and employment.

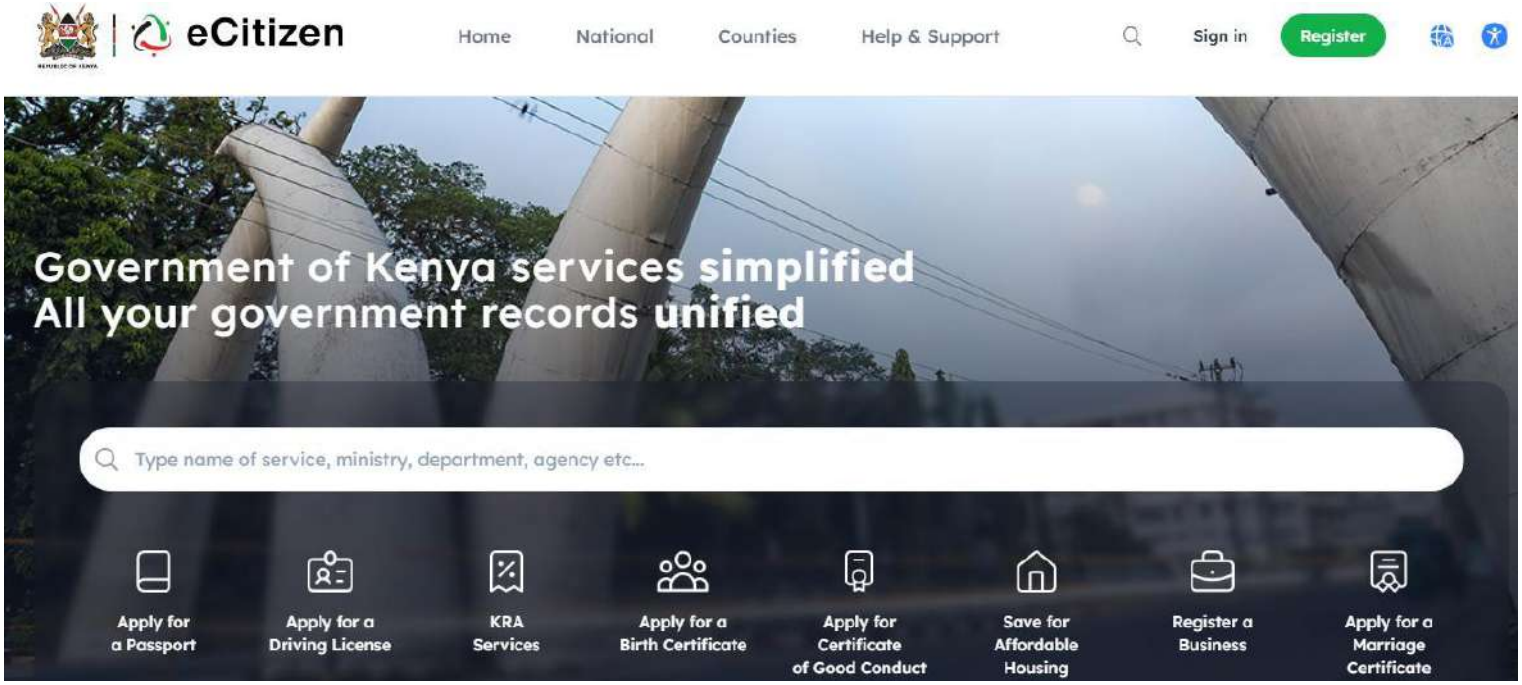
Examples in Kenya:

- Growth of mobile financial services.
- Expansion of online businesses.
- Development of technology-based enterprises.
- Digital marketing.
- Online freelance work.

Explanation: ICT helps businesses reach customers, improve services and participate in wider markets.

B. Improved access to government services

Governments use ICT to make public services more accessible and efficient.



Examples of digital government services in Kenya include:

- eCitizen services.
- KRA online tax services.
- Online application and payment platforms.
- Digital public information services.
- Online business registration services.

Benefits:

1. Reduces unnecessary physical visits to offices.

2. Improves access to public information.
3. Saves time.
4. Supports transparency.
5. Improves service delivery.
6. Makes some government services accessible remotely.

C. Improved agricultural development

ICT supports farmers by providing information and services that improve agricultural activities.



Examples:

1. Accessing weather forecasts.
2. Checking market prices.
3. Receiving information on crop diseases.
4. Accessing agricultural extension advice.
5. Communicating with suppliers and buyers.
6. Learning modern farming practices.

Benefits:

- Supports informed farming decisions.
- Improves access to markets.
- Helps farmers plan planting seasons.
- Promotes agricultural productivity.

- Reduces information barriers.

D. Improved healthcare delivery

ICT contributes to better healthcare services through digital systems.

Examples:

- Electronic patient records.
- Telemedicine.
- Digital health information systems.
- Computerised hospital management.
- Electronic appointment scheduling.

Benefits:

1. Improves access to health information.
2. Supports patient record management.
3. Promotes communication among medical professionals.
4. Supports health research.
5. Improves coordination of services.

E. Improved disaster management

ICT helps communities and government agencies communicate during emergencies.

Examples:

- Weather warning systems.
- Emergency communication platforms.
- Digital mapping.
- Online public safety announcements.
- Communication networks used during floods and droughts.

Benefits:

- Faster communication of warnings.
- Improved coordination.
- Supports emergency planning.
- Helps communities prepare for disasters.
- Supports rescue and response activities.

F. Promotion of national and cultural integration

ICT enables people from different geographical, cultural and linguistic backgrounds to interact.

Examples:

- Sharing Kenyan cultural heritage online.
- Digital preservation of indigenous knowledge.

- Online cultural exhibitions.
- Communication between communities.
- Access to educational content about different Kenyan communities.

Benefits:

1. Promotes cultural understanding.
2. Encourages national unity.
3. Supports cultural preservation.
4. Promotes exchange of ideas.
5. Increases awareness of diversity.

G. Improved public awareness and civic participation

ICT enables citizens to access information about public affairs and participate in discussions on national development.

Examples:

- Accessing public announcements.
- Following parliamentary proceedings.
- Participating in online public consultations.
- Accessing information about public policies.
- Sharing views through digital platforms.

Benefits:

- Promotes informed citizenship.
- Improves public awareness.
- Encourages participation in development.
- Supports accountability.
- Strengthens communication between citizens and institutions.

H. Environmental conservation

ICT supports environmental protection and sustainable development.

Examples:

- Digital monitoring of forests.
- Satellite monitoring of land use.
- Electronic environmental records.
- Digital weather monitoring.
- Online environmental awareness campaigns.

Benefits:

1. Supports environmental research.

2. Improves monitoring of natural resources.
3. Helps identify environmental changes.
4. Promotes environmental education.
5. Supports conservation planning.

1.10 NEGATIVE IMPACTS OF ICT ON THE WIDER SOCIETY

A. Digital divide

Definition

The digital divide refers to the gap between individuals, households, communities or regions that have access to ICT and those that have limited or no access.





Causes of the digital divide:

1. **Poverty:** Some households cannot afford computers, smartphones or Internet subscriptions.
2. **Poor network coverage:** Some remote areas have limited access to reliable communication networks.
3. **Low digital literacy:** Some people lack the skills required to use digital devices effectively.
4. **Electricity challenges:** Communities without reliable electricity may experience difficulties using digital devices.
5. **Disability barriers:** Some digital platforms are not designed to accommodate users with different disabilities.
6. **Geographical inequalities:** Urban areas may have better ICT infrastructure than some rural communities.

Effects of the digital divide:

- Unequal access to education.
- Unequal employment opportunities.
- Limited access to digital financial services.

- Reduced participation in online government services.
- Increased social and economic inequalities.
- Limited access to information.

Ways of reducing the digital divide:

1. Expanding broadband Internet coverage.
2. Establishing community digital learning centres.
3. Providing affordable digital devices.
4. Promoting digital literacy programmes.
5. Improving electricity access.
6. Developing accessible digital platforms.
7. Encouraging investment in rural ICT infrastructure.

B. Spread of misinformation

ICT allows information to spread rapidly through social media, websites and messaging applications.

However, false information can also spread quickly.

Effects:

1. Creates confusion.
2. Encourages public misunderstanding.
3. May cause unnecessary panic.
4. Can damage reputations.
5. May contribute to social conflict.

Control measures:

- Verify information before sharing.
- Use reliable news sources.
- Check publication dates.
- Compare information from different sources.
- Avoid forwarding unverified messages.

C. Environmental pollution through electronic waste

Definition of electronic waste (e-waste)

Electronic waste refers to discarded electrical and electronic equipment that is no longer needed, functional or suitable for use.

Examples:

- Old computers.
- Damaged mobile phones.
- Discarded printers.

- Broken televisions.
- Damaged batteries.
- Obsolete electronic components.



Causes of electronic waste:

1. Frequent replacement of electronic devices.
2. Rapid technological development.
3. Damage to electronic equipment.
4. Improper disposal of devices.
5. Increasing consumption of digital products.

Negative effects of e-waste:

- Environmental pollution.
- Soil contamination.

- Water pollution.
- Health risks from hazardous materials.
- Increased pressure on waste management systems.

Ways of managing electronic waste:

1. Repairing devices instead of discarding them.
2. Reusing functional electronic equipment.
3. Donating usable computers to schools and community centres.
4. Taking obsolete equipment to authorised e-waste collection facilities.
5. Promoting responsible electronic recycling.
6. Educating communities about proper disposal.

D. Increased unemployment in some sectors

Automation may reduce the need for workers to perform certain repetitive tasks.

Examples:

- Automated manufacturing.
- Computerised ticketing.
- Automated customer service.
- Digital document processing.

Effects:

1. Displacement of some workers.
2. Changes in employment requirements.
3. Increased demand for digital skills.
4. Need for retraining and reskilling.
5. Possible income challenges for affected households.

Important point: ICT does not only eliminate jobs. It also creates new occupations and industries. The challenge is to ensure that workers acquire the skills needed in changing workplaces.

E. Threats to national security

ICT systems are important in managing national infrastructure and public services.

However, cyberattacks and unauthorised access to critical information systems may threaten national security.

Examples:

- Attacks on government computer systems.
- Unauthorised access to sensitive databases.
- Disruption of communication networks.
- Online distribution of harmful propaganda.

Effects:

- Disruption of essential services.
- Exposure of confidential information.
- Financial losses.
- Reduced public confidence.
- Threats to national stability.

F. Cultural influence and erosion of local values

ICT exposes communities to different cultures, lifestyles and ideas from around the world.

Although cultural exchange is beneficial, uncontrolled exposure may influence local traditions and practices.

Examples:

- Reduced use of indigenous languages among some young people.
- Adoption of foreign cultural practices without understanding local values.
- Reduced participation in some traditional activities.
- Misrepresentation of cultural practices online.

Positive approach: Society should use ICT to preserve, document and promote Kenyan languages, traditions, history and cultural heritage.

G. Social conflicts and cyberbullying

Digital platforms may be misused to harass, threaten or intimidate other people.

Cyberbullying refers to repeated harmful behaviour directed at an individual through digital communication platforms.

Examples:

- Sending threatening messages.
- Sharing humiliating content without consent.
- Spreading harmful rumours online.
- Creating fake accounts to harass others.

Effects:

1. Emotional distress.
2. Damage to personal reputation.
3. Reduced confidence.
4. Social disagreements.
5. Disruption of learning and work.

Prevention:

- Promote responsible online communication.
- Respect other people's privacy.
- Report abusive content.

- Block harmful accounts.
- Encourage digital citizenship education.

1.11 IMPACT OF ICT ON DIFFERENT SECTORS IN KENYA

ICT affects different sectors in different ways.

Sector	Positive impact	Possible negative impact
Education	E-learning and digital resources	Digital divide and online distractions
Agriculture	Weather information and market access	High cost of technology
Health	Telemedicine and electronic records	Data privacy risks
Banking	Faster electronic transactions	Online financial fraud
Transport	Digital navigation and booking	System failures
Business	E-commerce and digital marketing	Cybersecurity threats
Government	Online public services	Digital exclusion
Manufacturing	Automation and productivity	Job displacement
Environment	Digital monitoring	Electronic waste
Communication	Instant communication	Misinformation

1.12 ICT IN THE EDUCATION SECTOR

ICT has changed the way teaching and learning are conducted in Kenyan schools.



Applications of ICT in education

1. **Digital learning materials:** Teachers and learners access electronic textbooks, notes and revision resources.
2. **Online learning:** Learners can participate in lessons through online platforms.
3. **Computer-based assessment:** Digital systems can be used to prepare, administer and analyse assessments.
4. **Research:** Learners access educational information from digital libraries and academic websites.
5. **School administration:** Schools use digital systems to manage learner records, attendance and examination results.
6. **Multimedia teaching:** Teachers use videos, animations, presentations and simulations to explain concepts.
7. **Communication:** Teachers communicate with parents and learners through electronic platforms.

Challenges of ICT in education

- Unreliable Internet connectivity.
- High cost of digital devices.
- Inadequate electricity.
- Limited digital literacy.
- Cybersecurity risks.
- Unequal access to digital resources.
- Distractions from non-educational online activities.

1.13 ICT IN THE HEALTH SECTOR



Applications

1. Electronic health records.
2. Telemedicine consultations.

3. Digital appointment booking.
4. Medical research.
5. Hospital management systems.
6. Digital medical imaging.
7. Health education and awareness.

Benefits

- Better patient record management.
- Improved communication.
- Easier retrieval of medical information.
- Supports healthcare delivery in remote areas.
- Improved coordination of hospital activities.

Challenges

- High installation costs.
- Exposure of confidential patient information.
- System failures.
- Limited digital skills.
- Unequal access to digital healthcare services.

1.14 ICT IN AGRICULTURE



Applications

1. Accessing weather forecasts.
2. Obtaining agricultural market prices.
3. Identifying crop diseases using digital resources.

4. Accessing information on modern farming techniques.
5. Communicating with agricultural experts.
6. Marketing agricultural products online.
7. Monitoring farms using digital technologies.

Benefits

- Improved farming decisions.
- Increased access to agricultural information.
- Better market opportunities.
- Improved communication.
- Support for agricultural productivity.

Challenges

- Limited network coverage in some areas.
- High cost of digital equipment.
- Limited digital literacy.
- Inadequate access to reliable information.
- Dependence on electricity and connectivity.

1.15 ICT IN BUSINESS AND COMMERCE



Electronic commerce (e-commerce) refers to the buying and selling of goods and services through electronic networks, particularly the Internet.

Applications of ICT in business

1. Online marketing.
2. Electronic payments.
3. Stock management.
4. Customer relationship management.
5. Online shopping.
6. Electronic accounting.
7. Digital communication.
8. Business data analysis.

Benefits

- Access to wider markets.
- Reduced transaction time.
- Improved customer service.
- Better stock management.
- Increased business efficiency.
- Easier communication with suppliers.

Challenges

- Online fraud.
- Data security risks.
- Internet connectivity problems.
- High technology costs.
- Competition from other online businesses.

1.16 ICT IN BANKING AND FINANCIAL SERVICES

ICT has transformed the financial sector by making financial services more accessible.

Examples in Kenya include:

- Mobile money services.
- Internet banking.
- Mobile banking applications.
- Electronic funds transfers.
- Automated teller machines (ATMs).
- Electronic payment systems.



Benefits

1. Faster money transfers.
2. Convenient bill payments.
3. Reduced need to carry cash.
4. Improved financial record keeping.
5. Access to financial services beyond traditional banking hours.
6. Supports business transactions.

Challenges

1. Online financial fraud.
2. Unauthorised access to accounts.
3. Network interruptions.
4. Transaction errors.
5. Digital exclusion.
6. Losses resulting from unsafe transactions.

1.17 COMPARISON BETWEEN ORGANISATIONS THAT USE ICT AND THOSE THAT DO NOT

One of the important inquiry questions in this sub-strand is:

How does the performance of organisations using ICT compare to those that do not?

Organisations that effectively use ICT may perform better than those relying entirely on manual systems. However, the actual performance depends on the quality of technology, management, staff skills and available resources.

Area of operation	Organisations using ICT	Organisations not using ICT
Communication	Faster electronic communication	May rely on physical letters and manual communication
Record keeping	Electronic storage and retrieval	Paper-based records
Data processing	Faster computerised processing	Slower manual processing

Customer service	Online support and electronic communication	May require physical visits
Marketing	Online advertising and digital platforms	Mainly traditional advertising
Decision-making	Data analysis and digital reports	May rely on manual analysis
Stock management	Computerised inventory systems	Manual stock records
Financial transactions	Electronic payments and transfers	May rely more on cash and manual records
Collaboration	Virtual meetings and document sharing	More dependence on physical meetings
Productivity	Automation can increase output	Repetitive manual activities may take longer

Advantages of organisations using ICT

1. Faster completion of tasks.
2. Improved accuracy.
3. Better information management.
4. Reduced paperwork.
5. Improved communication.
6. Wider market access.
7. Better customer service.
8. Improved monitoring and evaluation.

Challenges faced by organisations using ICT

1. High installation costs.
2. Cybersecurity threats.
3. System failures.
4. Need for employee training.
5. Frequent software updates.
6. Dependence on electricity and Internet connectivity.

Advantages of organisations not using ICT

Although organisations that do not use ICT may face operational limitations, they may have certain advantages in specific situations.

1. Lower initial expenditure on computer systems.
2. Less dependence on Internet connectivity.
3. Fewer technology-related maintenance requirements.
4. Some traditional activities may be performed without specialised digital skills.

Limitations of organisations not using ICT

1. Slow information processing.
2. Difficulties managing large records.

3. Delayed communication.
4. Limited access to wider markets.
5. Increased paperwork.
6. Difficulties competing with technologically advanced organisations.

Conclusion: ICT can improve organisational performance when properly implemented. Organisations should invest in suitable technology, train employees and establish appropriate security measures.

1.18 RESPONSIBLE USE OF ICT IN SOCIETY

Responsible ICT use refers to the ethical, safe, lawful and appropriate use of digital devices, computer systems and communication networks.

Every ICT user has a responsibility to protect themselves, other people and the digital environment.

A. Practising digital citizenship

Digital citizenship refers to the responsible and appropriate participation of individuals in the digital environment.

Good digital citizenship involves:

1. Respecting other users online.
2. Communicating politely.
3. Avoiding cyberbullying.
4. Respecting copyright.
5. Sharing accurate information.
6. Protecting personal information.
7. Following online rules and regulations.

B. Protecting personal information

Users should take measures to safeguard confidential information.

Practices include:

- Using strong passwords.
- Avoiding sharing passwords.
- Activating additional account security where available.
- Avoiding suspicious links.
- Logging out of shared computers.
- Limiting unnecessary sharing of personal information.

C. Observing copyright laws

Copyright refers to the legal protection given to creators of original works.

Examples of copyrighted materials include:

- Books.
- Photographs.

- Music.
- Videos.
- Computer programs.
- Digital educational materials.

Responsible practices:

1. Acknowledge sources of information.
2. Obtain permission where required.
3. Avoid unauthorised copying.
4. Use properly licensed materials.
5. Respect intellectual property rights.

D. Promoting healthy ICT use

Users should develop healthy digital habits.

Examples:

- Taking regular breaks.
- Maintaining correct sitting posture.
- Avoiding excessive screen use.
- Balancing online and offline activities.
- Using appropriate screen brightness.
- Avoiding unnecessary device use during sleep hours.

E. Preventing cybercrime

Users should:

1. Avoid sharing confidential information with strangers.
2. Use trusted websites.
3. Verify online transactions.
4. Install security updates.
5. Use reputable security software.
6. Report suspicious activities.
7. Avoid opening unknown attachments.

F. Promoting environmental responsibility

ICT users should:

- Dispose of electronic waste properly.
- Reuse functional devices.
- Repair equipment where practical.
- Switch off unused equipment.

- Support electronic recycling programmes.
- Avoid unnecessary replacement of functional devices.

1.19 GOVERNMENT'S ROLE IN PROMOTING RESPONSIBLE ICT USE IN KENYA

The Kenyan government plays an important role in promoting the development, regulation and responsible use of ICT.

A. Development of ICT infrastructure

The government supports the expansion of:

- Broadband Internet.
- Fibre-optic networks.
- Communication infrastructure.
- Digital public service systems.
- ICT facilities in learning institutions.

B. Development of ICT policies and laws

Policies and laws provide guidelines on the use of technology, information protection and online activities.

Relevant Kenyan legal and institutional frameworks include:

1. **The Constitution of Kenya, 2010:** Provides for rights and freedoms, including privacy and access to information.

2. **The Kenya Information and Communications Act:** Provides a legal framework for the regulation of information and communication services.

3. **The Data Protection Act, 2019:** Provides for the protection of personal data and regulates its processing.

4. **The Computer Misuse and Cybercrimes Act, 2018:** Addresses various computer-related offences and cybercrime activities.

5. **The Access to Information Act, 2016:** Provides a framework for access to information held by public entities and certain private bodies.

C. Promotion of digital literacy

The government and other stakeholders promote digital skills through:

- ICT training programmes.
- Digital learning initiatives.
- Public awareness campaigns.
- Training in computer applications.
- Community digital skills development.

D. Protection of personal data

The Office of the Data Protection Commissioner (ODPC) is an important institution in Kenya responsible for overseeing the implementation of data protection requirements.

Its role includes:

- Promoting awareness of data protection.

- Supporting compliance with data protection requirements.
- Addressing data protection complaints.
- Providing guidance on personal data handling.

E. Promoting cybersecurity

The government works with relevant institutions and stakeholders to improve cybersecurity awareness, coordination and protection of digital infrastructure.

1.20 WAYS OF MAXIMISING THE POSITIVE IMPACTS OF ICT IN SOCIETY

The positive effects of ICT can be increased through responsible planning and implementation.

1. **Improving ICT infrastructure:** Expanding Internet coverage and electricity access makes digital services available to more communities.

2. **Providing digital literacy training:** Training enables people to use technology effectively and safely.

3. **Promoting affordable ICT devices:** Affordable devices increase access to digital resources.

4. **Strengthening cybersecurity:** Appropriate security measures reduce cybercrime and protect information.

5. **Encouraging innovation:** Supporting technology-based innovations promotes economic development.

6. **Promoting digital inclusion:** Designing accessible digital systems ensures that people with different needs can participate.

7. **Supporting local digital content development:** Developing local educational and cultural materials makes ICT more relevant to Kenyan communities.

8. **Promoting responsible online behaviour:** Digital citizenship education encourages respectful and ethical use of technology.

9. **Improving data protection:** Organisations should protect the personal information of their customers, employees and other users.

10. **Promoting electronic waste management:** Responsible disposal reduces environmental pollution.

1.21 DEVELOPING DIGITAL CONTENT TO CREATE AWARENESS ON THE IMPACT OF ICT

Digital content refers to information created and shared in electronic formats.

Examples include:

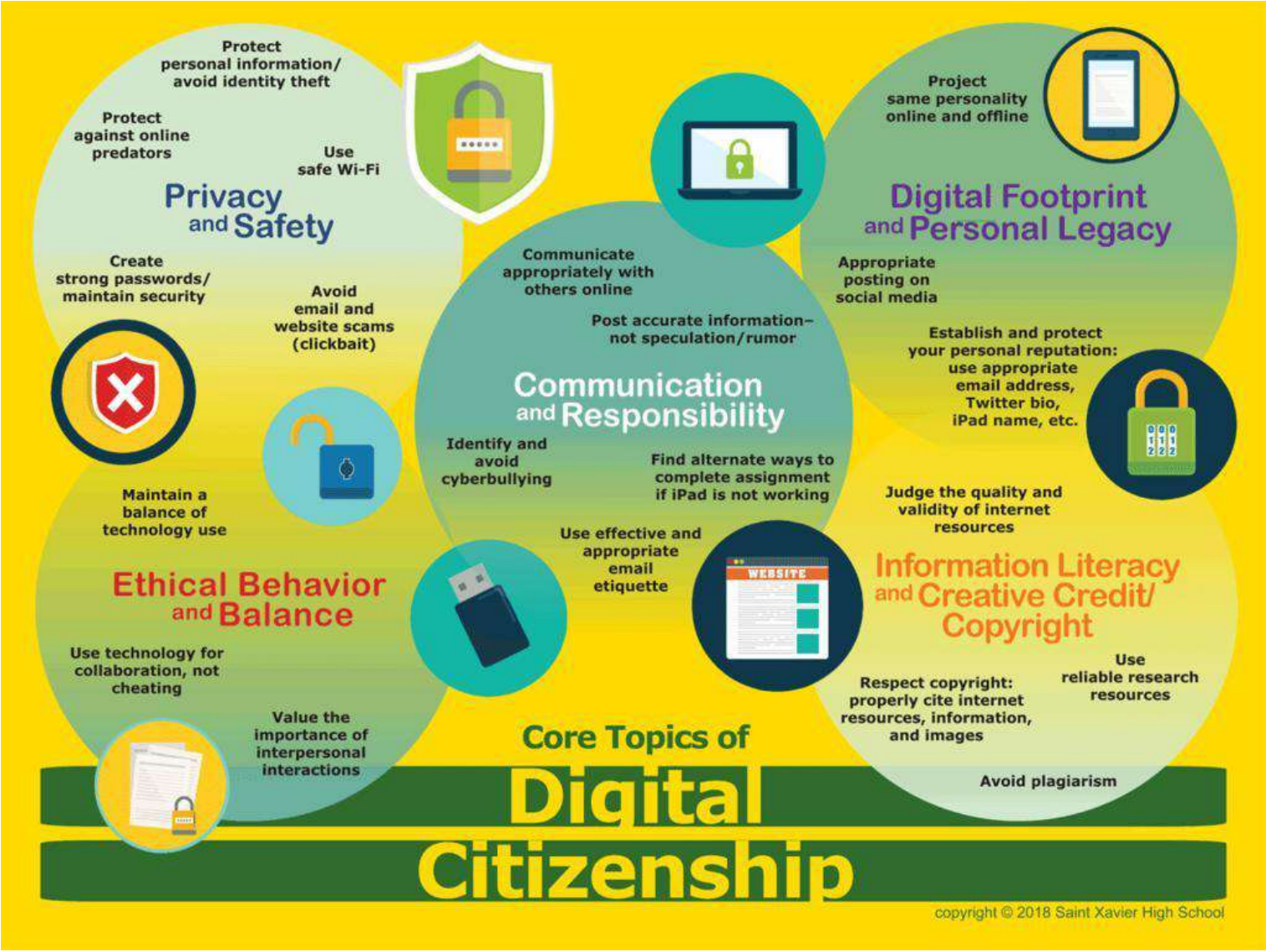
- Posters.
- Videos.
- Infographics.
- Digital presentations.
- Podcasts.
- Websites.
- Social media awareness messages.
- Electronic brochures.

Importance of developing digital awareness content

1. Educates the public on the benefits of ICT.

2. Creates awareness of cybercrime.
3. Promotes responsible social media use.
4. Educates learners about digital privacy.
5. Encourages healthy technology habits.
6. Promotes awareness of electronic waste.
7. Encourages digital inclusion.

Steps in developing an ICT awareness poster



1. Identify the topic.
2. Determine the target audience.
3. Identify the main message.
4. Collect accurate information.
5. Choose appropriate software.
6. Design an attractive layout.
7. Add relevant images and illustrations.
8. Use readable fonts and suitable colours.

9. Proofread the content.
10. Save and share the completed poster.

Suggested practical classroom activity

Activity: Developing an awareness poster on the responsible use of ICT

Learners work in groups to develop a digital poster with the title:

USE ICT RESPONSIBLY FOR A BETTER SOCIETY.

The poster should include:

- Three benefits of ICT.
- Three negative effects of ICT.
- Four guidelines for responsible ICT use.
- Relevant pictures.
- A memorable awareness message.

Competencies developed:

- Digital literacy.
- Communication.
- Collaboration.
- Creativity and imagination.
- Critical thinking and problem-solving.
- Citizenship.

1.22 EVALUATING THE IMPACT OF ICT ON SOCIETY

Evaluation refers to the process of examining the effects of ICT to determine whether its benefits outweigh its disadvantages in a particular situation.

When evaluating ICT, learners should consider both positive and negative consequences.

Factors to consider when evaluating ICT

1. **Accessibility:** Are digital services available to different members of society?

2. **Affordability:** Can individuals and organisations afford the technology?

3. **Efficiency:** Does ICT reduce the time required to perform tasks?

4. **Accuracy:** Does ICT improve the accuracy of information processing?

5. **Security:** Does the technology adequately protect information?

6. **Privacy:** Does the system protect personal information?

7. **Economic impact:** Does ICT create business and employment opportunities?

8. **Social impact:** Does ICT improve communication and relationships?

9. **Environmental impact:** Does the technology contribute to electronic waste or support environmental conservation?

10. **Sustainability:** Can the technology be maintained and used effectively over a long period?

Example of evaluating ICT in a Kenyan secondary school

Consider a secondary school that introduces computer-based learning.

Area evaluated	Positive effect	Possible challenge
Teaching	Interactive lessons	Need for teacher training
Learning	Access to digital resources	Internet costs
Assessment	Faster marking of some tests	Technical failures
Administration	Improved record keeping	Data security risks
Communication	Faster parent communication	Unequal device access

Overall evaluation: Introducing ICT can improve the quality and efficiency of education. However, the school should provide adequate training, reliable connectivity, appropriate security and equitable access to devices.

1.23 KEY TERMS AND DEFINITIONS

Term	Meaning
ICT	Use of digital technologies to process, store and communicate information
Society	A group of people sharing institutions, relationships and activities
Digital literacy	Ability to use digital technologies effectively and responsibly
Digital divide	Gap between people with access to ICT and those without adequate access
Cybercrime	Illegal activities involving computers and digital networks
Cybersecurity	Measures used to protect systems, networks and information
Data privacy	Protection of personal information from inappropriate access or use
Automation	Use of technology to perform tasks with reduced human intervention

E-commerce	Buying and selling goods and services electronically
Telemedicine	Delivery of certain healthcare services using communication technologies
E-waste	Discarded electrical and electronic equipment
Misinformation	False or inaccurate information shared without necessarily intending to deceive
Disinformation	Deliberately created or shared false information intended to mislead
Digital citizenship	Responsible and appropriate participation in the digital environment
E-learning	Learning supported or delivered through electronic technologies
Downtime	Period when a system is unavailable or not functioning as intended
Peopleware	Human beings involved in operating and managing ICT systems
Intellectual property	Creations of the mind that may be protected by law
Digital content	Information produced and shared in electronic formats
Digital inclusion	Ensuring people have meaningful opportunities to access and use digital technologies

1.24 SUMMARY OF THE SUB-STRAND

ICT has become an important driver of social, economic and technological development.

The major points covered in this sub-strand include:

1. ICT refers to technologies used to collect, process, store, retrieve and communicate information.
2. ICT affects individuals, organisations and society.
3. ICT improves communication and access to information.
4. ICT creates employment and business opportunities.
5. ICT supports education, agriculture, healthcare and government services.
6. ICT improves organisational efficiency and productivity.
7. ICT may contribute to cybercrime, privacy violations and misinformation.
8. The digital divide creates inequalities in access to technology.
9. Electronic waste presents environmental challenges.
10. Responsible ICT use promotes safety, inclusion and sustainable development.

SECTION 2: REVISION QUESTIONS

GRADE 11 ICT – REVISION EXERCISE

STRAND 1.0: ICT AND SOCIETY

Sub-strand 1.1: Impact of ICT on Society

Assessment section	Marks
Section A: Multiple Choice Questions	30
Section B: Structured Questions	50
Total	80

Instructions:

1. Answer all questions.
2. In Section A, select the most appropriate answer from the alternatives provided.
3. In Section B, write clear and well-explained answers.

SECTION A: MULTIPLE CHOICE QUESTIONS (30 MARKS)

Choose the correct answer from the alternatives A, B, C and D.

Question 1. Which of the following best describes Information and Communication Technology?

A. The use of machines for manufacturing goods only.

B. The use of digital technologies to process, store and communicate information.

C. The study of human relationships in society.

D. The use of electricity in industrial production.

Question 2. Which of the following is an example of communication technology?

A. Keyboard.

B. Printer.

C. Mobile phone.

D. Desktop processor.

Question 3. A farmer in Narok uses a smartphone to obtain weather forecasts before planting crops. Which benefit of ICT is demonstrated?

A. Improved access to agricultural information.

B. Increased electronic waste.

C. Reduced agricultural production.

D. Increased social isolation.

Question 4. Which of the following is a positive impact of ICT on education?

A. Increased examination malpractice.

B. Reduced access to information.

C. Increased digital distractions.

D. Improved access to digital learning resources.

Question 5. Which term refers to the gap between people who have access to digital technologies and those who do not?

A. Digital citizenship.

B. Digital divide.

C. Digital marketing.

D. Digital transformation.

Question 6. A supermarket uses a computerised system to monitor goods entering and leaving the store. This demonstrates the use of ICT in:

A. Cultural preservation.

B. Entertainment.

C. Inventory management.

D. Social networking.

Question 7. Which of the following is an example of telemedicine?

A. A doctor providing medical consultation through a video communication platform.

B. A learner watching a music video.

C. A farmer selling vegetables physically.

D. A teacher marking handwritten assignments.

Question 8. Which of the following is a negative impact of excessive ICT use on individuals?

A. Improved communication.

B. Increased access to knowledge.

C. Improved personal organisation.

D. Reduced physical activity.

Question 9. Which of the following best describes cybercrime?

A. The use of computers for educational purposes.

B. Illegal activities carried out using digital technologies.

C. The use of digital devices for entertainment.

D. The development of computer applications.

Question 10. A school stores learners' examination records in a computerised database. What is the main advantage?

A. Increased paperwork.

B. Increased manual errors.

C. Easier storage and retrieval of records.

D. Reduced access to information.

Question 11. Which of the following is an example of e-commerce?

A. Buying a textbook through an online shopping platform.

B. Reading a printed newspaper.

C. Attending a physical classroom lesson.

D. Writing notes in an exercise book.

Question 12. Which of the following is a major cause of the digital divide in rural communities?

A. Excessive use of computers.

B. Increased digital marketing.

C. Availability of online libraries.

D. Limited Internet infrastructure.

Question 13. Which Kenyan government platform provides access to various digital public services?

A. YouTube.

B. eCitizen.

C. WhatsApp.

D. Facebook.

Question 14. The practice of using technology to perform tasks that were previously carried out manually is known as:

A. Communication.

B. Data entry.

C. Automation.

D. Social networking.

Question 15. Which of the following is a negative organisational impact of ICT?

A. Improved record keeping.

B. Increased operational efficiency.

C. Better customer service.

D. High installation and maintenance costs.

Question 16. An employee receives an email requesting confidential banking information through an unfamiliar link. This may be an example of:

A. Phishing.

B. E-learning.

C. Telemedicine.

D. Digital marketing.

Question 17. Which of the following is an appropriate way of protecting personal information online?

A. Sharing passwords with friends.

B. Using strong passwords.

C. Publishing personal identification details publicly.

D. Opening all unknown email attachments.

Question 18. Which of the following best describes electronic waste?

A. Information stored in electronic databases.

B. Digital advertisements displayed online.

C. Discarded electrical and electronic equipment.

D. Documents shared through email.

Question 19. Which ICT application can help a Kenyan farmer identify suitable planting periods?

A. Digital weather forecasting services.

B. Computer games.

C. Online entertainment platforms.

D. Social networking advertisements.

Question 20. Which of the following is an advantage of ICT in banking?

A. Increased dependence on physical documents.

B. Reduced access to financial services.

C. Increased manual processing.

D. Faster electronic financial transactions.

Question 21. Which of the following is a possible negative effect of ICT on employment?

A. Creation of new digital jobs.

B. Job displacement through automation.

C. Increased digital literacy.

D. Improved communication among workers.

Question 22. A business uses online advertisements to reach customers in different counties. This demonstrates:

A. Electronic waste management.

B. Digital exclusion.

C. Digital marketing.

D. Cyberbullying.

Question 23. Which of the following is an example of responsible digital citizenship?

A. Respecting other users and avoiding cyberbullying.

B. Sharing false information online.

C. Accessing other people's accounts without permission.

D. Publishing confidential information.

Question 24. Which organisation in Kenya is responsible for overseeing the implementation of data protection requirements?

A. Kenya National Examinations Council.

B. Kenya Revenue Authority.

C. Teachers Service Commission.

D. Office of the Data Protection Commissioner.

Question 25. What is the main purpose of telemedicine?

A. To manufacture medical equipment.

B. To support the delivery of healthcare services through communication technologies.

C. To advertise entertainment programmes.

D. To store agricultural records.

Question 26. Which of the following is a negative impact of ICT on society?

A. Improved access to government services.

B. Better agricultural information.

C. Spread of misinformation.

D. Improved communication.

Question 27. A school introduces digital learning but some learners cannot access computers or the Internet. Which challenge is demonstrated?

A. Digital divide.

B. Automation.

C. E-commerce.

D. Electronic marketing.

Question 28. Which of the following practices supports environmental conservation when using ICT?

A. Discarding damaged computers in rivers.

B. Burning electronic waste in open spaces.

C. Replacing functional devices unnecessarily.

D. Taking obsolete electronic devices to authorised recycling facilities.

Question 29. An organisation analyses sales data to identify its most popular products. Which benefit of ICT is demonstrated?

A. Increased social isolation.

B. Improved decision-making.

C. Increased electronic waste.

D. Reduced customer service.

Question 30. Which of the following is the most appropriate way to evaluate the impact of ICT on society?

A. Considering only its financial benefits.

B. Examining only the negative effects.

C. Examining both positive and negative effects on individuals, organisations and society.

D. Considering only the number of computers available.

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

Answer all questions.

Question 1. (10 marks)

a) Define the term Information and Communication Technology (ICT). (2 marks)

b) Identify four components of an ICT system. (4 marks)

c) Explain two ways in which ICT has improved communication among individuals in Kenya. (4 marks)

Question 2. (10 marks)

a) Explain five positive impacts of ICT on individuals in society. (5 marks)

b) Describe five negative impacts of excessive or inappropriate ICT use on individuals. (5 marks)

Question 3. (10 marks)

a) Explain five ways in which ICT improves the performance of organisations. (5 marks)

b) Describe five challenges that organisations may experience when implementing ICT systems. (5 marks)

Question 4. (10 marks)

a) Explain five ways in which ICT contributes to national development in Kenya. (5 marks)

b) Describe five negative impacts of ICT on the wider society. (5 marks)

Question 5. (10 marks)

A secondary school in Kenya has introduced computer-based learning, electronic learner records and online communication between teachers and parents. However, some learners have limited access to digital devices, while some teachers lack adequate digital skills.

a) Identify two benefits of ICT demonstrated in the school. (2 marks)

b) Explain four challenges the school may experience when implementing ICT. (4 marks)

c) Suggest four measures the school can take to improve the effective and responsible use of ICT. (4 marks)

Question 6. (10 marks)

a) Define the term digital divide. (2 marks)

b) Explain four factors that contribute to the digital divide in Kenya. (4 marks)

c) Suggest four ways through which the digital divide can be reduced in Kenyan society. (4 marks)

MARKING SCHEME

GRADE 11 ICT – REVISION EXERCISE

STRAND 1.0: ICT AND SOCIETY

SUB-STRAND 1.1: IMPACT OF ICT ON SOCIETY

TOTAL MARKS: 80

SECTION A: MULTIPLE-CHOICE QUESTIONS (30 MARKS)

Each correct answer carries 1 mark.

Question	Answer
1	B
2	C
3	A
4	D
5	B
6	C
7	A
8	D
9	B
10	C
11	A
12	D
13	B
14	C
15	D
16	A
17	B
18	C
19	A
20	D
21	B
22	C
23	A
24	D
25	B

26	C
27	A
28	D
29	B
30	C

Total: 30 marks

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

QUESTION 1 (10 MARKS)

a) Define the term Information and Communication Technology (ICT). (2 marks)

ICT refers to the use of digital technologies, electronic devices and communication systems to collect, process, store, retrieve and transmit information.

- Correct definition – 2 marks.

b) Identify four components of an ICT system. (4 marks)

Award 1 mark for each correct answer.

1. Hardware – Physical components of a computer system, such as keyboards and monitors.
2. Software – Programmes and applications used to operate computer systems.
3. Data – Raw facts and figures processed to produce meaningful information.
4. Peopleware (human resources) – Individuals who operate, manage and maintain ICT systems.

Other acceptable answers:

- Procedures.
- Communication networks.

c) Explain two ways in which ICT has improved communication among individuals in Kenya. (4 marks)

Award 2 marks for each well-explained point.

1. Instant messaging: Applications such as WhatsApp enable people to exchange messages instantly regardless of their geographical locations.
2. Video conferencing: Platforms such as Zoom and Google Meet allow people to communicate through live audio and video.
3. Social networking: Platforms such as Facebook enable individuals to share information, ideas and experiences.
4. Email communication: Email enables people to send documents, messages and other information quickly.
5. Mobile communication: Mobile phones enable people to make calls and send messages over long distances.

Any two well-explained points.

QUESTION 2 (10 MARKS)

a) Explain five positive impacts of ICT on individuals in society. (5 marks)

Award 1 mark for each correct point.

1. Improved access to education: Individuals can access online learning materials, electronic books and educational videos.
2. Better communication: ICT enables people to communicate quickly through emails, messaging applications and video calls.
3. Access to employment opportunities: Online platforms enable individuals to search and apply for jobs.
4. Improved access to healthcare: Telemedicine enables patients to consult healthcare professionals remotely.
5. Access to information: Individuals can obtain information on various subjects through the Internet.
6. Improved financial services: Mobile banking and digital payment systems make financial transactions easier.
7. Entertainment: ICT provides access to digital games, films, music and other entertainment resources.
8. Improved personal organisation: Digital calendars and reminder applications help individuals manage their activities.

Award any five correct points.

b) Describe five negative impacts of excessive or inappropriate ICT use on individuals. (5 marks)

Award 1 mark for each correct point.

1. Reduced physical activity: Excessive use of computers and mobile devices may reduce participation in physical activities.
2. Cyberbullying: Individuals may experience harassment, intimidation or humiliation through digital platforms.
3. Loss of privacy: Personal information may be exposed or accessed without permission.
4. Internet addiction: Excessive Internet use may interfere with studies, work and social responsibilities.
5. Eye strain: Prolonged screen exposure may cause eye discomfort and visual fatigue.
6. Exposure to misinformation: Individuals may be misled by false or inaccurate information.
7. Social isolation: Excessive reliance on digital communication may reduce face-to-face interactions.
8. Financial losses: Online fraud and scams may cause individuals to lose money.

Award any five correct points.

QUESTION 3 (10 MARKS)

a) Explain five ways in which ICT improves the performance of organisations. (5 marks)

Award 1 mark for each correct point.

1. Improved communication: Organisations use emails and video conferencing to communicate with employees, suppliers and customers.
2. Efficient record keeping: Computerised databases enable organisations to store and retrieve records easily.
3. Increased productivity: Automation enables organisations to perform repetitive tasks faster.

4. Improved decision-making: Data analysis tools help managers make informed decisions.
5. Better customer service: Organisations use online platforms to respond to customer enquiries and complaints.
6. Reduced operational delays: Digital systems speed up processes such as payments and ordering.
7. Improved marketing: Organisations use social media and websites to advertise their products and services.
8. Improved financial management: Accounting software helps organisations prepare budgets and financial reports.

Award any five correct points.

b) Describe five challenges that organisations may experience when implementing ICT systems. (5 marks)

Award 1 mark for each correct point.

1. High installation costs: Purchasing computers, software and networking equipment requires substantial financial resources.
2. Maintenance costs: ICT systems require regular maintenance, repairs and upgrades.
3. Cybersecurity threats: Organisations may experience hacking, malware attacks and data breaches.
4. Lack of skilled personnel: Some employees may lack the necessary ICT skills to operate new systems.
5. Resistance to change: Some employees may be unwilling to adopt new technologies.
6. System failures: Hardware breakdowns and software errors may interrupt organisational operations.
7. Unreliable Internet connectivity: Poor network connections may interfere with online activities.
8. Data loss: Technical failures or accidental deletion may result in the loss of important information.

Award any five correct points.

QUESTION 4 (10 MARKS)

a) Explain five ways in which ICT contributes to national development in Kenya. (5 marks)

Award 1 mark for each correct point.

1. Improvement of education: ICT supports digital learning, online research and access to educational resources.
2. Improvement of healthcare: Telemedicine and digital medical records improve healthcare service delivery.
3. Economic growth: ICT promotes e-commerce, digital entrepreneurship and the growth of technology-based businesses.
4. Improved agricultural production: Farmers access weather forecasts, market prices and modern farming information.
5. Efficient government services: Platforms such as eCitizen enable citizens to access government services electronically.
6. Employment creation: ICT creates employment opportunities in software development, networking, digital marketing and other technology-related fields.
7. Improved financial inclusion: Mobile money and digital banking enable more people to access financial services.

8. Improved national security: ICT supports communication, information management and coordination among security agencies.
9. Improved transport: Digital navigation and traffic management systems improve transport operations.

Award any five correct points.

b) Describe five negative impacts of ICT on the wider society. (5 marks)

Award 1 mark for each correct point.

1. Cybercrime: ICT may be used to commit crimes such as online fraud, identity theft and hacking.
2. Unemployment: Automation may replace some jobs previously performed by human workers.
3. Electronic waste: Discarded computers and other electronic devices may cause environmental pollution.
4. Spread of misinformation: False information can spread quickly through social media platforms.
5. Digital divide: Unequal access to digital technologies may increase social and economic inequalities.
6. Loss of cultural values: Excessive exposure to unsuitable online content may negatively influence cultural practices and values.
7. Privacy violations: Unauthorised collection and sharing of personal information may affect individuals and communities.
8. Social isolation: Excessive dependence on digital communication may weaken face-to-face social interactions.

Award any five correct points.

QUESTION 5 (10 MARKS)

a) Identify two benefits of ICT demonstrated in the school. (2 marks)

Award 1 mark for each correct answer.

1. Improved teaching and learning through computer-based learning.
2. Efficient storage and retrieval of learners' records through electronic databases.
3. Improved communication between teachers and parents through online platforms.
4. Easier access to digital learning resources.

Award any two.

b) Explain four challenges the school may experience when implementing ICT. (4 marks)

Award 1 mark for each correct point.

1. Inadequate digital devices: Some learners may lack computers, tablets or smartphones needed for digital learning.
2. Limited digital skills: Some teachers may lack the necessary skills to use ICT effectively in teaching.
3. Poor Internet connectivity: Unreliable Internet access may interrupt online lessons and communication.
4. High implementation costs: Purchasing computers, software and networking equipment may be expensive.

5. Power interruptions: Electricity shortages may interfere with the use of digital devices.
6. Cybersecurity risks: School records and learners' personal information may be exposed to unauthorised access.

Award any four correct points.

c) Suggest four measures the school can take to improve the effective and responsible use of ICT. (4 marks)

Award 1 mark for each correct point.

1. Provide teacher training: Organise regular ICT training to improve teachers' digital skills.
2. Acquire more digital devices: Purchase additional computers and tablets to improve access among learners.
3. Improve Internet connectivity: Provide reliable Internet access to support online learning.
4. Establish ICT usage policies: Develop rules governing responsible and acceptable use of digital technologies.
5. Promote cybersecurity awareness: Train teachers and learners on strong passwords, online privacy and safe Internet practices.
6. Provide technical support: Employ or assign qualified personnel to maintain ICT equipment.
7. Establish device-sharing programmes: Introduce computer laboratory schedules to ensure all learners access digital devices.

Award any four correct points.

QUESTION 6 (10 MARKS)

a) Define the term digital divide. (2 marks)

The digital divide refers to the gap or inequality between individuals, communities or regions that have access to and can effectively use digital technologies and those that lack such access or skills.

- Correct explanation of the gap in access – 1 mark.
- Reference to unequal ability or opportunity to use digital technologies – 1 mark.

b) Explain four factors that contribute to the digital divide in Kenya. (4 marks)

Award 1 mark for each correct point.

1. Poverty: Some families cannot afford computers, smartphones and other digital devices.
2. Poor Internet infrastructure: Some rural areas have limited or unreliable Internet connectivity.
3. Low digital literacy: Some individuals lack the skills required to operate digital devices and access online services.
4. High cost of Internet services: Expensive data bundles may prevent some people from accessing online resources.
5. Limited electricity supply: Some remote communities lack reliable access to electricity for charging and operating digital devices.
6. Geographical inequalities: Remote areas may have fewer ICT facilities compared to urban areas.
7. Language barriers: Some digital resources may not be available in languages understood by all users.

Award any four correct points.

c) Suggest four ways through which the digital divide can be reduced in Kenyan society. (4 marks)

Award 1 mark for each correct point.

1. Expanding Internet infrastructure: Extend broadband and mobile network coverage to rural and remote areas.
2. Providing affordable devices: Support access to low-cost computers, tablets and smartphones.
3. Promoting digital literacy: Organise ICT training programmes for learners, teachers and community members.
4. Establishing community ICT centres: Set up digital centres where people can access computers and the Internet.
5. Improving electricity access: Extend electricity supply to underserved communities.
6. Reducing Internet costs: Encourage affordable Internet packages to increase accessibility.
7. Promoting inclusive digital content: Develop digital resources in local languages and accessible formats.
8. Government support: Introduce policies and programmes that promote equal access to digital technologies.

Award any four correct points.

COMPETENCY-BASED LEARNING ACTIVITIES

These activities can be used for classroom practice, group assignments, projects and continuous assessment.

Activity 1: ICT impact investigation

Learners visit or investigate an organisation such as a school, hospital, bank or supermarket.

They should:

1. Identify ICT devices used.
2. Explain how the devices are used.
3. Identify benefits of using ICT.
4. Identify challenges experienced.
5. Suggest ways of improving ICT use.

Activity 2: Group debate

Motion: ICT has more positive impacts than negative impacts on Kenyan society.

Divide learners into two groups:

- Group A supports the motion.
- Group B opposes the motion.

Learners should use relevant examples from education, agriculture, health, business and government services.

Activity 3: Digital awareness project

Develop a digital poster or presentation on:

PROMOTING RESPONSIBLE ICT USE AMONG KENYAN YOUTH

Include:

- Benefits of ICT.
- Cybersecurity awareness.
- Digital privacy.
- Healthy ICT habits.
- Prevention of cyberbullying.
- Responsible sharing of information.

Activity 4: Organisational comparison

Compare a school or business that uses ICT with one that relies mainly on manual operations.

Present findings on:

- Communication.
- Record keeping.
- Productivity.
- Customer service.

- Costs.
- Decision-making.



1.0 INTRODUCTION TO DIGITAL CITIZENSHIP

Digital technology has become an essential part of everyday life. People use computers, smartphones, tablets and the Internet to communicate, learn, work, conduct business and access government services.

In Kenya, digital platforms have transformed how people interact with one another. Learners use online educational resources, businesses advertise products through social media, and citizens access services through government digital platforms.

However, the increased use of ICT has created ethical challenges. Some individuals misuse digital technologies by spreading misinformation, engaging in cyberbullying, violating copyright, invading other people's privacy and participating in online fraud.

These challenges demonstrate the importance of digital citizenship.

Digital citizenship encourages individuals to use technology responsibly, ethically, safely and legally. It promotes respect, honesty, accountability and consideration for other people in the digital environment.

1.1 MEANING AND DEFINITION OF DIGITAL CITIZENSHIP

Definition

Digital citizenship refers to the responsible, ethical, safe and appropriate use of digital technologies and online platforms when accessing information, communicating, creating content and participating in digital society.

It involves understanding one's rights, responsibilities and obligations when using computers, mobile phones, the Internet and other digital communication technologies.

A good digital citizen:

1. Communicates respectfully online.
2. Respects other people's privacy.
3. Protects personal and confidential information.
4. Avoids cyberbullying and online harassment.
5. Respects copyright and intellectual property rights.
6. Shares accurate and reliable information.
7. Uses digital resources responsibly.
8. Observes laws and regulations governing ICT use.
9. Protects digital devices and information systems.
10. Considers the social and environmental effects of technology.

Example in the Kenyan context:

A Grade 11 learner who uses a school computer to research an assignment, acknowledges the sources consulted, avoids copying another person's work and communicates respectfully in an online classroom demonstrates good digital citizenship.

1.2 IMPORTANCE OF DIGITAL CITIZENSHIP

Digital citizenship is important because it guides individuals on how to participate responsibly in the digital environment.

A. Promotes responsible ICT use

Digital citizenship encourages people to use technology for constructive and beneficial purposes.

For example:

- Using the Internet for educational research.
- Using mobile phones for communication.
- Using digital platforms to access government services.
- Using computers to develop useful digital content.

B. Protects individual privacy

Digital citizenship encourages users to respect personal information belonging to themselves and others.

Examples:

- Avoiding publication of another person's photographs without appropriate consent.
- Protecting passwords.
- Avoiding sharing confidential school records.
- Seeking permission before recording other people.

C. Promotes respectful communication

It encourages individuals to communicate politely and avoid abusive language, threats and harassment.

D. Reduces cybercrime

Knowledge of digital responsibilities helps users identify suspicious activities and avoid becoming victims or participants in online crimes.

E. Promotes academic integrity

Digital citizenship encourages learners to produce original work, acknowledge sources and avoid plagiarism.

F. Encourages equality and inclusion

It promotes equal opportunities for different members of society to access and benefit from ICT.

G. Promotes environmental responsibility

It encourages proper management of electronic waste and responsible consumption of digital equipment.

H. Builds trust in digital platforms

Responsible behaviour promotes confidence among users of online services, digital businesses and communication platforms.

1.3 DIGITAL CITIZENSHIP AND DIGITAL ETHICS

Definition of digital ethics

Digital ethics refers to the moral principles, values and standards that guide individuals and organisations in making responsible decisions when developing, accessing and using digital technologies.

It concerns what is right and wrong when interacting with computers, digital information, online platforms and other users.

Digital ethics helps people understand the consequences of their actions in the digital environment.

Examples of digital ethics

1. Respecting people's privacy when using social media.
2. Avoiding the publication of false information.
3. Acknowledging the original creators of digital materials.
4. Avoiding unauthorised access to computer systems.
5. Respecting other people's opinions online.
6. Avoiding the use of digital devices in ways that endanger others.
7. Using ICT without discriminating against other people.
8. Protecting confidential information.
9. Avoiding online harassment.
10. Using technology in accordance with applicable laws.

Relationship between digital citizenship and digital ethics

Digital ethics provides the moral principles that guide behaviour, while digital citizenship involves applying those principles when participating in the digital environment.

For example, respecting another person's privacy is an ethical principle. Refusing to share that person's private photograph without consent is an example of practising digital citizenship.

1.4 PRINCIPLES OF DIGITAL CITIZENSHIP

Digital citizenship is guided by principles that promote responsible participation in the digital environment.

A. Respect for other users

Respect involves treating other people with dignity and consideration when communicating through digital platforms.

Examples:

1. Using polite language in online discussions.
2. Respecting different opinions.
3. Avoiding insults and abusive messages.
4. Not publishing embarrassing information about others.
5. Avoiding discrimination based on gender, disability, culture or social background.

B. Digital responsibility

Digital responsibility refers to the obligation of ICT users to consider the consequences of their actions when using digital technologies.

Examples:

- Using computers for appropriate purposes.
- Avoiding harmful online activities.
- Reporting suspicious online behaviour.
- Following school ICT laboratory rules.
- Taking responsibility for content shared online.

C. Digital privacy

Digital privacy refers to the protection of personal information and control over how such information is collected, used and shared.

Examples of personal information include:

1. Full names.
2. Telephone numbers.
3. Home addresses.
4. Identification details.
5. Photographs.
6. School details.
7. Financial information.
8. Personal communication records.

Responsible practices:

- Obtain consent before sharing other people's information.
- Avoid publishing confidential documents.
- Use appropriate privacy settings.
- Protect personal accounts.
- Avoid collecting information unnecessarily.

D. Digital security

Digital security involves protecting digital devices, computer systems, networks and information against unauthorised access, damage or misuse.

Examples of good security practices:

1. Using strong passwords.
2. Updating computer software.
3. Locking devices when not in use.
4. Avoiding suspicious links.
5. Using trusted applications.
6. Keeping important information backed up.

E. Digital literacy

Digital literacy refers to the ability to find, evaluate, create and communicate information effectively using digital technologies.

A digitally literate person should be able to:

- Search for information.
- Evaluate the reliability of websites.
- Use computer applications.
- Identify misleading information.
- Create digital documents.
- Communicate appropriately online.

F. Digital inclusion

Digital inclusion refers to ensuring that all members of society have meaningful opportunities to access and use digital technologies.

It considers:

- Availability of devices.
- Affordable Internet access.
- Digital skills.
- Accessibility for persons with disabilities.
- Availability of relevant digital content.

- Access for rural and underserved communities.

G. Digital law

Digital law refers to the legal rules and regulations that govern the use of digital technologies, computer systems and online platforms.

Examples include laws relating to:

- Personal data protection.
- Cybercrime prevention.
- Copyright protection.
- Electronic transactions.
- Access to information.
- Unauthorised access to computer systems.

H. Digital etiquette

Digital etiquette refers to the accepted standards of polite and appropriate behaviour when communicating and interacting through digital platforms.

Examples:

1. Avoid typing messages entirely in capital letters when this may be interpreted as shouting.
2. Use respectful language.
3. Avoid sending unnecessary messages.
4. Do not interrupt online meetings.
5. Avoid sharing unrelated content in academic groups.
6. Respect other people's time.
7. Avoid spreading rumours.

1.5 IMPACT OF ICT USE ON ETHICS IN SOCIETY

Definition

The impact of ICT use on ethics in society refers to the ways in which the use or misuse of digital technologies influences moral values, acceptable behaviour, social responsibilities and relationships among individuals and communities.

ICT can promote positive ethical behaviour when used responsibly. However, inappropriate use can encourage dishonesty, disrespect, discrimination, exploitation and other unethical practices.

The following are major ethical concerns associated with ICT use in society.

A. Distracted driving while using mobile phones



Definition

Distracted driving refers to driving a vehicle while engaging in activities that divert the driver's attention from the road and the safe operation of the vehicle.

Using a mobile phone while driving is a form of distracted driving.

Examples of unethical mobile phone use while driving

1. Reading text messages while driving.
2. Making phone calls without appropriate hands-free arrangements.
3. Reading social media notifications.
4. Watching videos while operating a vehicle.
5. Taking photographs while driving.
6. Typing messages while controlling a vehicle.

Negative impacts on society

1. **Increased road accidents:** Divided attention reduces a driver's ability to respond appropriately to road conditions.

2. **Loss of lives:** Distracted driving can result in serious accidents affecting drivers, passengers, pedestrians and other road users.

3. **Property destruction:** Accidents may damage vehicles, buildings and other property.

4. **Economic losses:** Families, businesses and government institutions may incur expenses associated with road accidents.

5. **Emotional suffering:** Road accidents may cause distress to families and communities.

6. **Disruption of transport:** Accidents may cause traffic congestion and delays.

Ethical concerns

- Failure to prioritise road safety.
- Disregard for the safety of passengers and pedestrians.
- Irresponsible use of communication devices.
- Failure to observe traffic regulations.

Mitigating strategies

1. Avoid handling a mobile phone while driving.
2. Put the phone away before starting a journey.
3. Stop in a safe, legally permitted place before attending to a phone.
4. Use vehicle safety features responsibly.
5. Educate drivers on distracted driving.
6. Observe applicable traffic laws and regulations.
7. Encourage passengers to help manage non-urgent communications.

Important lesson: No message or phone call is more important than road safety.

B. Cyberbullying



Definition

Cyberbullying refers to the use of digital communication technologies to harass, intimidate, humiliate, threaten or repeatedly harm another person.

It may occur through social media, messaging platforms, emails, online games and other digital communication channels.

Forms of cyberbullying

1. **Harassment:** Repeatedly sending unwanted, insulting or threatening messages.
2. **Impersonation:** Pretending to be another person online in order to damage their reputation.
3. **Public humiliation:** Sharing embarrassing information or content to shame another individual.
4. **Exclusion:** Deliberately leaving someone out of online groups or activities to cause distress.
5. **Threatening messages:** Sending messages intended to frighten or intimidate another person.
6. **Rumour spreading:** Sharing unverified or harmful claims about another person.
7. **Unwanted sharing of private content:** Publishing another person's private photographs, recordings or information without permission.

Causes of cyberbullying

- Lack of digital ethics.
- Misuse of social media.
- Peer pressure.
- Desire for attention.
- Poor understanding of online consequences.
- Discrimination and intolerance.
- Misuse of anonymity.

Negative impacts of cyberbullying

1. **Emotional distress:** Victims may experience fear, sadness, anxiety and loss of confidence.
2. **Poor academic performance:** Affected learners may experience difficulties concentrating on their studies.
3. **Social isolation:** Victims may withdraw from social interactions.
4. **Damage to reputation:** Harmful online content may affect how others perceive an individual.
5. **Conflict:** Cyberbullying may create disagreements among learners, families and communities.
6. **Reduced participation:** Victims may become reluctant to participate in online learning and communication.

Strategies for preventing cyberbullying

1. Promote respectful online communication.
2. Educate learners on digital citizenship.
3. Avoid responding aggressively to abusive messages.
4. Block and report abusive accounts.
5. Preserve relevant evidence when reporting serious incidents.
6. Encourage affected individuals to seek support from trusted adults or appropriate authorities.
7. Establish clear school policies on online behaviour.

8. Promote peer support and inclusion.
9. Avoid forwarding humiliating photographs or messages.
10. Encourage responsible social media use.

Example in a Kenyan school: A learner creates a messaging group for a class and repeatedly posts insulting messages about another learner. This is cyberbullying and should be addressed through school safeguarding procedures and appropriate reporting channels.

C. Misinformation and disinformation

Misinformation

Misinformation refers to false, inaccurate or misleading information shared without necessarily intending to deceive others.

Disinformation

Disinformation refers to false information deliberately created or distributed to mislead people.

Examples in Kenyan society

1. Sharing false examination dates.
2. Circulating unverified reports about school closures.
3. Publishing misleading information about public health.
4. Sharing fabricated government announcements.
5. Spreading false claims about individuals or organisations.
6. Sharing edited photographs that misrepresent events.

Causes

- Failure to verify information.
- Sensational social media posts.
- Poor digital literacy.
- Deliberate manipulation.
- Impersonation of trusted information sources.
- Sharing messages without checking their accuracy.

Negative impacts on society

1. **Public confusion:** People may make decisions based on inaccurate information.
2. **Fear and panic:** False reports about emergencies may create unnecessary fear.
3. **Damage to reputation:** Individuals and organisations may be unfairly portrayed.
4. **Social conflict:** Misleading information may cause disagreements between communities.
5. **Poor decision-making:** Individuals may act on inaccurate information.
6. **Loss of trust:** People may lose confidence in digital communication and legitimate information sources.

Strategies for controlling misinformation

1. Verify information before sharing.

2. Consult reliable information sources.
3. Check the date and original author of information.
4. Compare reports from different credible sources.
5. Avoid forwarding suspicious messages.
6. Use recognised fact-checking resources.
7. Report misleading content through appropriate platform channels.
8. Promote media and information literacy.

Practical classroom illustration

A message circulating in a school WhatsApp group claims that all national examinations have been postponed. Before forwarding it, a responsible digital citizen checks official announcements from the relevant education authorities.

D. Copyright violations



Definition of copyright

Copyright refers to legal protection granted to creators of original works, giving them certain rights over how their works are reproduced, distributed, communicated and otherwise used.

Examples of copyrighted works include:

- Textbooks.
- Photographs.
- Music.
- Films.
- Computer software.
- Digital illustrations.
- Educational videos.

- Research publications.

Meaning of copyright violation

Copyright violation occurs when a person uses, reproduces, distributes or communicates protected creative work without the required permission or legal justification.

Examples of copyright violations

1. Reproducing an entire textbook and selling copies without authorisation.
2. Using another person's photograph in an advertisement without permission where permission is required.
3. Copying computer software unlawfully.
4. Uploading copyrighted films without authorisation.
5. Reproducing another author's educational materials and claiming ownership.
6. Publishing another person's music as one's own creation.

Negative impacts of copyright violations

1. **Financial losses:** Creators may lose income from unauthorised distribution of their work.

2. **Discourages creativity:** Creators may become less motivated to develop original content.

3. **Unfair competition:** Individuals who copy work may gain advantages over original creators.

4. **Loss of recognition:** Original creators may fail to receive proper acknowledgement.

5. **Legal consequences:** Unauthorised use may lead to legal disputes and applicable penalties.

6. **Reduced innovation:** Widespread infringement can undermine the creative industry.

Strategies for preventing copyright violations

1. Obtain permission before using protected materials where required.
2. Acknowledge the original creators.
3. Use properly licensed resources.
4. Observe copyright notices and licence conditions.
5. Create original digital content.
6. Use public-domain materials appropriately.
7. Educate learners on intellectual property rights.
8. Avoid unauthorised reproduction and distribution.

Kenyan context: Copyright protection is provided under the Copyright Act, 2001, as amended. The Kenya Copyright Board (KECOBO) plays a role in copyright administration and public awareness.

E. Plagiarism

Definition

Plagiarism refers to presenting another person's words, ideas, research, designs or creative work as one's own without appropriate acknowledgement.

It is an ethical violation because it involves dishonesty and failure to recognise the contribution of the original creator.

Forms of plagiarism

1. **Direct plagiarism:** Copying another person's words exactly without acknowledgement.

2. **Mosaic plagiarism:** Combining copied phrases or ideas from different sources without proper acknowledgement.

3. **Paraphrasing plagiarism:** Rewriting another person's ideas using different words without acknowledging the original source.

4. **Self-plagiarism:** Reusing one's previously submitted work in a new assignment without disclosure where original work is required.

5. **Source misrepresentation:** Giving incorrect or misleading details about the source of information.

Examples in education

- Copying an assignment from the Internet and submitting it as original work.
- Copying another learner's project.
- Using a textbook explanation without acknowledging the author.
- Submitting another person's research as one's own.
- Copying diagrams without acknowledging their source.

Negative impacts of plagiarism

1. Reduces academic integrity.
2. Discourages independent thinking.
3. Gives unfair academic advantages.
4. Undermines originality and creativity.
5. Damages a learner's academic reputation.
6. May lead to disciplinary action.
7. Violates the rights of original creators.

Strategies for avoiding plagiarism

1. Write assignments using one's own understanding.
2. Acknowledge information sources.
3. Use quotation marks for direct quotations.
4. Provide appropriate references.
5. Paraphrase correctly while acknowledging the source.
6. Keep records of research sources.
7. Avoid copying another learner's work.
8. Follow the referencing guidelines provided by the teacher.

Difference between copyright violation and plagiarism

Copyright violation	Plagiarism
Involves unauthorised use of protected work.	Involves presenting another person's work or ideas as one's own.
Primarily concerns legal rights.	Primarily concerns academic and ethical honesty.
May occur even when the creator is acknowledged.	May occur even when the material is not copyright-protected.
May result in legal consequences.	May result in academic or professional consequences.

Important: Acknowledging the author does not automatically give permission to use copyrighted work. Both acknowledgement and appropriate authorisation or legal justification may be necessary.

F. Immorality and inappropriate digital content

Definition

In the context of digital citizenship, digital immorality refers to the use of digital technologies to create, access, distribute or promote content and activities that violate accepted moral values, ethical standards or applicable laws.

Examples include:

1. Sharing sexually explicit material.
2. Distributing humiliating photographs.
3. Promoting hatred and discrimination.
4. Publishing content intended to exploit other people.
5. Using digital platforms to encourage harmful behaviour.
6. Sharing violent or degrading content.

Negative impacts

1. May negatively influence behaviour.
2. May expose young people to inappropriate content.
3. Can undermine respect for other people.
4. May contribute to harassment and exploitation.
5. Can damage personal and social relationships.
6. May result in legal consequences where laws are violated.

Strategies for promoting ethical digital content use

1. Encourage access to educational and constructive materials.
2. Use age-appropriate digital resources.
3. Apply suitable privacy and safety settings.

4. Report harmful or illegal content.
5. Promote respect and dignity.
6. Provide digital literacy education.
7. Encourage parental and school guidance for young users.
8. Observe applicable laws and platform rules.

G. Digital divide and digital inequality

Definition

The digital divide refers to the gap between individuals, households, communities or geographical regions that have access to suitable ICT resources and those that have limited or no access.

Digital inequality concerns differences in the quality, affordability, skills and benefits associated with access to digital technologies.





Causes of the digital divide in Kenya

1. **Poverty:** Some families cannot afford computers, smartphones and Internet subscriptions.
2. **Poor network coverage:** Some rural and remote areas have limited access to reliable Internet services.
3. **Low digital literacy:** Some individuals lack the skills needed to use digital devices effectively.
4. **Unreliable electricity:** Limited electricity access makes it difficult to use ICT equipment.
5. **Disability barriers:** Some websites and applications are not accessible to persons with disabilities.
6. **Geographical inequalities:** ICT infrastructure may be more readily available in urban centres than in remote communities.
7. **Language barriers:** Some digital resources may not be available in languages understood by all users.

Ethical concerns associated with the digital divide

- Unequal access to educational opportunities.

- Exclusion from digital government services.
- Limited access to employment information.
- Unequal access to financial services.
- Increased social and economic inequality.
- Limited participation in digital society.

Strategies for reducing the digital divide

1. Expand Internet infrastructure in rural areas.
2. Establish community ICT centres.
3. Improve access to electricity.
4. Promote affordable Internet services.
5. Provide digital literacy training.
6. Encourage accessible website and application design.
7. Support digital learning programmes in schools.
8. Develop educational resources in local and widely understood languages.
9. Encourage public-private partnerships in ICT development.
10. Support access to affordable digital devices.

H. Environmental degradation resulting from ICT use

Definition of environmental degradation

Environmental degradation refers to the deterioration of the natural environment through activities that damage ecosystems, pollute air and water, contaminate soil or deplete natural resources.

ICT contributes to environmental challenges through the manufacture, use and disposal of electronic devices and the energy consumed by digital infrastructure.



Ways ICT contributes to environmental degradation

1. Electronic waste generation

Discarded computers, phones, printers and other electronic equipment contribute to e-waste.

2. Soil pollution

Improper disposal of electronic equipment may release hazardous substances into the soil.

3. Water pollution

Poorly managed electronic waste may contaminate water sources.

4. Air pollution

Unsafe burning or processing of electronic waste may release harmful pollutants.

5. Energy consumption

Computers, communication networks, data centres and other ICT infrastructure require electricity.

6. Natural resource depletion

Manufacturing electronic devices requires minerals, metals, water and other natural resources.

7. Packaging waste

The distribution of ICT equipment may generate plastic, cardboard and other packaging waste.

Negative impacts on society

1. Environmental contamination.
2. Increased pressure on waste management systems.
3. Health risks associated with exposure to hazardous materials.
4. Increased demand for natural resources.
5. Contribution to greenhouse gas emissions where energy is generated from fossil fuels.
6. Increased environmental management costs.

Strategies for reducing environmental degradation

1. Reuse functional electronic equipment.
2. Repair devices instead of discarding them unnecessarily.
3. Dispose of e-waste through authorised collection and recycling facilities.
4. Switch off equipment when it is not needed.
5. Promote energy-efficient devices.
6. Support responsible manufacturing and recycling.
7. Educate communities on e-waste management.
8. Avoid dumping electronic equipment in rivers, forests and open spaces.
9. Encourage responsible purchasing decisions.
10. Promote sustainable ICT practices.

1.6 OTHER ETHICAL CONCERNS ASSOCIATED WITH ICT USE

Apart from the major issues discussed above, other ethical concerns include the following.

A. Invasion of privacy

This occurs when personal information is accessed, collected, used or shared without appropriate authority or consent.

Examples:

- Accessing another person's email without permission.
- Publishing confidential photographs.
- Sharing private conversations.
- Collecting personal information without a lawful basis.

Mitigation:

- Respect privacy.
- Seek consent where required.
- Use appropriate security controls.
- Limit access to confidential records.
- Observe data protection requirements.

B. Identity theft

Identity theft refers to the unauthorised use of another person's personal information to impersonate that individual.

Examples:

- Using another person's personal details to create an account.
- Impersonating someone on social media.
- Misusing another person's identification details.

Mitigation:

1. Protect personal information.
2. Use strong account security.
3. Avoid sharing confidential documents carelessly.
4. Report suspected impersonation.
5. Verify the identity of people requesting personal information.

C. Online fraud

Online fraud refers to the use of digital platforms to deceive individuals or organisations for unlawful financial or other benefits.

Examples:

- Fake online shops.
- False job advertisements.

- Impersonation of legitimate service providers.
- Misleading payment requests.

Mitigation:

- Verify online sellers.
- Use trusted payment systems.
- Avoid suspicious offers.
- Protect financial information.
- Report suspicious transactions.

D. Unauthorised access to computer systems

This involves accessing a computer, network, account or information system without permission.

Examples:

- Accessing another learner's school account.
- Reading confidential files without authority.
- Using another person's login credentials.
- Accessing restricted organisational databases.

Mitigation:

1. Use individual accounts.
2. Protect passwords.
3. Apply access permissions.
4. Lock unattended computers.
5. Observe organisational ICT policies.

E. Discrimination through digital technologies

Digital discrimination occurs when people are unfairly treated or excluded through the use or design of digital systems.

Examples:

- Websites that cannot be used by people with visual impairments.
- Digital services that exclude users without expensive devices.
- Online harassment based on disability or cultural background.
- Biased automated decisions.

Mitigation:

- Promote inclusive digital design.
- Provide accessible services.
- Encourage equal opportunities.
- Respect diversity.

- Evaluate digital systems for unfair treatment.

1.7 ETHICAL USE OF ICT IN SOCIETY

Definition

Ethical use of ICT refers to the responsible and morally acceptable use of digital devices, computer systems, networks and online platforms in a manner that respects the rights, privacy, safety and dignity of other people.

Ethical ICT use requires individuals to make decisions that do not unnecessarily harm others or violate applicable laws.

A. Using proper digital etiquette

Digital etiquette refers to the accepted standards of appropriate conduct when interacting online.

Guidelines for proper digital etiquette

1. Use polite and respectful language.
2. Avoid abusive or offensive expressions.
3. Respect different opinions.
4. Avoid unnecessary forwarding of messages.
5. Use appropriate greetings in professional communication.
6. Avoid typing entire messages in capital letters when this may appear aggressive.
7. Do not interrupt virtual meetings.
8. Avoid posting irrelevant material in educational groups.
9. Respond to messages appropriately.
10. Respect other people's time and availability.

Example: A learner participating in an online classroom discussion should use respectful language when disagreeing with another learner's opinion.

B. Respecting other users' privacy

Privacy is an important aspect of ethical ICT use.

Guidelines

1. Seek permission before sharing another person's photographs where consent is required.
2. Do not publish private conversations without permission.
3. Avoid accessing another person's account.
4. Do not disclose confidential school information.
5. Avoid sharing personal details about other people.
6. Respect privacy settings on online platforms.
7. Protect personal documents.
8. Avoid recording individuals in private situations without appropriate consent.

C. Respecting confidentiality

Definition

Confidentiality refers to the responsibility to protect information from being disclosed to people who are not authorised to access it.

Examples of confidential information include:

- Learner examination records.
- Medical records.
- Employee salary information.
- Bank account information.
- Private business records.
- Personal correspondence.

Guidelines for maintaining confidentiality

1. Share information only with authorised individuals.
2. Use passwords to protect confidential files.
3. Avoid leaving sensitive documents open on shared computers.
4. Do not forward confidential emails without authority.
5. Store records securely.
6. Follow organisational information-handling procedures.
7. Report suspected information breaches appropriately.

D. Responsible use of digital resources

Responsible use involves using digital devices, networks and applications for appropriate purposes.

Examples:

- Using school computers for learning activities.
- Avoiding unnecessary downloading of unknown files.
- Avoiding unauthorised software installation.
- Respecting institutional ICT policies.
- Using the Internet without disrupting others.
- Avoiding excessive use of shared digital resources.

E. Verifying information before sharing

A responsible digital citizen should evaluate information before forwarding or publishing it.

Steps for verifying online information

1. Identify the original source.
2. Check the author or organisation responsible.
3. Examine the date of publication.

4. Compare the information with other reliable sources.
5. Check whether evidence supports the claims.
6. Be cautious of sensational headlines.
7. Avoid sharing information that cannot be verified.

F. Respecting intellectual property rights

Users should recognise and respect the rights of people who create digital materials.

Examples:

- Acknowledging authors of textbooks.
- Obtaining permission to use photographs where necessary.
- Following software licence conditions.
- Citing online research sources.
- Avoiding unauthorised copying of digital content.

G. Observing applicable laws and policies

Ethical ICT users should understand and follow laws, regulations and institutional policies governing the use of technology.

Examples:

- Observing data protection requirements.
- Avoiding cybercrime.
- Respecting copyright.
- Following school ICT laboratory rules.
- Complying with platform terms and safety requirements.

1.8 RESPONSIBLE USE OF SOCIAL MEDIA PLATFORMS

Definition of social media

Social media refers to digital platforms and applications that allow users to create, share, discuss and interact with information, images, videos and other forms of digital content.

Social media supports communication, education, entertainment, business and public awareness.

Examples of social media activities

1. Sharing educational information.
2. Participating in online discussions.
3. Communicating with friends and family.
4. Advertising products and services.
5. Sharing community announcements.
6. Promoting social awareness.
7. Participating in professional networks.

Guidelines for responsible social media use

1. Use respectful language.
2. Avoid spreading rumours.
3. Protect account passwords.
4. Respect other users' privacy.
5. Avoid impersonation.
6. Do not participate in cyberbullying.
7. Verify information before sharing.
8. Avoid publishing confidential information.
9. Respect intellectual property rights.
10. Report harmful or suspicious content.
11. Use privacy settings appropriately.
12. Balance online activities with other responsibilities.

Negative effects of irresponsible social media use

- Cyberbullying.
- Spread of misinformation.
- Loss of privacy.
- Online fraud.
- Reputation damage.
- Social conflicts.
- Exposure to inappropriate content.
- Excessive screen use.

1.9 LAWS AND POLICIES GOVERNING ICT USE IN KENYA

Kenya has established legal and policy frameworks to guide the responsible use of ICT, protect citizens and address misuse of digital technologies.

Learners should understand the purpose of these laws rather than memorising legal penalties.

A. The Constitution of Kenya, 2010

The Constitution provides the foundation for protecting fundamental rights and freedoms in Kenya.

Relevant provisions include:

1. **Article 31 – Right to privacy:** Protects individuals against certain forms of interference with their privacy and communications.

2. **Article 33 – Freedom of expression:** Protects freedom of expression, subject to constitutional limitations.

3. **Article 34 – Freedom of the media:** Provides for freedom and independence of the media.

4. **Article 35 – Access to information:** Provides for the right of access to information held by the State and information held by another person where required for the exercise or protection of a right or fundamental freedom.

Importance in digital citizenship:

These constitutional rights provide a foundation for privacy, responsible communication, access to information and respect for other people's rights.

B. The Data Protection Act, 2019

The Data Protection Act, 2019 provides a framework for the protection of personal data and regulates its processing in Kenya.

It establishes the Office of the Data Protection Commissioner.

Main areas covered

1. Protection of personal information.
2. Rights of individuals whose data is processed.
3. Responsibilities of data controllers and data processors.
4. Regulation of personal data processing.
5. Handling of data protection complaints.
6. Requirements relating to lawful processing of personal information.

Example: A school collecting learners' personal information should handle that information in accordance with applicable data protection requirements.

C. The Computer Misuse and Cybercrimes Act, 2018

This Act provides a legal framework for addressing offences involving computer systems and digital technologies.

It deals with various forms of computer misuse and cybercrime.

Areas addressed include:

1. Unauthorised access to computer systems.
2. Computer-related fraud.
3. Computer forgery.
4. Unauthorised interference with computer systems.
5. Identity theft.
6. Phishing.
7. Cyber harassment.
8. Other offences involving digital technologies.

Importance: It helps protect individuals, organisations and digital infrastructure against unlawful computer-related activities.

Current legal note: The Act was amended in 2025, so users consulting the law should refer to the current consolidated version rather than relying only on the original 2018 text.

D. The Copyright Act, 2001

The Copyright Act provides legal protection for eligible creative works.

Examples:

- Books.
- Music.
- Photographs.
- Films.
- Computer programs.
- Artistic works.

Importance in digital citizenship:

1. Protects creators' rights.
2. Promotes originality.
3. Encourages creativity.
4. Discourages unauthorised reproduction.
5. Supports the creative industry.

E. The Access to Information Act, 2016

This Act provides a framework for access to information held by public entities and certain private bodies.

Importance:

- Promotes transparency.
- Supports public accountability.
- Encourages informed citizenship.
- Enables access to relevant public information.
- Supports participation in governance.

F. The Kenya Information and Communications Act

This Act provides a legal framework for regulating aspects of the communications sector in Kenya.

It is relevant to communication services and the development and regulation of the ICT environment.

G. Institutional bodies supporting ethical ICT use in Kenya

Institution	Main role
Office of the Data Protection Commissioner (ODPC)	Oversees personal data protection requirements
Communications Authority of Kenya (CA)	Regulates the communications sector
Kenya Copyright Board (KECOBO)	Administers copyright-related matters
National Computer and Cybercrimes Coordination Committee (NC4)	Coordinates national cybersecurity matters
Kenya Computer Incident Response Team Coordination Centre (KE-CIRT/CC)	Supports cybersecurity incident coordination and response

1.10 MITIGATING STRATEGIES FOR ETHICAL CONCERNS ASSOCIATED WITH ICT

Definition of mitigation

Mitigation refers to actions taken to reduce, prevent or minimise the negative effects of a particular activity or problem.

Mitigating strategies for ICT ethical concerns are measures used to promote responsible technology use and reduce unethical behaviour in society.

A. Digital literacy education

Digital literacy programmes teach people how to use technology effectively, safely and responsibly.

Activities include:

1. Training learners on responsible Internet use.
2. Teaching information verification skills.
3. Educating communities on online privacy.
4. Conducting cybersecurity awareness sessions.
5. Teaching proper digital communication.

B. Establishing ICT policies

Schools and organisations should develop clear policies that guide technology use.

Examples:

- School computer laboratory rules.
- Acceptable Internet use policies.
- Password management procedures.
- Data protection guidelines.
- Social media communication guidelines.

C. Promoting cybersecurity awareness

Individuals should be educated about common online risks and appropriate protective practices.

Examples:

1. Recognising suspicious messages.
2. Protecting passwords.
3. Using secure accounts.
4. Keeping software updated.
5. Avoiding suspicious downloads.
6. Reporting security incidents.

D. Promoting respect and tolerance

Digital platforms should encourage respectful interactions among users.

Measures:

- Avoid discriminatory communication.

- Respect different opinions.
- Discourage cyberbullying.
- Promote inclusion.
- Encourage constructive discussions.

E. Enforcing applicable laws

Relevant authorities and institutions should promote compliance with laws relating to:

- Cybercrime.
- Copyright.
- Privacy.
- Personal data protection.
- Digital communications.

F. Encouraging responsible content creation

Digital content creators should:

1. Produce original materials.
2. Verify information before publication.
3. Acknowledge sources.
4. Avoid harmful content.
5. Respect privacy.
6. Follow applicable copyright requirements.

G. Promoting digital inclusion

Society should improve access to digital technologies by:

- Expanding Internet coverage.
- Providing affordable devices.
- Improving electricity access.
- Supporting community ICT centres.
- Providing digital skills training.
- Developing accessible digital platforms.

H. Encouraging proper e-waste management

Measures include:

- Reusing equipment.
- Repairing damaged devices.
- Recycling electronic materials.
- Using authorised collection facilities.
- Educating communities on responsible disposal.

I. Encouraging responsible mobile phone use

Examples:

1. Avoid using mobile phones while driving.
2. Avoid unnecessary phone use during lessons.
3. Respect others when using speakerphones.
4. Avoid disturbing people in quiet environments.
5. Use devices for constructive purposes.

J. Reporting unethical online behaviour

Users should report:

- Cyberbullying.
- Online impersonation.
- Threatening communication.
- Suspicious online activities.
- Unauthorised disclosure of confidential information.
- Harmful content that violates platform rules or applicable laws.

1.11 PRACTISING ETHICAL ICT USE THROUGH A MOCK SOCIAL MEDIA PLATFORM

A mock social media platform is a simulated online environment created for learning and practising responsible digital behaviour without exposing learners to the risks of a real public platform.

It enables learners to understand the responsibilities associated with online communication.



A. Objectives of the activity

By participating in the activity, learners should be able to:

1. Practise appropriate digital etiquette.
2. Respect the privacy of other users.
3. Protect confidential information.
4. Identify unethical online behaviour.
5. Communicate respectfully.
6. Recognise misinformation.
7. Understand the importance of copyright.
8. Follow online rules and policies.
9. Develop responsible digital citizenship habits.

B. Requirements for the activity

- Computers or tablets.
- A teacher-prepared mock social media interface.
- Sample user profiles.
- Simulated posts and comments.
- Digital citizenship guidelines.
- A classroom observation checklist.

C. Steps for conducting the activity

Step 1: Formation of groups

Learners form small groups and agree on the responsibilities of each member.

Step 2: Creating simulated user profiles

Each group creates fictional profiles using imaginary names rather than actual personal details.

Step 3: Publishing educational posts

Learners prepare appropriate posts on topics such as:

- Environmental conservation.
- Road safety.
- Responsible Internet use.
- School activities.
- Community development.

Step 4: Interacting with other users

Learners comment on other groups' posts using respectful language.

Step 5: Identifying unethical behaviour

The teacher provides simulated examples of:

- Insulting comments.
- False information.
- Copyright violations.
- Unauthorised sharing of photographs.
- Discriminatory messages.

Learners identify the ethical problem in each example.

Step 6: Applying corrective measures

Learners demonstrate how to:

- Report inappropriate posts.
- Correct misinformation.
- Seek permission before sharing content.
- Respond respectfully.
- Protect confidential information.

Step 7: Reflection

Each group explains what it has learnt about responsible digital participation.

D. Expected learning outcomes

Learners should demonstrate:

- Respectful communication.
- Responsible information sharing.
- Privacy awareness.
- Ethical content creation.
- Responsible online interaction.
- Ability to recognise unethical practices.

E. Suggested assessment checklist

Assessment area	Expected performance
Digital etiquette	Communicates respectfully
Privacy	Respects personal information
Confidentiality	Protects sensitive information
Information sharing	Checks accuracy before sharing
Copyright	Acknowledges creators
Responsibility	Follows platform rules
Collaboration	Works positively with others

1.12 DIGITAL LITERACY AWARENESS IN THE COMMUNITY

Digital literacy awareness involves educating individuals and communities on the knowledge, skills and attitudes needed to use digital technologies safely, effectively and responsibly.

It is important because not every member of society has the same level of digital knowledge or access to technology.

Importance of community digital literacy awareness

1. Promotes responsible Internet use.
2. Reduces online fraud.
3. Encourages privacy protection.
4. Promotes respectful online communication.
5. Helps people identify misinformation.
6. Encourages proper e-waste disposal.
7. Promotes access to digital opportunities.
8. Improves community participation in digital services.

A. Target groups for digital literacy outreach

Learners may organise awareness activities for:

- Fellow learners.
- Teachers.
- Parents and guardians.
- Small-scale business owners.
- Farmers.
- Community groups.
- Older members of society.
- Persons with disabilities.

B. Topics to cover during community outreach

1. Protecting personal information.
2. Recognising online fraud.
3. Preventing cyberbullying.
4. Avoiding misinformation.
5. Respecting copyright.
6. Using mobile phones responsibly.
7. Protecting children and young people online.
8. Managing electronic waste.
9. Accessing digital learning resources.
10. Using digital government services responsibly.

C. Steps for organising a digital literacy outreach programme

1. Identify the target community.
2. Assess the community's digital literacy needs.
3. Select an appropriate awareness topic.
4. Set clear learning objectives.
5. Prepare relevant digital materials.
6. Identify suitable communication methods.
7. Organise the outreach activity.
8. Deliver the awareness messages.
9. Allow participants to ask questions.
10. Evaluate the effectiveness of the activity.

D. Examples of community outreach activities

1. School awareness campaign

Learners prepare posters on avoiding cyberbullying and protecting personal information.

2. Parent awareness meeting

Learners demonstrate responsible mobile phone use and safe digital communication.

3. Community e-waste campaign

Learners educate residents on proper disposal and recycling of electronic equipment.

4. Digital information verification campaign

Learners explain how to identify misleading messages and verify information before sharing.

5. Online privacy awareness

Learners prepare presentations explaining the importance of protecting passwords and personal information.

1.13 THE CONSEQUENCES OF UNETHICAL ICT USE ON SOCIETY

Unethical ICT use affects individuals, organisations, communities and the country.

Ethical concern	Possible consequences
Cyberbullying	Emotional distress, damaged relationships and social conflict
Misinformation	Confusion, fear and poor decisions
Copyright violation	Financial losses to creators and reduced respect for intellectual property
Plagiarism	Academic dishonesty and reduced originality

Privacy violation	Exposure and misuse of personal information
Digital divide	Unequal access to digital opportunities
Distracted driving	Increased road safety risks
Environmental degradation	Pollution and depletion of natural resources
Online fraud	Financial losses and reduced trust
Unauthorised access	Loss or exposure of confidential information

Effects on individuals

1. Loss of privacy.
2. Financial exploitation.
3. Damage to reputation.
4. Emotional distress.
5. Reduced academic integrity.
6. Loss of confidence.
7. Exposure to inappropriate content.

Effects on organisations

1. Financial losses.
2. Damage to reputation.
3. Loss of confidential information.
4. Reduced customer trust.
5. Legal and compliance challenges.
6. Disruption of operations.
7. Increased security expenses.

Effects on society

1. Increased social conflicts.
2. Reduced trust in information.
3. Increased inequality.
4. Environmental pollution.
5. Threats to public safety.
6. Reduced respect for ethical values.
7. Increased demand for cybersecurity and public awareness programmes.

1.14 DIGITAL CITIZENSHIP IN DIFFERENT KENYAN SETTINGS

Digital citizenship applies to different areas of everyday life.

A. Digital citizenship in schools

Responsible practices include:

- Using school computers appropriately.
- Avoiding plagiarism.
- Respecting teachers and fellow learners online.
- Protecting learner records.
- Avoiding cyberbullying.
- Acknowledging research sources.
- Following school ICT policies.

B. Digital citizenship in families

Responsible practices include:

- Respecting family members' privacy.
- Communicating respectfully.
- Using digital devices appropriately.
- Avoiding excessive screen use.
- Supporting digital literacy.
- Helping family members identify online risks.

C. Digital citizenship in business

Responsible practices include:

- Protecting customer information.
- Advertising products honestly.
- Respecting intellectual property.
- Avoiding misleading online promotions.
- Protecting electronic payment information.
- Communicating professionally.

D. Digital citizenship in government services

Responsible practices include:

- Providing accurate information when using online services.
- Protecting login credentials.
- Respecting official communication procedures.
- Protecting citizens' personal information.
- Avoiding unauthorised access to government systems.

E. Digital citizenship in agriculture

Responsible practices include:

- Sharing accurate agricultural information.
- Respecting farmers' personal information.
- Avoiding false market information.
- Using digital agricultural resources responsibly.
- Respecting intellectual property in agricultural research.

1.15 KEY TERMS AND DEFINITIONS

Term	Definition
Digital citizenship	Responsible and ethical participation in the digital environment
Digital ethics	Moral principles guiding the use of digital technologies
Digital etiquette	Standards of polite behaviour when interacting online
Cyberbullying	Using digital technologies to harass or harm others
Misinformation	False or inaccurate information shared without necessarily intending to deceive
Disinformation	False information deliberately shared to mislead
Copyright	Legal protection for eligible original creative works
Plagiarism	Presenting another person's work or ideas as one's own without appropriate acknowledgement
Digital divide	Gap between people who have access to ICT and those who do not
Digital privacy	Protection and appropriate control of personal information
Confidentiality	Responsibility to prevent unauthorised disclosure of information
Digital security	Protection of digital systems, networks and information
Digital literacy	Ability to use digital technologies effectively and responsibly
Identity theft	Unauthorised use of another person's identity information
Digital immorality	Unethical or inappropriate behaviour involving digital technologies
E-waste	Discarded electrical and electronic equipment
Digital inclusion	Ensuring meaningful access to and use of digital technologies
Intellectual property	Creations of the mind that may be protected by law
Cybercrime	Illegal activity involving computers or digital networks
Digital responsibility	Obligation to use technology appropriately and consider its consequences
Digital footprint	The trail of information a person leaves through digital activities
Online impersonation	Pretending to be another person in a digital environment
Mock social media platform	A simulated social media environment used for learning and practice

SECTION 2: GRADE 11 ICT REVISION QUESTIONS

REVISION EXERCISE

STRAND 1.0: ICT AND SOCIETY

SUB-STRAND 1.2: DIGITAL CITIZENSHIP

Section	Description	Marks
A	Multiple Choice Questions	30
B	Structured Questions	50
Total		80

Instructions

1. Answer all questions.
2. Select the correct answer in Section A.
3. Write clear and well-explained answers in Section B.
4. Use relevant examples from the Kenyan context where appropriate.

SECTION A: MULTIPLE CHOICE QUESTIONS (30 MARKS)

Choose the correct answer from the alternatives A, B, C and D.

Question 1. Which of the following best describes digital citizenship?

A. Using computers for entertainment only.

B. Responsible and ethical participation in the digital environment.

C. Using the Internet without restrictions.

D. Developing computer hardware.

Question 2. Which of the following demonstrates good digital etiquette?

A. Insulting people during online discussions.

B. Publishing private conversations.

C. Using respectful language when communicating online.

D. Forwarding unverified information.

Question 3. A learner copies information from a website and submits it as original work without acknowledging the source. This is known as:

A. Plagiarism.

B. Digital inclusion.

C. Cybersecurity.

D. Copyright protection.

Question 4. Which of the following is the main purpose of copyright protection?

A. Preventing people from accessing the Internet.

B. Encouraging the unauthorised sharing of information.

C. Preventing all forms of digital communication.

D. Protecting the rights of creators of original works.

Question 5. Which of the following best describes cyberbullying?

A. Using a computer to prepare educational notes.

B. Using digital platforms to harass or intimidate another person.

C. Sharing authorised educational information.

D. Communicating respectfully through email.

Question 6. A person shares a false message without knowing that it is inaccurate. This is an example of:

A. Copyright infringement.

B. Digital inclusion.

C. Misinformation.

D. Digital literacy.

Question 7. Which of the following is an example of disinformation?

A. Deliberately creating and sharing false information to mislead people.

B. Sharing an accurate educational article.

C. Publishing an authorised school announcement.

D. Correcting an inaccurate social media post.

Question 8. Which Kenyan law provides a framework for protecting personal information?

A. Traffic Act.

B. Education Act.

C. Public Finance Management Act.

D. Data Protection Act, 2019.

Question 9. Which of the following is an example of a digital privacy violation?

A. Using a password to protect a document.

B. Publishing another person's private photographs without appropriate permission.

C. Logging out of a shared computer.

D. Using privacy settings on an online account.

Question 10. The practice of accessing another person's computer account without permission is an example of:

A. Digital inclusion.

B. Digital literacy.

C. Unauthorised access.

D. Digital etiquette.

Question 11. Which of the following is an appropriate strategy for preventing cyberbullying?

A. Reporting abusive behaviour through appropriate channels.

B. Forwarding insulting messages.

C. Creating fake accounts to attack others.

D. Publishing embarrassing photographs.

Question 12. Which of the following is the most appropriate action before sharing information obtained from social media?

A. Forwarding it immediately.

B. Changing its headline.

C. Adding unsupported details.

D. Verifying its accuracy and source.

Question 13. The digital divide refers to:

A. Differences between computer brands.

B. The gap between people with access to ICT and those with limited or no access.

C. Differences between computer operating systems.

D. The separation of computer hardware and software.

Question 14. Which of the following contributes to the digital divide in rural Kenya?

A. Availability of digital libraries.

B. Increased computer literacy.

C. Limited Internet infrastructure.

D. Availability of electricity.

Question 15. Which of the following demonstrates respect for intellectual property?

A. Acknowledging the original creator of a photograph.

B. Claiming another person's work as one's own.

C. Copying an entire textbook without permission.

D. Distributing copyrighted software unlawfully.

Question 16. Which of the following is a negative environmental impact associated with ICT?

A. Improved digital learning.

B. Faster communication.

C. Better agricultural information.

D. Electronic waste pollution.

Question 17. Which of the following is an appropriate way of managing electronic waste?

A. Dumping old computers in rivers.

B. Taking obsolete equipment to authorised recycling facilities.

C. Burning discarded electronic equipment in open spaces.

D. Throwing damaged batteries into ordinary waste carelessly.

Question 18. A person who communicates politely and respects other people's opinions online demonstrates:

A. Cybercrime.

B. Digital exclusion.

C. Good digital etiquette.

D. Plagiarism.

Question 19. Which of the following is an example of distracted driving?

A. Reading text messages while operating a vehicle.

B. Stopping safely before answering a phone call.

C. Following traffic signs.

D. Wearing a seat belt.

Question 20. Which Kenyan institution oversees the implementation of personal data protection requirements?

A. Kenya National Examinations Council.

B. Kenya Revenue Authority.

C. Teachers Service Commission.

D. Office of the Data Protection Commissioner.

Question 21. Which of the following best describes confidentiality?

A. Sharing all organisational information publicly.

B. Protecting information from unauthorised disclosure.

C. Publishing private information on social media.

D. Allowing everyone to access confidential records.

Question 22. Which of the following is a suitable way of preventing plagiarism?

A. Copying assignments from other learners.

B. Removing the names of original authors.

C. Acknowledging sources and producing original work.

D. Submitting another person's research.

Question 23. A school creates a simulated social networking environment to teach learners responsible online communication. This is an example of:

A. A mock social media platform.

B. A computer virus.

C. A digital banking system.

D. An electronic waste facility.

Question 24. Which of the following is a benefit of community digital literacy awareness?

A. Increased online harassment.

B. Increased misinformation.

C. Reduced access to information.

D. Improved understanding of responsible ICT use.

Question 25. Which of the following actions demonstrates respect for another person's privacy?

A. Sharing their personal messages publicly.

B. Seeking appropriate permission before sharing their private information.

C. Accessing their email without consent.

D. Publishing their personal photographs without permission.

Question 26. Which of the following Kenyan laws addresses offences involving computer systems and cybercrime?

A. Copyright Act, 2001.

B. Access to Information Act, 2016.

C. Computer Misuse and Cybercrimes Act, 2018.

D. Traffic Act.

Question 27. What is the most appropriate action when a learner encounters cyberbullying?

A. Report the behaviour and seek appropriate support.

B. Forward the abusive messages to other learners.

C. Create another account to retaliate.

D. Publish the victim's private information.

Question 28. Which of the following is an example of responsible digital content creation?

A. Publishing unverified rumours.

B. Copying another person's work without acknowledgement.

C. Sharing private information without permission.

D. Creating original educational content and acknowledging sources.

Question 29. Which of the following best explains digital responsibility?

A. Using technology without considering its consequences.

B. Taking responsibility for one's actions when using digital technologies.

C. Sharing confidential information freely.

D. Ignoring online rules and policies.

Question 30. What is the main purpose of digital citizenship education?

A. Encouraging unlimited Internet use.

B. Promoting dependence on digital devices.

C. Promoting safe, ethical and responsible participation in digital society.

D. Preventing people from accessing digital technologies.

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

Answer ALL questions.

Question 1. Digital Citizenship (8 marks)

a) Define the term digital citizenship. (2 marks)

b) Identify three principles of digital citizenship. (3 marks)

c) Explain three reasons why digital citizenship is important in Kenyan society. (3 marks)

Question 2. Ethical Concerns Associated with ICT (8 marks)

a) Define the term digital ethics. (2 marks)

b) Explain three negative effects of cyberbullying on individuals and society. (3 marks)

c) State three strategies that can be used to prevent cyberbullying in schools. (3 marks)

Question 3. Information Ethics and Intellectual Property (8 marks)

a) Differentiate between plagiarism and copyright violation. (2 marks)

b) Explain three ways through which learners can avoid plagiarism when preparing digital assignments. (3 marks)

c) State three negative effects of spreading misinformation in society. (3 marks)

Question 4. Privacy, Security and Kenyan ICT Laws (8 marks)

a) Explain two ways of protecting personal information when using digital platforms. (2 marks)

b) State three Kenyan laws that are relevant to responsible ICT use. (3 marks)

c) Explain three ways in which an individual can maintain confidentiality when using ICT. (3 marks)

Question 5. Digital Divide and Environmental Responsibility (9 marks)

a) Define the term digital divide. (2 marks)

b) Explain three factors that contribute to the digital divide in Kenya. (3 marks)

c) Suggest four measures that can be used to reduce environmental degradation associated with ICT. (4 marks)

Question 6. Practical Application of Digital Citizenship (9 marks)

A secondary school in Kenya has established a digital learning platform where learners and teachers share educational materials, communicate and participate in online discussions.

However, some learners have been sharing insulting messages, copying digital assignments without acknowledgement and publishing other learners' photographs without permission.

a) Identify three unethical practices demonstrated in the scenario. (3 marks)

b) Explain three responsibilities that learners should observe when using the digital learning platform. (3 marks)

c) Suggest three measures the school can introduce to promote ethical ICT use among learners. (3 marks)

MARKING SCHEME

GRADE 11 ICT – REVISION EXERCISE

STRAND 1.0: ICT AND SOCIETY

SUB-STRAND 1.2: DIGITAL CITIZENSHIP

TOTAL MARKS: 80

SECTION A: MULTIPLE-CHOICE QUESTIONS (30 MARKS)

Each question carries 1 mark.

Question	Answer
1	B
2	C
3	A
4	D
5	B
6	C
7	A
8	D
9	B
10	C
11	A
12	D
13	B
14	C
15	A
16	D
17	B
18	C
19	A
20	D
21	B
22	C
23	A
24	D
25	B

26	C
27	A
28	D
29	B
30	C

Section A: 30 marks

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

QUESTION 1: DIGITAL CITIZENSHIP (8 MARKS)

a) Define the term digital citizenship. (2 marks)

Digital citizenship refers to the responsible, ethical, safe and appropriate use of digital technologies and the Internet when participating in online activities and digital communities.

Mark allocation:

- Responsible and ethical use of digital technologies – 1 mark.
- Appropriate participation in online environments – 1 mark.

b) Identify three principles of digital citizenship. (3 marks)

Award 1 mark for each correct answer.

1. Digital etiquette: Communicating politely and respectfully when interacting with others online.
2. Digital responsibility: Taking responsibility for one's actions when using digital technologies.
3. Digital security: Protecting personal information and digital devices against online threats.
4. Digital literacy: Having the knowledge and skills required to use digital technologies effectively.
5. Digital rights and responsibilities: Understanding one's rights and obligations when using digital platforms.
6. Digital access: Promoting equal opportunities for individuals to access digital technologies.
7. Respect for intellectual property: Acknowledging and respecting the ownership of digital content.

Award any three.

c) Explain three reasons why digital citizenship is important in Kenyan society. (3 marks)

Award 1 mark for each correct explanation.

1. Promotes online safety: It helps individuals protect themselves against cyberbullying, online fraud and other digital threats.
2. Encourages responsible communication: It promotes respectful interactions among people using social media and other digital platforms.
3. Protects personal information: It encourages individuals to safeguard confidential information when using online services.
4. Promotes respect for the law: It encourages people to follow Kenyan laws governing digital activities.
5. Prevents misinformation: It encourages individuals to verify information before sharing it online.

6. Promotes digital inclusion: It encourages equal access to digital technologies and online opportunities.

Award any three.

QUESTION 2: ETHICAL CONCERNS ASSOCIATED WITH ICT (8 MARKS)

a) Define the term digital ethics. (2 marks)

Digital ethics refers to the moral principles and standards that guide appropriate, responsible and acceptable behaviour when using digital technologies and online platforms.

Mark allocation:

- Moral principles or standards governing behaviour – 1 mark.
- Application to the use of digital technologies – 1 mark.

b) Explain three negative effects of cyberbullying on individuals and society. (3 marks)

Award 1 mark for each correct explanation.

1. Emotional distress: Victims may experience fear, embarrassment, anxiety and reduced self-confidence.
2. Poor academic performance: Learners affected by cyberbullying may lose concentration and interest in their studies.
3. Social isolation: Victims may withdraw from friends, classmates and online communities.
4. Damaged reputation: Abusive messages and embarrassing content may damage an individual's public image.
5. Disruption of school activities: Cyberbullying may create conflicts among learners and interfere with learning.
6. Reduced online participation: Victims may become unwilling to participate in online discussions and learning activities.

Award any three.

c) State three strategies that can be used to prevent cyberbullying in schools. (3 marks)

Award 1 mark for each correct answer.

1. Establish clear school policies against cyberbullying.
2. Educate learners on responsible digital communication.
3. Encourage learners to report cyberbullying incidents to teachers or school administrators.
4. Promote respectful communication and positive online behaviour.
5. Provide guidance and counselling services to affected learners.
6. Monitor school digital learning platforms appropriately.
7. Involve parents in promoting responsible ICT use.

Award any three.

QUESTION 3: INFORMATION ETHICS AND INTELLECTUAL PROPERTY (8 MARKS)

a) Differentiate between plagiarism and copyright violation. (2 marks)

- Plagiarism: Presenting another person's ideas, words or work as one's own without acknowledging the original source. (1 mark)

- Copyright violation: Using, reproducing, distributing or sharing protected creative work without the required authorisation or licence. (1 mark)

b) Explain three ways through which learners can avoid plagiarism when preparing digital assignments. (3 marks)

Award 1 mark for each correct explanation.

1. Acknowledging sources: Learners should provide references for information obtained from books, websites and other sources.
2. Using quotation marks: Directly copied words should be placed in quotation marks and attributed to the original author.
3. Paraphrasing correctly: Learners should express ideas in their own words while acknowledging the original source.
4. Producing original work: Learners should develop their own ideas instead of copying entire assignments from others.
5. Using plagiarism detection tools: Learners may use appropriate software to identify unacknowledged copied content.

Award any three.

c) State three negative effects of spreading misinformation in society. (3 marks)

Award 1 mark for each correct answer.

1. Creates public panic: False information may cause unnecessary fear and confusion.
2. Damages reputations: False claims may harm the reputation of individuals and organisations.
3. Promotes social conflict: Misleading information may cause disagreements and divisions within communities.
4. Affects decision-making: People may make poor decisions based on inaccurate information.
5. Undermines public trust: Repeated misinformation may reduce confidence in institutions and information sources.
6. Threatens public health: False medical information may encourage harmful health decisions.

Award any three.

QUESTION 4: PRIVACY, SECURITY AND KENYAN ICT LAWS (8 MARKS)

a) Explain two ways of protecting personal information when using digital platforms. (2 marks)

Award 1 mark for each correct explanation.

1. Using strong passwords: Create unique and difficult-to-guess passwords to prevent unauthorised access to accounts.
2. Enabling two-factor authentication: Use an additional verification method to improve account security.
3. Adjusting privacy settings: Restrict access to personal information and online activities.
4. Avoiding suspicious links: Do not open unfamiliar links that may be used to steal personal information.
5. Using secure websites: Share sensitive information only through trusted and secure platforms.

6. Avoiding oversharing: Do not publish sensitive personal information unnecessarily.

Award any two.

b) State three Kenyan laws that are relevant to responsible ICT use. (3 marks)

Award 1 mark for each correct answer.

1. Data Protection Act, 2019: Provides a framework for protecting personal data and regulating its processing.
2. Computer Misuse and Cybercrimes Act, 2018: Addresses offences involving computer systems and cybercrime.
3. Copyright Act, 2001: Protects the rights of creators and owners of original works.
4. Access to Information Act, 2016: Provides a framework for access to information held by public entities and relevant private bodies.

Award any three.

c) Explain three ways in which an individual can maintain confidentiality when using ICT. (3 marks)

Award 1 mark for each correct explanation.

1. Restricting access: Only authorised individuals should be allowed to access confidential information.
2. Using passwords: Protect files, devices and accounts using strong passwords.
3. Encrypting information: Use encryption to prevent unauthorised people from reading sensitive information.
4. Logging out of accounts: Always log out after using shared computers.
5. Avoiding public sharing: Do not disclose confidential information on social media or other public platforms.
6. Secure storage: Store confidential documents in protected digital locations.

Award any three.

QUESTION 5: DIGITAL DIVIDE AND ENVIRONMENTAL RESPONSIBILITY (9 MARKS)

a) Define the term digital divide. (2 marks)

The digital divide refers to the gap or inequality between individuals, communities or regions that have access to digital technologies and the Internet and those that have limited or no access to them.

Mark allocation:

- Identification of the gap or inequality – 1 mark.
- Reference to unequal access to digital technologies or the Internet – 1 mark.

b) Explain three factors that contribute to the digital divide in Kenya. (3 marks)

Award 1 mark for each correct explanation.

1. Poverty: Some families cannot afford computers, smartphones and other digital devices.
2. Poor Internet infrastructure: Some rural and remote areas have limited network coverage and unreliable Internet connectivity.
3. Low digital literacy: Some people lack the knowledge and skills required to operate digital devices.

4. High Internet costs: Expensive data bundles prevent some people from accessing online services.
5. Limited electricity supply: Some communities lack reliable electricity for operating and charging digital devices.
6. Geographical inequalities: Urban areas may have better ICT facilities than remote rural communities.
7. Language barriers: Some people may struggle to use digital platforms because of limited content in languages they understand.

Award any three.

c) Suggest four measures that can be used to reduce environmental degradation associated with ICT. (4 marks)

Award 1 mark for each correct answer.

1. Recycling electronic waste: Take obsolete computers, phones and other electronic equipment to authorised recycling facilities.
2. Repairing electronic devices: Repair faulty equipment instead of disposing of it unnecessarily.
3. Reusing electronic equipment: Donate or transfer functional computers and devices to schools and other institutions that need them.
4. Proper disposal of batteries: Dispose of used batteries through appropriate electronic waste collection programmes.
5. Using energy-efficient devices: Choose equipment that consumes less electricity.
6. Promoting responsible purchasing: Avoid unnecessary replacement of functional electronic equipment.
7. Creating environmental awareness: Educate ICT users about the dangers of improper electronic waste disposal.
8. Adopting green computing: Encourage energy conservation and environmentally friendly ICT practices.

Award any four.

QUESTION 6: PRACTICAL APPLICATION OF DIGITAL CITIZENSHIP (9 MARKS)

a) Identify three unethical practices demonstrated in the scenario. (3 marks)

Award 1 mark for each correct answer.

1. Cyberbullying through sharing insulting messages.
2. Plagiarism through copying digital assignments without acknowledging the original sources.
3. Violation of privacy through publishing other learners' photographs without permission.

b) Explain three responsibilities that learners should observe when using the digital learning platform. (3 marks)

Award 1 mark for each correct explanation.

1. Respecting others: Learners should communicate politely and avoid insulting, harassing or intimidating other users.
2. Acknowledging sources: Learners should reference information obtained from other people's work to avoid plagiarism.

3. Protecting privacy: Learners should seek appropriate permission before sharing other people's photographs or personal information.
4. Sharing accurate information: Learners should verify information before posting or forwarding it.
5. Following school rules: Learners should observe the school's ICT policies and acceptable-use guidelines.
6. Protecting account details: Learners should keep their passwords confidential and avoid unauthorised access to other accounts.

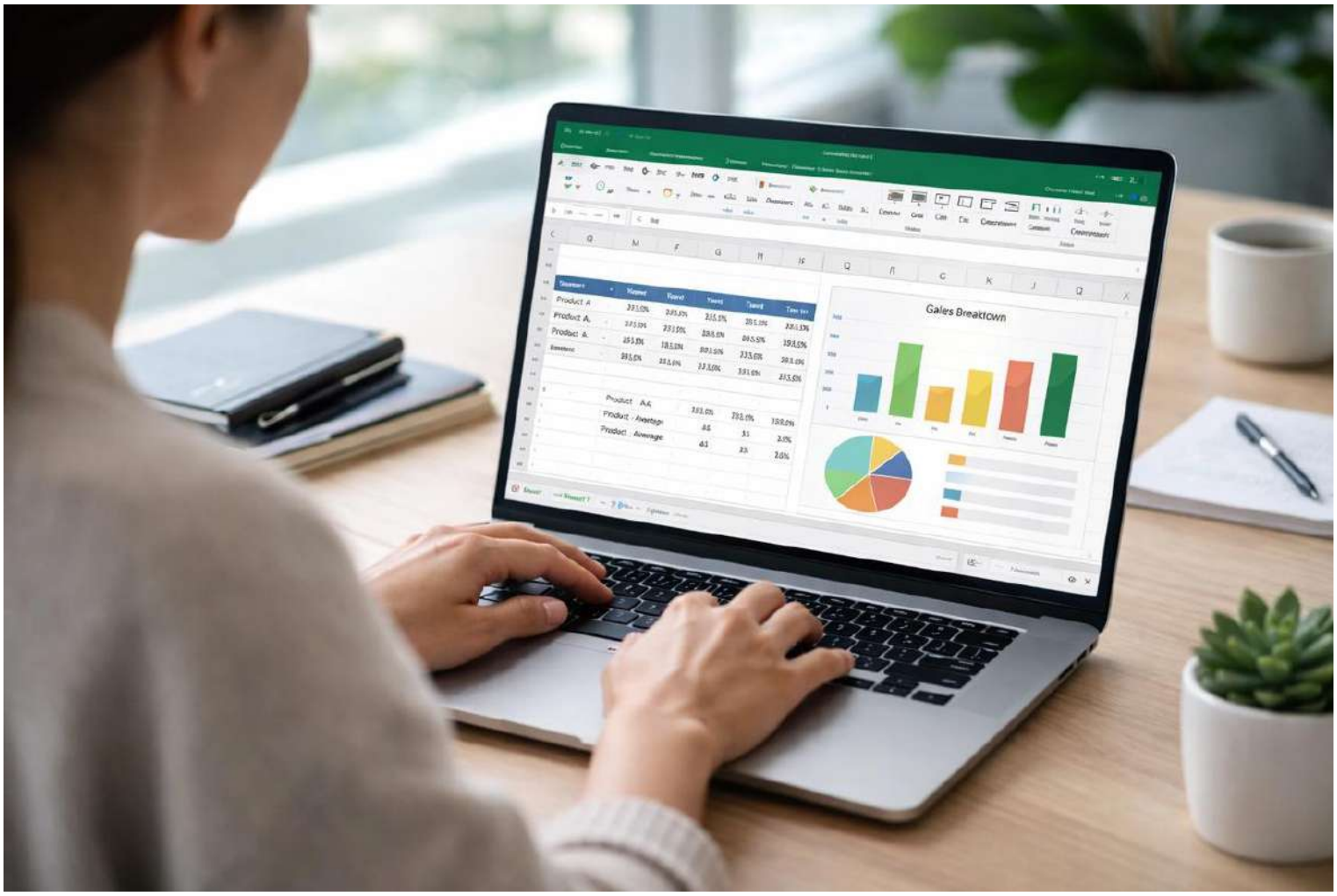
Award any three.

c) Suggest three measures the school can introduce to promote ethical ICT use among learners. (3 marks)

Award 1 mark for each correct answer.

1. Digital citizenship education: Organise lessons and awareness programmes on responsible online behaviour.
2. Establish ICT policies: Develop clear rules governing the use of digital learning platforms.
3. Monitor online activities: Teachers should supervise online discussions and address inappropriate behaviour.
4. Introduce reporting mechanisms: Provide safe channels through which learners can report cyberbullying and privacy violations.
5. Provide guidance and counselling: Support learners involved in cyberbullying incidents and promote positive behaviour.
6. Train teachers and learners: Conduct regular training on digital ethics, privacy and intellectual property.
7. Involve parents: Encourage parents to guide learners on responsible use of digital technologies.

Award any three.



1.0 INTRODUCTION TO SPREADSHEETS

Information and Communication Technology has transformed the way individuals and organisations collect, organise, process, analyse and present information.

In modern society, people and organisations handle large amounts of data daily. Schools maintain learner records, businesses monitor sales, banks manage financial transactions, farmers record agricultural production, and government institutions process statistical information.

Managing such information manually can be time-consuming, inaccurate and difficult, especially when dealing with large datasets.

Spreadsheet productivity tools provide an efficient way of managing and manipulating numerical and non-numerical data.

In Kenya, spreadsheets are widely used in:

- Schools to calculate examination results and prepare learner performance reports.
- Businesses to record sales, expenses and profits.
- Banks to organise financial information.
- Hospitals to manage administrative records.
- Agricultural organisations to analyse crop production.

- Government institutions to organise statistical information.
- Non-governmental organisations to manage project budgets.

This sub-strand introduces learners to spreadsheet productivity tools and how they can be applied to solve real-life problems.

1.1 MEANING AND DEFINITION OF A SPREADSHEET

Definition

A spreadsheet is an electronic document organised into rows and columns, consisting of cells in which data can be entered, stored, organised, calculated, analysed and presented.

A spreadsheet is also a software application used to manipulate numerical and non-numerical data through formulas, functions, tables, charts and other data management tools.

A spreadsheet enables users to:

1. Enter and store data systematically.
2. Perform mathematical calculations.
3. Organise information into rows and columns.
4. Analyse large datasets.
5. Sort and filter records.
6. Create graphs and charts.
7. Prepare financial reports.
8. Compare different sets of information.
9. Identify trends and patterns.
10. Support decision-making.

Example:

A secondary school in Narok County may use a spreadsheet to record the marks scored by Grade 11 learners in different subjects.

D27 | fx | 88

	A	B	C	D	E	F	G	H
1	STUDENT NAME	ENGLISH	MATHEMATICS	PHYSICS	CHEMISTRY	BIOLOGY	TOTAL	
2	A	72	88	77	88	90	415	
3	B	66	89	78	90	97	420	
4	C	86	87	81	89	89	432	
5	D	54	98	80	87	88	407	
6	E	76	95	67	99	87	424	
7	F	71	96	69	94	91	421	
8	G	83	70	87	91	86	417	
9	H	94	79	84	85	84	426	
10	I	93	67	80	87	96	423	
11	J	90	69	91	72	88	410	
12	K	83	88	94	78	94	437	
13	L	81	79	69	79	93	401	
14	M	65	90	79	69	79	382	
15	N	75	91	83	80	94	423	
16	O	63	88	85	81	82	399	
17	P	54	81	79	82	83	379	
18	Q	50	79	73	85	97	384	
19	R	67	79	75	93	86	400	
20	S	78	89	84	80	88	419	
21	T	78	90	86	95	91	440	
22	U	69	91	69	94	95	418	
23	V	71	98	68	90	92	419	
24	W	82	78	79	79	82	400	
25	X	93	81	90	78	93	435	
26	Y	95	82	84	99	80	440	
27	Z	86	89	88	91	80	434	

The spreadsheet can automatically calculate:

- Total marks.
- Average marks.
- Subject rankings.
- Highest and lowest marks.
- Performance grades.
- Class mean scores.

This reduces manual calculations and improves the accuracy of school records.

1.2 MEANING OF SPREADSHEET PRODUCTIVITY TOOLS

Spreadsheet productivity tools are software applications and built-in features that enable users to create, edit, organise, calculate, analyse, visualise and share data in spreadsheet form.

They provide an organised environment for manipulating information and performing calculations.

Examples of spreadsheet productivity tools include:



1. Microsoft Excel

A spreadsheet application developed by Microsoft. It is used for data entry, calculations, data analysis, chart creation and financial modelling.

Example: A school uses Excel to calculate examination results.



2. LibreOffice Calc

A free and open-source spreadsheet application included in the LibreOffice productivity suite.

Example: A small business uses Calc to manage stock records and calculate daily sales.



3. Google Sheets

A web-based spreadsheet application provided by Google. It enables users to create, edit, analyse and share spreadsheets online.

Example: Teachers collaborate on a shared spreadsheet to prepare a departmental assessment report.

Other spreadsheet applications include:

- Apple Numbers.
- WPS Spreadsheets.
- Zoho Sheet.
- ONLYOFFICE Spreadsheet Editor.

1.3 IMPORTANCE OF SPREADSHEET PRODUCTIVITY TOOLS IN DATA MANIPULATION

Data manipulation refers to the process of organising, modifying, calculating, transforming and analysing data to make it meaningful and useful.

Spreadsheet applications are important in data manipulation for the following reasons.

A. Performing automatic calculations

Spreadsheets perform mathematical operations using formulas and functions.

Examples:

- Addition of examination marks.
- Calculation of average scores.
- Determination of business profits.
- Calculation of employee salaries.
- Calculation of agricultural production costs.

Explanation: Once a formula is entered, the spreadsheet automatically updates the result when the related data changes.

B. Organising large amounts of data

Spreadsheets arrange information into rows and columns, making it easier to store and retrieve records.

Examples:

- A school maintains learner admission records.
- A supermarket records products and their prices.
- A farmer maintains a record of harvested crops.

C. Improving accuracy

Spreadsheet formulas and functions reduce errors associated with repeated manual calculations.

For example, a teacher can use the SUM function to calculate the total marks of 100 learners instead of adding each learner's marks manually.

However, incorrect data entry or poorly written formulas can still produce incorrect results.

D. Saving time

Spreadsheets perform calculations and data processing tasks quickly.

For example, a business can calculate the total sales of several hundred transactions within seconds using a formula.

E. Supporting decision-making

Spreadsheets enable users to analyse information and make informed decisions.

Examples:

- A school identifies subjects in which learners need additional support.
- A farmer compares crop yields from different seasons.
- A business identifies its most profitable products.

- A savings group examines its monthly financial performance.

F. Presenting information clearly

Spreadsheet applications provide charts, tables and formatting tools that make information easier to understand.

Examples:

- Bar charts for comparing examination results.
- Pie charts for displaying expenditure proportions.
- Line graphs for showing changes in monthly sales.

G. Updating information easily

Users can modify data without having to prepare an entirely new document.

For example, when the price of maize changes, a trader can update the price in a spreadsheet and automatically recalculate the total value of stock.

H. Facilitating collaboration

Some spreadsheet applications allow several authorised users to work on the same document.

Example:

Teachers in a school can collaborate using Google Sheets to prepare a common assessment performance report.

I. Storing and retrieving information

Spreadsheets provide a convenient way of keeping organised records that can be retrieved whenever required.

J. Reducing operational costs

Spreadsheet tools reduce the need for excessive paper records, repeated manual calculations and some administrative processes.

K. Identifying trends and patterns

Spreadsheet applications can analyse information collected over time.

Example:

A farmer can compare monthly milk production to identify periods when production increases or decreases.

L. Improving report preparation

Spreadsheets enable users to prepare professional reports containing calculations, tables, charts and summaries.

1.4 DIFFERENT TYPES OF SPREADSHEET PRODUCTIVITY TOOLS

Spreadsheet tools can be classified according to their accessibility, licensing arrangements and working environments.

A. Desktop spreadsheet applications

These are spreadsheet applications installed on a computer and used through the computer's operating system.

Examples:

- Microsoft Excel desktop.
- LibreOffice Calc.
- Apple Numbers.

Characteristics:

1. Installed on a computer.
2. Can work without an Internet connection, depending on the application and task.
3. Can store files locally.
4. May support advanced calculations and data analysis.
5. Can handle large datasets, depending on the computer's capacity.

B. Web-based spreadsheet applications

These are spreadsheet applications accessed through a web browser.

Examples:

- Google Sheets.
- Excel for the web.
- Zoho Sheet.

Characteristics:

1. Accessed through an Internet browser.
2. Usually require an Internet connection for full online functionality.
3. Support online file storage.
4. May allow multiple users to collaborate.
5. Support sharing through access permissions.

C. Mobile spreadsheet applications

These are applications designed for smartphones and tablets.

Examples:

- Microsoft Excel mobile.
- Google Sheets mobile.
- WPS Office mobile.

Characteristics:

1. Designed for mobile devices.
2. Support data entry and editing.
3. Allow users to view spreadsheet information while away from computers.
4. Support some calculations and formatting.
5. Some features may be limited compared with desktop versions.

D. Open-source spreadsheet applications

These are applications whose source code is made available under an open-source licence.

Example: LibreOffice Calc.

Characteristics:

- Can be obtained without paying a software purchase fee.
- Allow users to work with spreadsheet data.
- Support formulas, functions and charts.
- Can be modified and redistributed according to their licences.

E. Proprietary spreadsheet applications

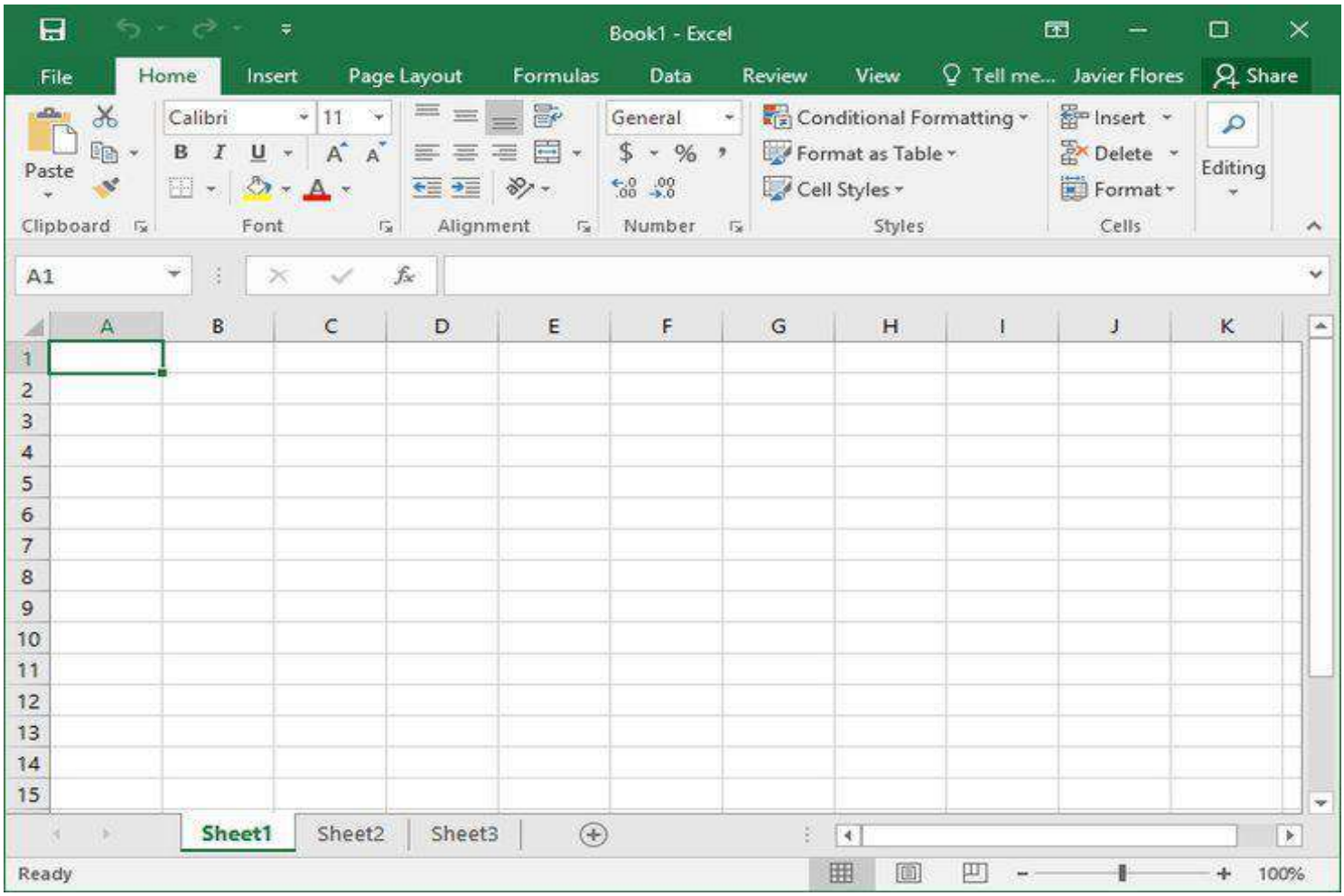
These are applications developed and distributed under licences that control how the software can be used, modified and distributed.

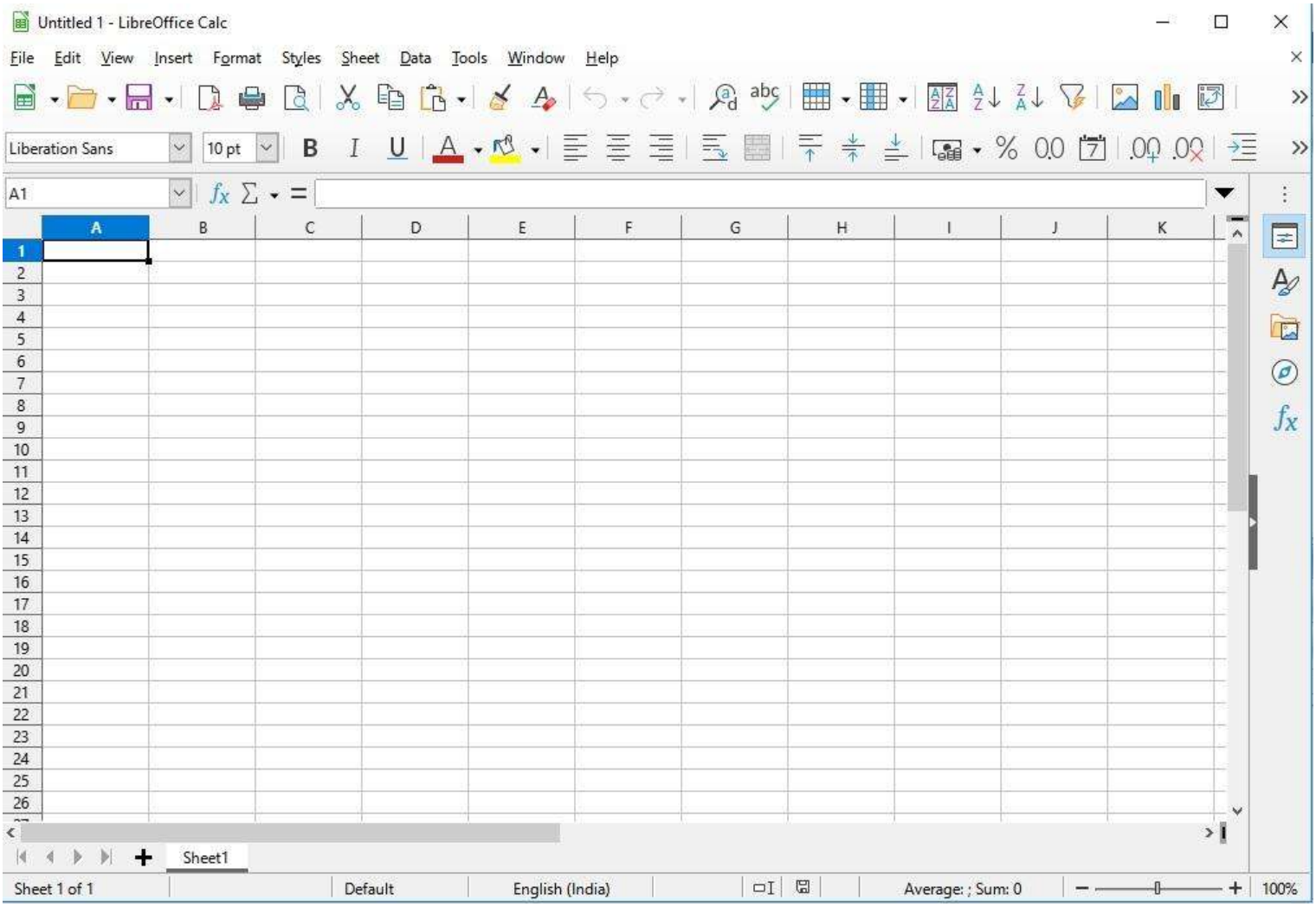
Examples:

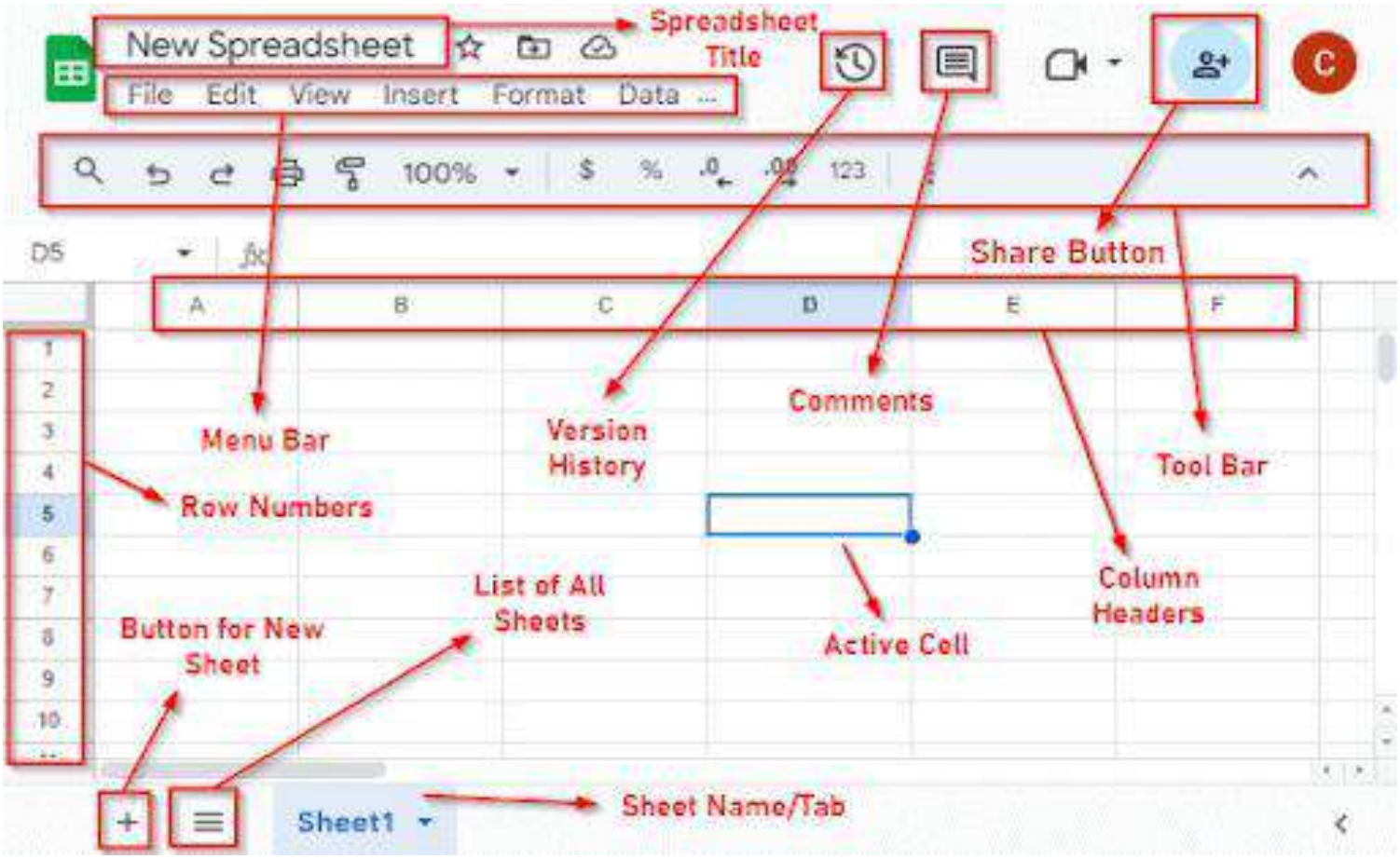
- Microsoft Excel.
- Apple Numbers.

1.5 COMPARISON OF SPREADSHEET PRODUCTIVITY TOOLS

Different spreadsheet applications provide similar basic functions, although they may differ in features, accessibility, licensing and collaboration capabilities.




Untitled 1 - LibreOffice Calc
File Edit View Insert Format Styles Sheet Data Tools Window Help
Liberation Sans
10 pt
A1
Sheet1
Sheet 1 of 1
Default
English (India)
Average: ; Sum: 0
100%


New Spreadsheet
Spreadsheet Title
File Edit View Insert Format Data ...
100%
D5
Share Button
Menu Bar
Version History
Comments
Tool Bar
Row Numbers
Column Headers
Active Cell
List of All Sheets
Button for New Sheet
Sheet1
Sheet Name/Tab

Feature	Microsoft Excel	LibreOffice Calc	Google Sheets
Developer	Microsoft	The Document Foundation community	Google
Licensing	Proprietary	Open-source	Proprietary service
Internet requirement	Not always required	Not always required	Required for normal online collaboration
File format	XLSX	ODS	Google Sheets format
Calculations	Supported	Supported	Supported
Charts	Supported	Supported	Supported
Sorting and filtering	Supported	Supported	Supported
Collaboration	Supported	Through compatible services and workflows	Built-in online collaboration
Data validation	Supported	Supported	Supported

Factors to consider when selecting a spreadsheet application

An individual or organisation should consider the following factors before choosing a spreadsheet productivity tool.

1. **Cost:** Consider the purchase, subscription and maintenance costs of the application.

2. **Ease of use:** Select software that users can understand and operate without unnecessary difficulty.

3. **Compatibility:** Consider whether the application can open and save files in formats used by other organisations.

4. **Availability of features:** Determine whether the application supports the required formulas, functions, charts and data analysis tools.

5. **Internet connectivity:** Consider whether the application can operate effectively where Internet access is limited.

6. **Collaboration:** Determine whether several users need to access and edit the same spreadsheet.

7. **Security:** Consider the security features available for protecting sensitive information.

8. **Storage capacity:** Consider the amount of data the application can handle efficiently.

9. **Technical support:** Consider the availability of assistance, documentation and user training.

10. **Device compatibility:** Ensure that the application can operate on the available computers, tablets or smartphones.

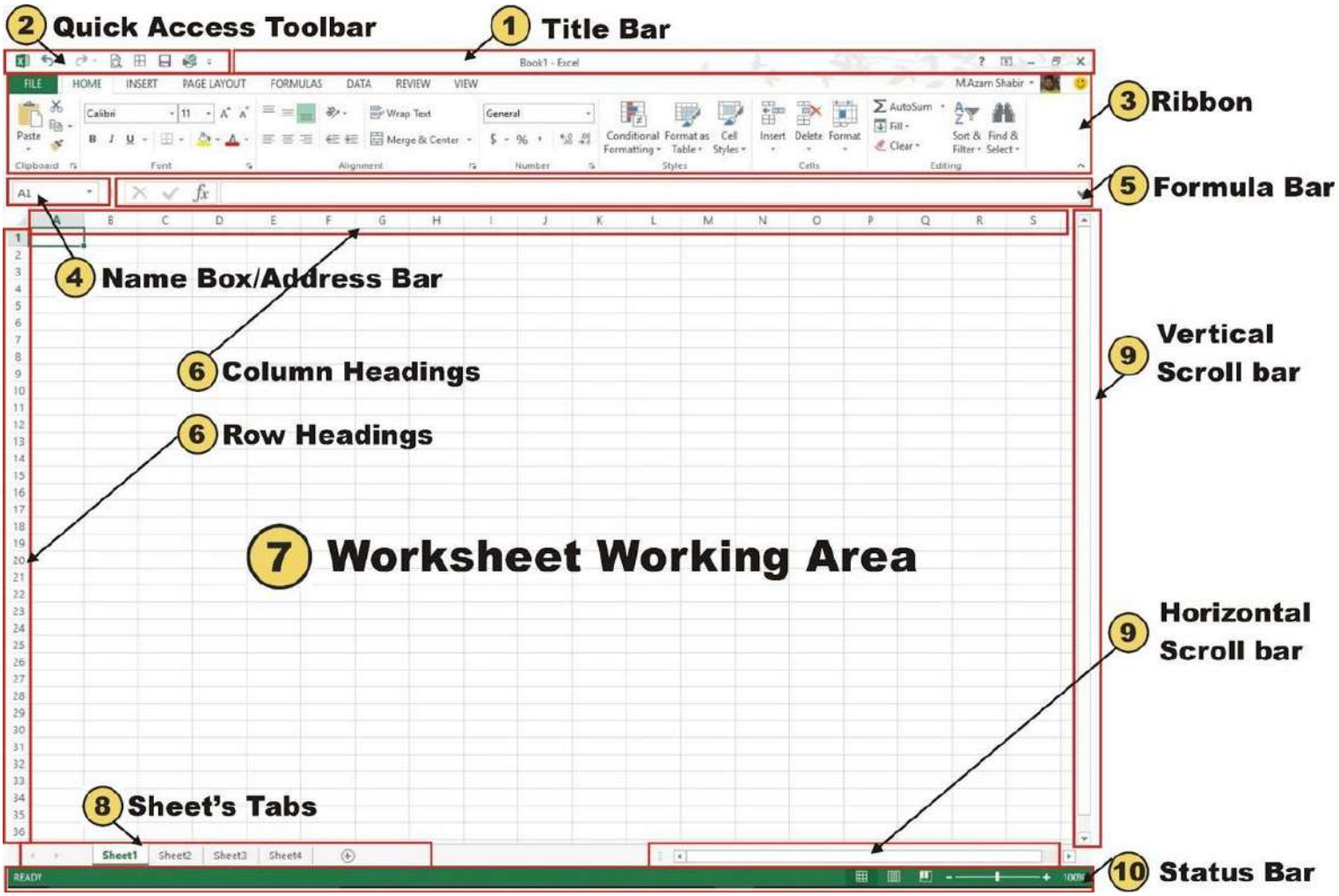
Selecting a suitable spreadsheet application in the Kenyan context

Situation	Suitable application
A rural school with limited Internet access	LibreOffice Calc or desktop Excel
Teachers preparing a collaborative assessment report	Google Sheets
A business requiring advanced data analysis	Microsoft Excel
A learner using an Internet-enabled smartphone	Google Sheets or Excel mobile
An institution requiring an open-source solution	LibreOffice Calc

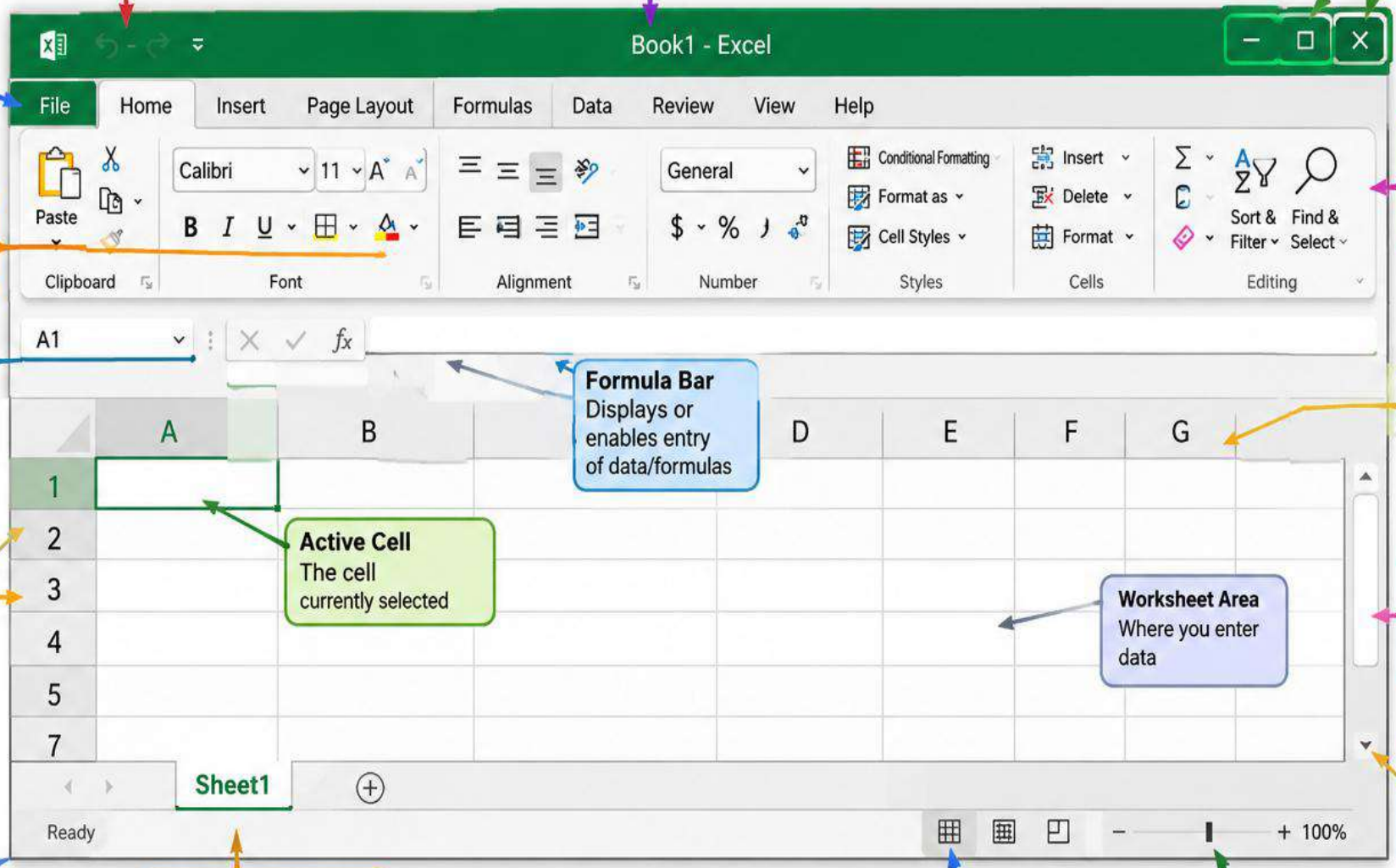
The most suitable application depends on the task, available resources and user requirements.

1.6 FEATURES AND COMPONENTS OF A SPREADSHEET WORKSHEET

A spreadsheet interface contains different components that help users enter, organise, manipulate and analyse data.



Microsoft Excel – All Parts Explained



Quick Access Toolbar
One-click access to common commands

Title Bar
Shows the name of the workbook

Window Controls
Minimise, Maximise or Close

File Tab
Access backstage view

Ribbon
Contains commands

Groups
Organise related commands

Name Box
Shows the address of the active cell

Formula Bar
Displays or enables entry of data/formulas

Column Headers
Label the columns

Active Cell
The cell currently selected

Row Headers
Label the rows

Worksheet Area
Where you enter data

Vertical Scroll Bar
Scroll up or down

Horizontal Scroll Bar
Scroll across the worksheet

Status Bar
Shows status (e.g. Ready)

Sheet Tabs
Switch between worksheets

View Buttons
Change view (Normal, Page Layout, Page Break Preview)

Zoom Slider
Zoom in or out

A. Workbook

Definition: A workbook is an electronic spreadsheet file that contains one or more worksheets.

A workbook can contain several related worksheets.

Example:

A school examination workbook may contain:

- Grade 9.
- Grade 10.
- Grade 11.
- Grade 12.
- Summary of performance.

B. Worksheet

Definition: A worksheet is a single spreadsheet page made up of rows and columns.

It is the working area where users enter and manipulate data.

A workbook may contain multiple worksheets.

C. Row

Definition: A row is a horizontal arrangement of cells in a worksheet.

Rows are identified using numbers.

Examples:

- Row 1.
- Row 2.
- Row 3.
- Row 25.

Rows normally extend from left to right across the worksheet.

D. Column

Definition: A column is a vertical arrangement of cells in a worksheet.

Columns are identified using letters.

Examples:

- Column A.
- Column B.
- Column C.
- Column D.

E. Cell

Definition: A cell is the intersection of a row and a column in a spreadsheet.

A cell is the basic unit used for entering data.

Examples:

- A1.
- B3.
- C10.
- D25.

Cell A1 is located at the intersection of column A and row 1.

F. Active cell

Definition: An active cell is the currently selected cell in a worksheet where data can be entered or edited.

It is normally identified by a highlighted border.

G. Cell address

Definition: A cell address is the unique identification of a cell based on its column letter and row number.

Examples:

Cell address	Location
A1	Column A, row 1
B5	Column B, row 5
D10	Column D, row 10
F20	Column F, row 20

H. Range

Definition: A range is a group of two or more cells selected for a particular operation.

Examples:

- A1:A10 represents cells from A1 to A10.
- B2:D8 represents a rectangular range from B2 to D8.
- A1:F20 represents a range covering six columns and twenty rows.

I. Formula bar

Definition: The formula bar is an area of the spreadsheet interface that displays the contents or formula of the active cell.

It allows users to view, enter and edit cell contents.

J. Name box

Definition: The name box displays the address of the currently selected cell or the name of a selected range.

Example:

When cell C5 is selected, the name box displays C5.

K. Ribbon or toolbar

Definition: The ribbon or toolbar contains commands and tools used to perform different spreadsheet operations.

Examples of commands include:

- Font formatting.
- Alignment.
- Number formatting.
- Sorting.
- Filtering.
- Chart insertion.
- Formula and function insertion.

L. Sheet tabs

Sheet tabs are located at the bottom of the worksheet interface and are used to navigate between worksheets within a workbook.

Users can:

1. Add new worksheets.
2. Rename worksheets.
3. Delete worksheets.
4. Move worksheets.
5. Copy worksheets.

M. Status bar

The status bar displays information about the current spreadsheet state.

Depending on the application and selection, it may display:

- Average of selected numbers.
- Sum of selected cells.
- Number of selected items.
- Zoom level.
- Worksheet viewing options.

N. Scroll bars

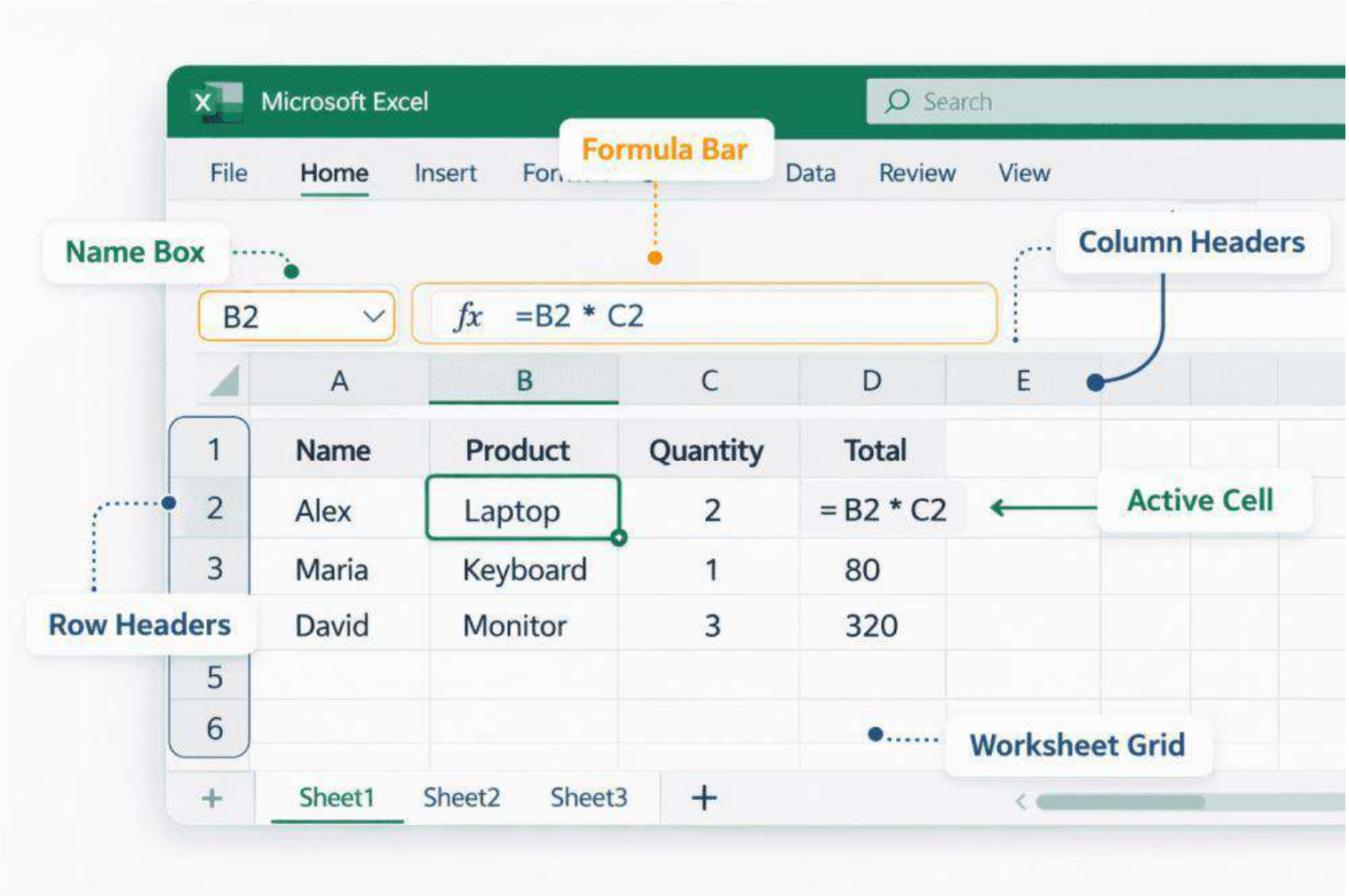
Scroll bars enable users to move through a worksheet horizontally and vertically.

O. Gridlines

Gridlines are faint lines that separate cells and help users identify the rows and columns of a worksheet.

1.7 UNDERSTANDING ROWS, COLUMNS AND CELLS

The following illustration demonstrates how spreadsheet data is arranged.



Consider the following spreadsheet:

	A	B	C	D
1	Learner	Mathematics	English	Total
2	Amina	78	85	163
3	Brian	65	70	135
4	Carol	88	92	180
5	David	72	68	140

From the worksheet:

1. A1 contains the heading Learner.
2. B2 contains 78.
3. C3 contains 70.
4. D4 contains 180.
5. The range B2:C5 contains examination marks.
6. The range A1:D5 contains the entire dataset.

Application: A teacher can use the spreadsheet to calculate totals, compare learner performance and identify learners who require academic support.

1.8 TYPES OF DATA ENTERED INTO A SPREADSHEET

Spreadsheet applications support different types of data.

Understanding the types of data is important because they determine how information is displayed, calculated and manipulated.

A. Text data (Labels)

Text data consists of letters, words, symbols and combinations of characters used mainly for identification or description.

Examples:

- Learner names.
- School names.
- Subject names.
- Product descriptions.
- County names.
- Employee names.

Examples in a worksheet:

A
Learner Name
Amina
Mathematics
Narok County

Text data is generally not used directly in mathematical calculations.

B. Numerical data (Values)

Numerical data consists of numbers that can be used in mathematical calculations.

Examples:

- 250.
- 250.
- 78.5.

- 12.75.
- 250.

Numerical data can be used in:

- Addition.
- Subtraction.
- Multiplication.
- Division.
- Statistical analysis.

C. Date and time data

Date and time data represents calendar dates and time values.

Examples:

- 07/11/2026.
- 15/01/2027.
- 8:30 AM.
- 14:45.

Uses include:

- Recording payment dates.
- Monitoring employee attendance.
- Tracking delivery schedules.
- Recording examination dates.

D. Currency data

Currency data represents monetary values.

Examples:

- KSh 500.
- KSh 2,500.
- KSh 15,000.

Uses:

- Calculating school fees.
- Recording sales.
- Preparing budgets.
- Monitoring expenditure.

E. Percentage data

Percentage data represents a value as a fraction of one hundred.

Examples:

- 25%.
- 50%.
- 75%.
- 92%.

Uses:

- Calculating examination percentages.
- Determining discounts.
- Calculating tax rates.
- Analysing business profits.

F. Logical data

Logical data consists of two possible values: TRUE and FALSE.

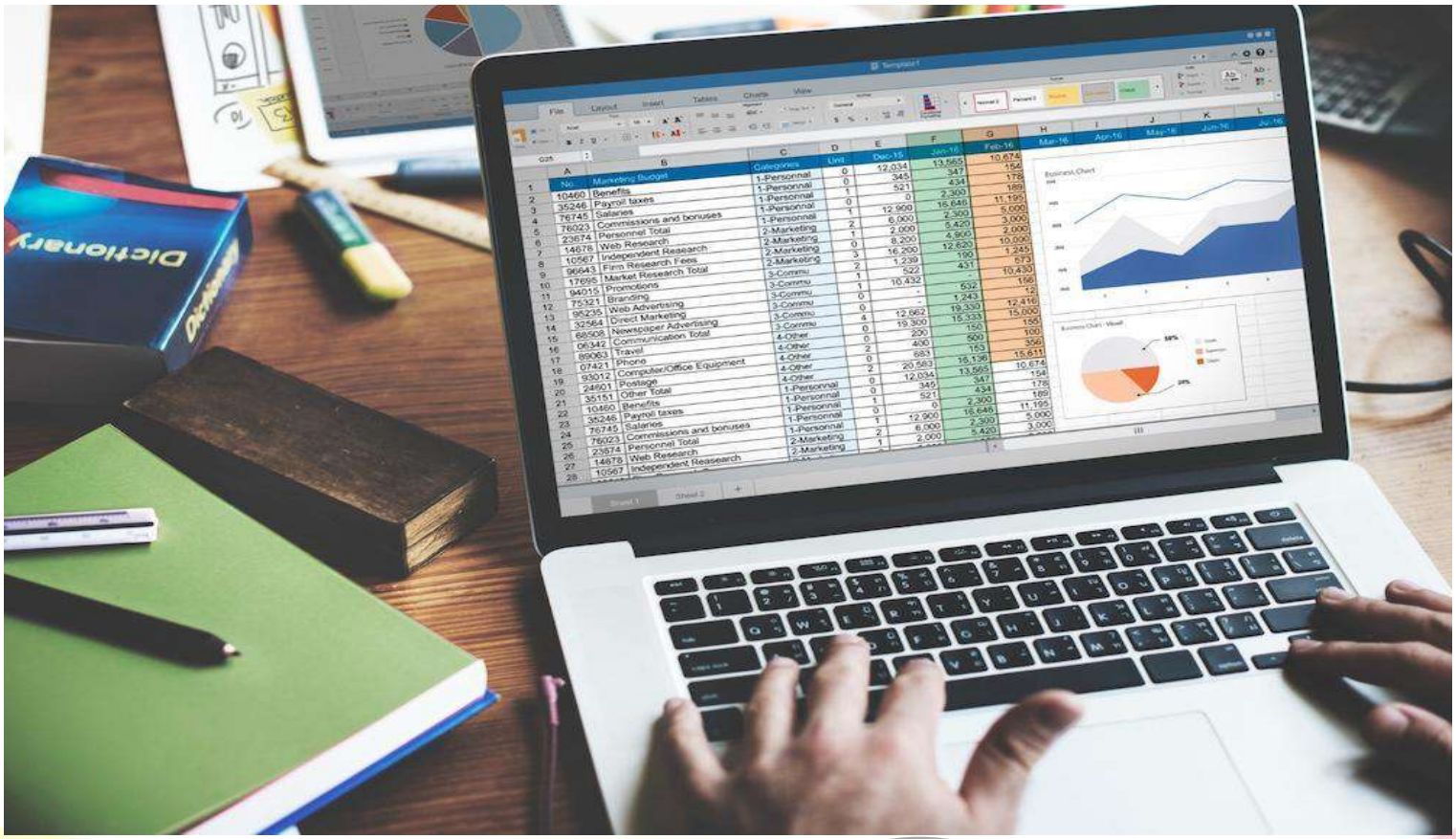
Examples:

- Whether a learner has paid school fees.
- Whether stock is available.
- Whether a payment has been confirmed.

Some spreadsheet functions use logical values when making decisions.

1.9 CREATING A SPREADSHEET FILE

Creating a spreadsheet involves opening a spreadsheet application, entering data, organising the information and saving the file for future use.



Procedure for creating a spreadsheet using Microsoft Excel

Step 1: Open Microsoft Excel

- Switch on the computer.
- Locate Microsoft Excel.
- Double-click the application icon.
- Wait for the application to load.

Step 2: Create a new workbook

- Select Blank Workbook.
- A new worksheet will appear.

Step 3: Enter data

- Click the required cell.
- Type the information.
- Press Enter to confirm the entry.
- Move to the next cell.

Step 4: Organise the data

- Enter headings in the first row.
- Place related information in the same column.
- Ensure that each row represents one record.
- Avoid unnecessary blank rows within the dataset.

Step 5: Format the worksheet

- Apply appropriate fonts.
- Adjust column widths.
- Apply borders.
- Use suitable number formats.
- Highlight important headings.

Step 6: Save the workbook

- Click File.
- Select Save As where appropriate.
- Choose the storage location.
- Enter a meaningful file name.
- Select the required file format.
- Click Save.

Example file name:

Grade_11_Examination_Results_2027.xlsx

Creating a spreadsheet using Google Sheets

1. Open a web browser.
2. Visit Google Sheets.
3. Sign in using an appropriate Google account.
4. Select Blank spreadsheet.
5. Enter the required information.
6. Rename the spreadsheet.
7. Organise and format the data.
8. Use the sharing controls to grant appropriate access to authorised users.

Google Sheets normally saves changes automatically when online and connected to the service.

1.10 EDITING AND FORMATTING SPREADSHEET DATA

A. Editing spreadsheet data

Editing refers to making changes to existing information in a worksheet.

Common editing operations include:

1. Inserting new data.
2. Deleting unwanted data.
3. Replacing incorrect information.
4. Copying cell contents.
5. Moving data.
6. Clearing cell contents.
7. Inserting rows.
8. Inserting columns.
9. Renaming worksheets.
10. Finding and replacing information.

Examples of editing operations

Correcting data:

A learner's name is incorrectly entered as Aminaah instead of Amina.

The user selects the cell and replaces the incorrect name with the correct one.

Inserting a row:

A teacher needs to add a new learner to the examination records.

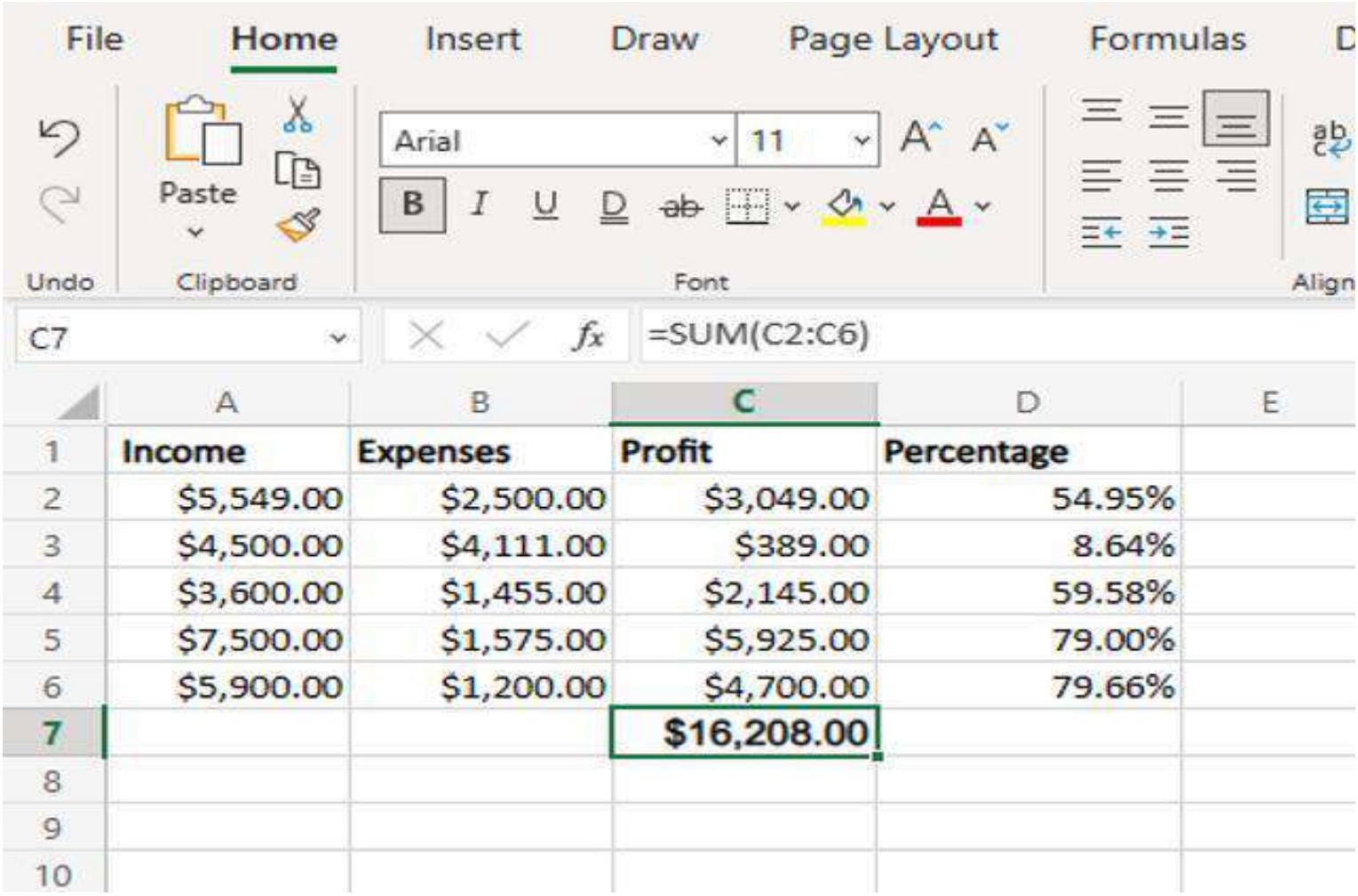
The teacher inserts a row in the appropriate position and enters the learner's details.

Deleting data:

A user removes a duplicate record from a dataset after confirming that it is unnecessary.

B. Formatting spreadsheet data

Formatting refers to changing the appearance and presentation of spreadsheet information to improve readability, organisation and understanding.



	A	B	C	D	E
1	**Income**	**Expenses**	**Profit**	**Percentage**	
2	$5,549.00	$2,500.00	$3,049.00	54.95%	
3	$4,500.00	$4,111.00	$389.00	8.64%	
4	$3,600.00	$1,455.00	$2,145.00	59.58%	
5	$7,500.00	$1,575.00	$5,925.00	79.00%	
6	$5,900.00	$1,200.00	$4,700.00	79.66%	
7			**$16,208.00**		
8					
9					
10					

Common formatting operations

1. Changing font type

This involves selecting a different typeface for spreadsheet contents.

Examples:

- Arial.
- Calibri.
- Aptos.
- Times New Roman.

2. Changing font size

This involves increasing or reducing the size of text.

Example: A worksheet heading may be formatted using size 16 while ordinary data uses size 11.

3. Applying bold formatting

Bold formatting makes selected text appear thicker and more prominent.

It is commonly used for:

- Column headings.
- Titles.
- Important figures.

4. Applying italics

Italics make text appear slanted.

They may be used to emphasise certain information.

5. Applying underline

Underline formatting places a line below selected text.

It is useful for emphasising headings.

6. Changing font colour

Users can apply different font colours to improve visibility and distinguish important information.

7. Applying cell background colour

This involves changing the background colour of selected cells.

Example: A teacher may use a light green background for examination headings.

8. Applying borders

Borders are lines placed around cells or ranges to separate information and improve presentation.

9. Text alignment

Alignment determines how information is positioned within a cell.

Types include:

- Left alignment.
- Centre alignment.
- Right alignment.
- Top alignment.
- Middle alignment.
- Bottom alignment.

10. Merging cells

Merging combines two or more selected cells into a single larger cell.

Example: Cells A1:D1 may be merged to display the heading:

GRADE 11 ASSESSMENT RESULTS

11. Text wrapping

Text wrapping displays lengthy information on multiple lines within the same cell instead of allowing it to extend beyond the cell boundary.

12. Adjusting column width and row height

This ensures that information is displayed clearly without unnecessary cutting off or overcrowding.

13. Applying number formats

Number formatting changes how numerical information is displayed.

Examples:

- Currency: KSh 2,500.00.
- Percentage: 85%.
- Date: 07/11/2027.
- Decimal: 45.75.

14. Conditional formatting

Conditional formatting automatically changes the appearance of cells when specified conditions are met.

For example, examination marks below 40 may be highlighted red, while marks of 70 and above may be highlighted green.

1.11 MATHEMATICAL OPERATORS IN SPREADSHEETS

Mathematical operators are symbols used to perform calculations in a spreadsheet.

Operator	Meaning	Example	Result
+	Addition	=10+5	15
-	Subtraction	=10-5	5
*	Multiplication	=10*5	50
/	Division	=10/5	2
^	Exponentiation	=2^3	8
%	Percentage	=50*10%	5

Importance of mathematical operators

1. Enable automatic calculations.
2. Reduce manual mathematical work.
3. Improve efficiency.
4. Support financial calculations.
5. Help users analyse numerical data.

1.12 UNDERSTANDING FORMULAS IN SPREADSHEETS

Definition

A formula is an expression entered into a spreadsheet cell to perform a calculation using values, cell references, mathematical operators and sometimes functions.

A spreadsheet formula normally begins with an equal sign (=).

Examples of formulas

1. =A1+B1 – Adds the values in cells A1 and B1.
2. =A1-B1 – Subtracts B1 from A1.
3. =A1*B1 – Multiplies A1 by B1.
4. =A1/B1 – Divides A1 by B1.
5. =(A1+B1)/2 – Calculates the average of two values.

Example of a formula in a school spreadsheet

A	B	C	D
Learner	Mathematics	English	Total
Amina	75	80	=B2+C2
Brian	65	70	=B3+C3
Carol	90	85	=B4+C4

The spreadsheet calculates the totals automatically.

Advantages of using formulas

1. Reduce repetitive calculations.
2. Save time.
3. Improve calculation efficiency.
4. Allow automatic recalculation.
5. Reduce some forms of human error.
6. Support analysis of large datasets.

1.13 CELL REFERENCES IN SPREADSHEETS

Definition

A cell reference is the address of a cell used in a formula or function to identify the location of data required for a calculation.

Cell references enable spreadsheet formulas to use values stored in different cells.

There are three main types of cell references.

A. Relative cell reference

A relative cell reference is a cell address that changes automatically when a formula is copied or moved to another cell.

Example:

If cell C2 contains:

=A2+B2

When the formula is copied to C3, it automatically changes to:

=A3+B3

Characteristics:

1. Changes when copied to another cell.
2. Adjusts according to the new formula location.
3. Is commonly used when applying similar calculations to many records.

B. Absolute cell reference

An absolute cell reference is a cell address that remains fixed when a formula is copied or moved to another cell.

It is identified by the dollar sign ($) placed before the column letter and row number.

Example:

=$B$2*A3

When copied to another cell, the reference $B$2 remains fixed.

Characteristics:

1. Does not change when copied.
2. Uses dollar signs before the column and row.
3. Is useful when calculations depend on a fixed value.

Kenyan business example:

A trader calculates the price of goods including a fixed VAT rate stored in cell B1.

If the VAT rate is stored in B1, the formula can use an absolute reference to ensure the rate remains fixed when the formula is copied down the worksheet.

C. Mixed cell reference

A mixed cell reference is a cell address in which either the column or the row is fixed while the other part changes when the formula is copied.

There are two types:

1. $A1 – The column A is fixed, but the row can change.
2. A$1 – The row 1 is fixed, but the column can change.

Comparison of cell references

Type	Example	Behaviour
Relative	A1	Column and row change
Absolute	$A$1	Column and row remain fixed
Mixed	$A1	Column remains fixed
Mixed	A$1	Row remains fixed

Importance of cell references

1. Enable calculations using data from different cells.
2. Simplify repeated calculations.
3. Improve formula efficiency.
4. Reduce the need to enter the same values repeatedly.
5. Support complex calculations.
6. Make spreadsheet models easier to update.

Microsoft Excel – Spreadsheet Shortcuts

Basic Navigation

Ctrl + ←	Move to start of current row
Ctrl + →	Move to end of current row
Ctrl + ↑	Move to start of current column
Ctrl + ↓	Move to end of current column
Home	Go to start of row
End	Go to end of row
Ctrl + Home	Go to A1
Ctrl + End	Go to last cell with data

Selecting Cells

Shift + Arrow	Extend selection
Ctrl + A	Select entire worksheet
Ctrl + Shift + Space	Select entire column
Shift + Space	Select entire row
Ctrl + Shift + Arrow	Select to edge of data

Editing

F2	Edit active cell
F4	Repeat last action
Ctrl + Z	Undo
Ctrl + Y	Redo
Ctrl + C	Copy
Ctrl + X	Cut
Ctrl + V	Paste
Ctrl + D	Fill down
Ctrl + R	Fill right

Formatting

Ctrl + B	Bold
Ctrl + I	Italic
Ctrl + U	Underline
Ctrl + 1	Format Cells
Ctrl + Shift + $	Currency format
Ctrl + Shift + %	Percentage format
Ctrl + Shift + #	Date format
Ctrl + Shift + @	Time format
Ctrl + Shift + ~	General format

Working with Rows & Columns

Ctrl + +	Insert row or column
Ctrl + –	Delete row or column
Alt + H + I + R	Insert rows
Alt + H + I + C	Insert columns
Alt + H + D + R	Delete rows
Alt + H + D + C	Delete columns

Data Handling

Ctrl + T	Create Table
Ctrl + K	Insert Hyperlink
Ctrl + ;	Insert current date
Ctrl + Shift + ;	Insert current time
Ctrl + '	Copy formula from above

Working with Sheets

Ctrl + N	New Workbook
Ctrl + O	Open Workbook
Ctrl + S	Save Workbook
Ctrl + P	Print
Ctrl + W	Close Workbook
Ctrl + Tab	Switch between sheets
Ctrl + Page Up	Go to previous sheet
Ctrl + Page Down	Go to next sheet
Shift + F11	Insert new worksheet

Functions & Formulas

Alt + =	AutoSum
Ctrl + Shift + Enter	Enter array formula
F3	Paste Name
F9	Calculate all worksheets
Ctrl + `	Show formulas

Views & Display

Ctrl + 9	Hide rows
Ctrl + 0	Hide columns
Ctrl + 1	Format Cells
Ctrl + 2	Page Break Preview
Ctrl + 3	Normal View
Ctrl + 4	Show/Hide formula bar

Useful Tips

- ✓ Use shortcuts to work faster and more efficiently.
- ✓ Practice regularly for better productivity.
- ✓ Combine shortcuts for advanced tasks.

Common Shortcuts Summary

⭐ Ctrl + C : Copy Ctrl + V : Paste Ctrl + Z : Undo

⭐ Ctrl + B : Bold Ctrl + I : Italic Ctrl + S : Save

Work Smarter with Excel!

1.14 FUNCTIONS IN SPREADSHEETS

Definition

A function is a predefined formula in a spreadsheet application that performs a specific calculation or operation using supplied values or cell references.

Functions simplify calculations and reduce the need to write long formulas manually.

Most spreadsheet functions follow this general structure:

=FUNCTION_NAME(argument1, argument2, ...)

Examples:

- =SUM(A1:A10)
- =AVERAGE(B2:B10)
- =MAX(C1:C20)

A. SUM function

Definition: The SUM function adds numerical values contained in selected cells or ranges.

Syntax:

=SUM(number1, number2, ...)

Example:

=SUM(B2:B6)

This adds all numerical values from B2 to B6.

Practical application:

A shopkeeper in Kilgoris records daily sales in cells B2 to B6. The SUM function calculates total sales.

B. AVERAGE function

Definition: The AVERAGE function calculates the arithmetic mean of numerical values in selected cells.

Syntax:

=AVERAGE(number1, number2, ...)

Example:

=AVERAGE(C2:C6)

This calculates the average of values in C2 to C6.

Practical application:

A teacher uses AVERAGE to calculate the mean examination score of learners.

C. MAX function

Definition: The MAX function identifies the highest numerical value in a selected range.

Syntax:

=MAX(A1:A10)

Example: It can identify the highest mark scored by a learner in a class.

D. MIN function

Definition: The MIN function identifies the lowest numerical value in a selected range.

Syntax:

=MIN(A1:A10)

Example: A teacher uses it to identify the lowest mark in an examination.

E. COUNT function

Definition: The COUNT function counts the number of cells containing numerical values in a specified range.

Syntax:

=COUNT(A1:A10)

Example: It can count the number of examination marks entered in a worksheet.

F. COUNTA function

Definition: COUNTA counts the number of non-empty cells in a selected range.

Syntax:

=COUNTA(A1:A10)

It counts cells containing text, numbers and other non-empty entries.

G. COUNTIF function

Definition: COUNTIF counts the number of cells in a range that satisfy a specified condition.

Syntax:

=COUNTIF(range, criteria)

Example:

=COUNTIF(B2:B20,">=50")

This counts the number of marks that are 50 or above.

Application: A teacher can use COUNTIF to determine how many learners attained a particular performance threshold.

H. SUMIF function

Definition: SUMIF adds values in a specified range that satisfy a given condition.

Syntax:

=SUMIF(range, criteria, sum_range)

Example:

=SUMIF(A2:A10,"Maize",B2:B10)

This adds the values in B2:B10 corresponding to records labelled Maize in A2:A10.

Application: A farmer can calculate the total quantity of maize harvested from different farms.

I. IF function

Definition: The IF function tests a condition and returns one result when the condition is TRUE and another result when it is FALSE.

Syntax:

=IF(logical_test, value_if_true, value_if_false)

Example:

=IF(B2>=50,"PASS","BELOW THRESHOLD")

The formula displays PASS if the value in B2 is at least 50. Otherwise, it displays BELOW THRESHOLD.

J. ROUND function

Definition: ROUND reduces a numerical value to a specified number of decimal places.

Syntax:

=ROUND(number, num_digits)

Example:

=ROUND(45.678,2)

Result: 45.68.

K. TODAY function

Definition: TODAY returns the current date according to the spreadsheet application's date system.

Syntax:

=TODAY()

Application: Recording or monitoring the current date in a report.

L. NOW function

Definition: NOW returns the current date and time according to the spreadsheet application's date and time settings.

Syntax:

=NOW()

M. CONCAT function

Definition: CONCAT combines text from different cells into one text string.

Example:

=CONCAT(A2," ",B2)

If A2 contains Mary and B2 contains Njeri, the result is Mary Njeri.

N. VLOOKUP function

Definition: VLOOKUP searches for a value in the first column of a table and returns a corresponding value from another column in the same row.

Syntax:

=VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

Example:

=VLOOKUP(A2,$F$2:$G$10,2,FALSE)

This searches for the value in A2 in the first column of the table F2:G10 and returns the corresponding value from the second column when an exact match is found.

Application: A school may use VLOOKUP to retrieve a learner's class or other information from an organised reference table.

O. MEDIAN function

Definition: MEDIAN identifies the middle value in an ordered set of numerical data.

Example:

=MEDIAN(A1:A10)

It is useful when analysing data that may contain unusually high or low values.

P. MODE function

Definition: MODE identifies the most frequently occurring numerical value in a dataset.

Example:

=MODE(A1:A10)

It can be used to identify the most frequently attained examination mark.

Summary of important spreadsheet functions

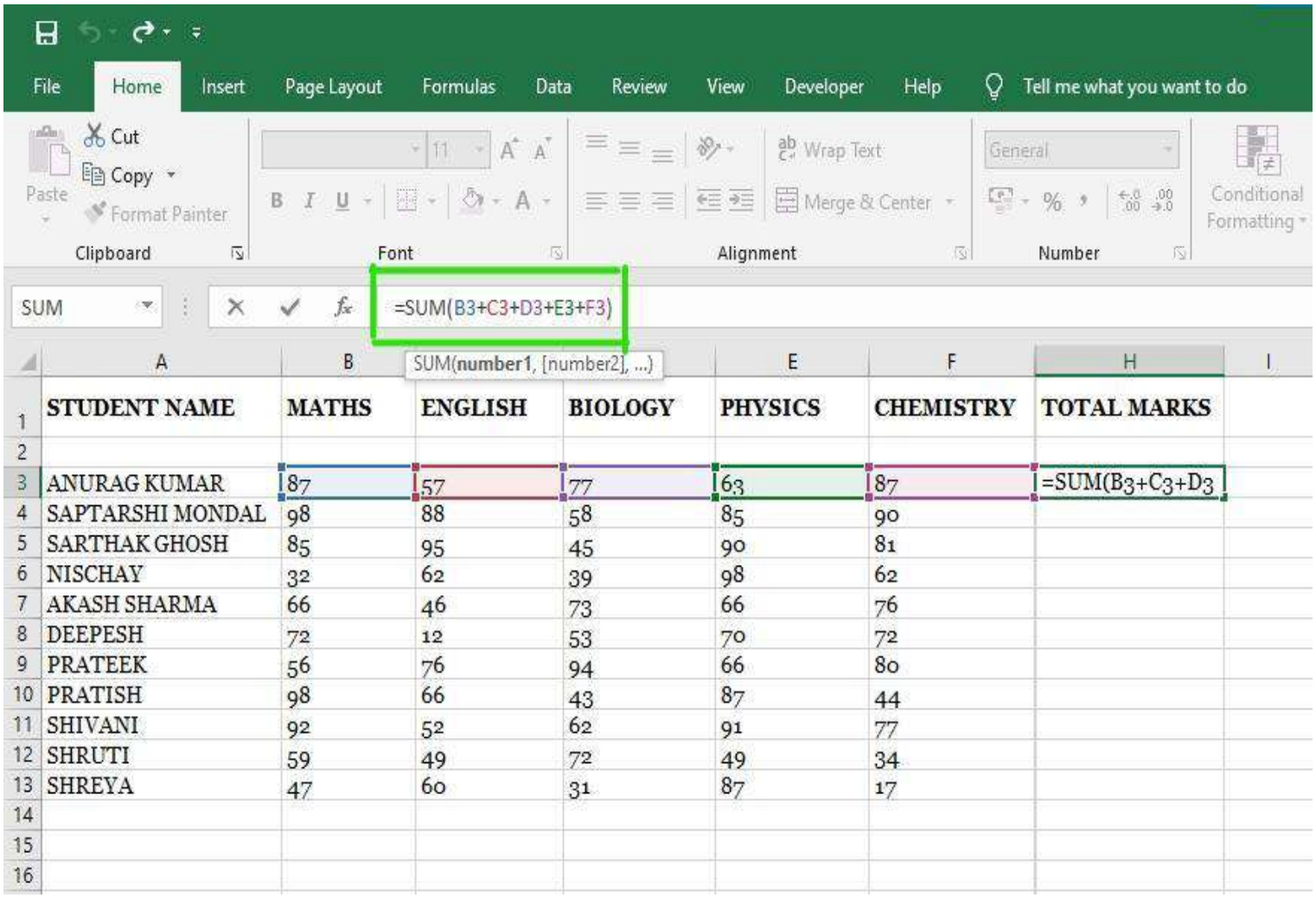
Function	Main purpose
SUM	Adds numerical values
AVERAGE	Calculates the arithmetic mean
MAX	Finds the highest value
MIN	Finds the lowest value
COUNT	Counts numerical cells
COUNTA	Counts non-empty cells
COUNTIF	Counts cells meeting a condition
SUMIF	Adds values meeting a condition
IF	Tests a condition

ROUND	Rounds numerical values
TODAY	Returns the current date
NOW	Returns current date and time
CONCAT	Combines text
VLOOKUP	Searches vertically in a table
MEDIAN	Finds the middle value
MODE	Finds the most frequent value

Important: Function availability and syntax may differ slightly between spreadsheet applications and versions.

1.15 PRACTICAL APPLICATION OF FORMULAS AND FUNCTIONS

Consider the following examination dataset for Grade 11 learners in a Kenyan secondary school.



	A	B	C	D	E	F	H
1	STUDENT NAME	MATHS	ENGLISH	BIOLOGY	PHYSICS	CHEMISTRY	TOTAL MARKS
2							
3	ANURAG KUMAR	87	57	77	63	87	=SUM(B3+C3+D3
4	SAPTARSHI MONDAL	98	88	58	85	90	
5	SARTHAK GHOSH	85	95	45	90	81	
6	NISCHAY	32	62	39	98	62	
7	AKASH SHARMA	66	46	73	66	76	
8	DEEPESH	72	12	53	70	72	
9	PRATEEK	56	76	94	66	80	
10	PRATISH	98	66	43	87	44	
11	SHIVANI	92	52	62	91	77	
12	SHRUTI	59	49	72	49	34	
13	SHREYA	47	60	31	87	17	
14							
15							
16							

Learner	Mathematics	English	Biology	Total
Amina	78	82	75	
Brian	65	70	68	
Carol	90	88	92	
David	55	62	58	
Esther	85	80	87	

Assuming the learner names are in A2:A6, Mathematics in B2:B6, English in C2:C6 and Biology in D2:D6:

Activity 1: Calculate total marks

In E2 enter:

=SUM(B2:D2)

Copy the formula down to E6.

Activity 2: Calculate average marks

In F2 enter:

=AVERAGE(B2:D2)

Copy down to F6.

Activity 3: Identify the highest Mathematics mark

Enter:

=MAX(B2:B6)

Activity 4: Identify the lowest English mark

Enter:

=MIN(C2:C6)

Activity 5: Calculate the class average in Biology

Enter:

=AVERAGE(D2:D6)

Activity 6: Count the number of learners with Mathematics marks of at least 70

Enter:

=COUNTIF(B2:B6,">=70")

Activity 7: Classify Mathematics performance

Enter the following formula in G2:

=IF(B2>=50,"MEETS THRESHOLD","BELOW THRESHOLD")

Copy the formula down to G6.

Activity 8: Calculate the total class marks in English

Enter:

=SUM(C2:C6)

These activities demonstrate how spreadsheet formulas and functions can be used to manipulate educational data.

1.16 ERRORS IN SPREADSHEET FORMULAS AND FUNCTIONS

Spreadsheet errors occur when formulas, functions or data are entered incorrectly or when calculations cannot be completed as expected.

Understanding common errors helps users identify and correct problems.

Error	Meaning	Possible solution
#DIV/0!	A formula attempts to divide by zero or an empty divisor	Check the divisor
#VALUE!	An inappropriate value is used in a calculation	Check the data types
#NAME?	The application does not recognise a function or name	Correct the spelling or defined name
#REF!	A formula contains an invalid cell reference	Restore or correct the reference
#N/A	A required value is unavailable or not found	Check lookup values and ranges
#NUM!	An invalid numerical value is used	Check numerical arguments
#NULL!	An invalid range intersection or reference operator is used	Correct the formula references

Ways of preventing spreadsheet errors

1. Check formulas before copying them.
2. Use correct cell references.
3. Enter data in the appropriate format.
4. Verify numerical values.
5. Check formulas after editing or deleting cells.
6. Use suitable functions.
7. Test calculations using known values.
8. Protect important formula cells against accidental editing.

EXCEL FORMULAS – Quick Reference Guide

1. Basic Mathematical Formulas

Formula	Function
=A1+B1	Addition
=A1-B1	Subtraction
=A1*B1	Multiplication
=A1/B1	Division
=A1^2	Power (square)
=SQRT(A1)	Square root
=ABS(A1)	Absolute value

2. Statistical Formulas

Formula	Function
=SUM(A1:A10)	Adds values
=AVERAGE(A1:A10)	Average
=MAX(A1:A10)	Highest value
=MIN(A1:A10)	Lowest value
=COUNT(A1:A10)	Count numbers
=COUNTA(A1:A10)	Count non-empty
=MEDIAN(A1:A10)	Middle value
=MODE.SNGL(A1:A10)	Most frequent
=RANK.EQ(A1,A1:A10,0)	Rank a value

3. Logical Formulas

Formula	Function
=IF(A1>=50,"PASS","FAIL")	Test a condition
=AND(A1>=50,B1>=50)	All true
=OR(A1>=50,B1>=50)	At least one true
=NOT(A1>50)	Reverse result
=IFERROR(A1/B1,0)	Handle errors
=IFS(A1>=80,"A",A1>=60,"B", TRUE,"C")	Multiple conditions

4. Counting and Conditional Formulas

Formula	Function
=COUNTIF(A1:A20,">=50")	Count ≥ 50
=COUNTIF(A1:A20,"PASS")	Count PASS
=COUNTIFS(A1:A20,">=50",B1:B20,"Male")	Count with 2 criteria
=SUMIF(A1:A20,"Male",B1:B20)	Sum by condition
=SUMIFS(C [illegible] Tale, B1:B20,">=50")	Sum with conditions

5. Text Formulas

Formula	Function
=CONCAT(A1,B1)	Join text
=LEFT(A1,3)	Left characters
=RIGHT(A1,3)	Right characters
=MID(A1,2,4)	Middle text
=LEN(A1)	Count characters
=UPPER(A1)	Uppercase
=LOWER(A1)	Lowercase
=PROPER(A1)	Capitalise words
=TRIM(A1)	Remove spaces

6. Date and Time Formulas

Formula	Function
=TODAY()	Current date
=NOW()	Date and time
=DAY(A1)	Day of month
=MONTH(A1)	Month
=YEAR(A1)	Year
=DATE(2026,11,10)	Create date
=DATEDIF(A1,B1,"Y")	Years between dates
=NETWORKDAYS(A1,B1)	Working days

7. Lookup and Reference Formulas

Formula	Function
=VLOOKUP(A2,D2:F10,2,FALSE)	Vertical search
=HLOOKUP(A2,B1:F3,2,FALSE)	Horizontal search
=XLOOKUP(A2,D2:D10,E2:E10)	Search & return
=INDEX(B2:B10,3)	Value at position
=MATCH(A2,B2:B10,0)	Position of value

8. Rounding Formulas

Formula	Function
=ROUND(A1,2)	Round to 2 d.p.
=ROUNDUP(A1,0)	Round up
=ROUNDDOWN(A1,0)	Round down
=INT(A1)	Integer part
=MOD(A1,B1)	Remainder
=CEILING(A1,10)	Next multiple of 10
=FLOOR(A1,10)	Previous multiple

9. Practical Example – Exam Results

Learner	Maths	English	Total	Grade
John	70	80	150	B
Mary	45	65	110	C
Peter	90	85	175	A

Total: =SUM(B2:C2)
Average: =AVERAGE(B2:C2)
Pass/Fail: =IF(D2>=100,"PASS","FAIL")

Key Excel Operators: + Addition | - Subtraction | * Multiplication | / Division | ^ Power | = Equal to | > Greater than | < Less than | >= Greater or equal | <= Less or equal | <> Not equal

Work Smarter with Excel!

1.17 ORGANISING DATA IN SPREADSHEETS

Data organisation refers to arranging information systematically so that it can be easily understood, accessed, retrieved, manipulated and analysed.

A well-organised spreadsheet makes data processing more efficient.

Common methods of organising data include:

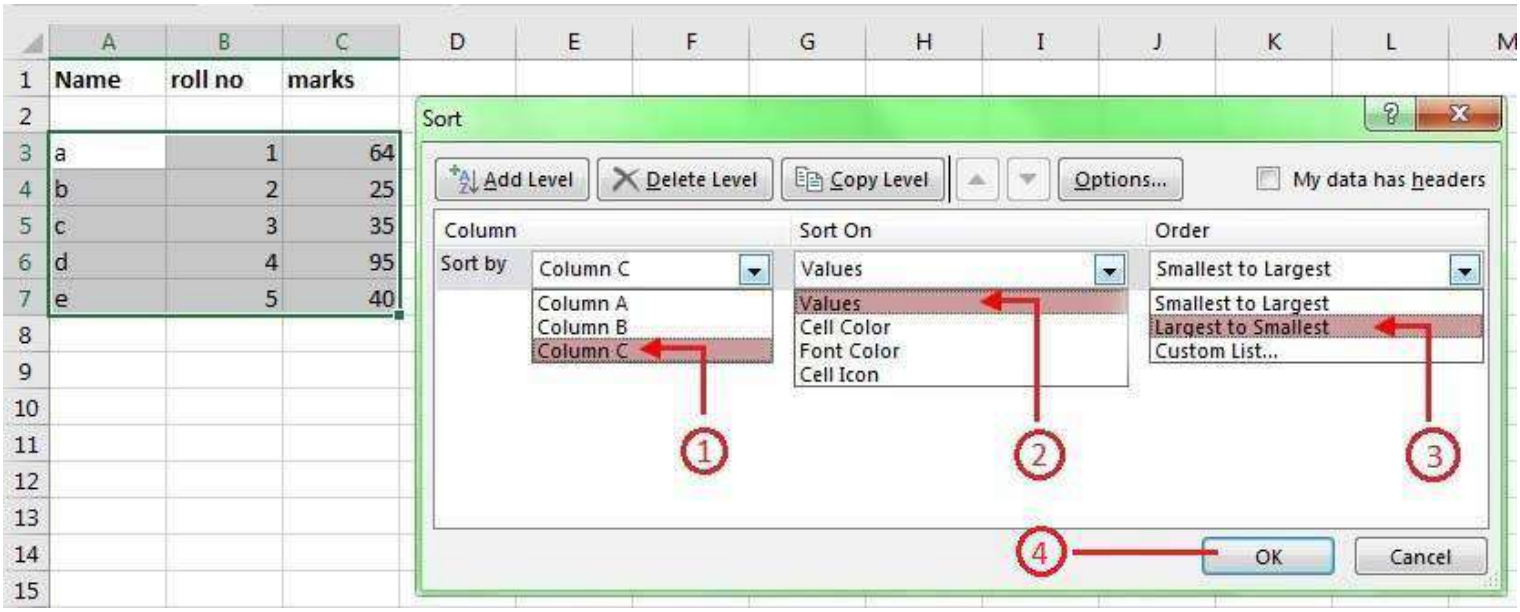
1. Sorting.
2. Filtering.
3. Data validation.
4. Conditional formatting.
5. Grouping.
6. Using spreadsheet forms.

A. SORTING DATA

Definition

Sorting is the process of arranging data in a particular order based on one or more selected columns or criteria.

Sorting makes it easier to locate information and identify patterns within a dataset.



Types of sorting

1. Ascending order

Ascending sorting arranges data from the smallest to the largest value or alphabetically from A to Z.

Examples:

- 10, 20, 30, 40, 50.
- Amina, Brian, Carol, David.
- Earliest date to latest date.

2. Descending order

Descending sorting arranges data from the largest to the smallest value or alphabetically from Z to A.

Examples:

- 90, 80, 70, 60, 50.
- David, Carol, Brian, Amina.
- Latest date to earliest date.

3. Multi-level sorting

Multi-level sorting involves arranging data using two or more columns.

Example:

A teacher sorts examination records first by class and then by total marks from highest to lowest within each class.

Procedure for sorting data in Microsoft Excel

1. Open the spreadsheet.
2. Select the dataset or click inside the data table.
3. Open the Data tab.
4. Select Sort.
5. Choose the column to sort by.
6. Select the sorting order.
7. Add another sorting level if necessary.
8. Click OK.

Importance of sorting

1. Helps identify the highest and lowest values.
2. Makes information easier to retrieve.
3. Improves data organisation.
4. Supports ranking.
5. Simplifies comparison.
6. Helps identify trends and patterns.

Practical Kenyan example:

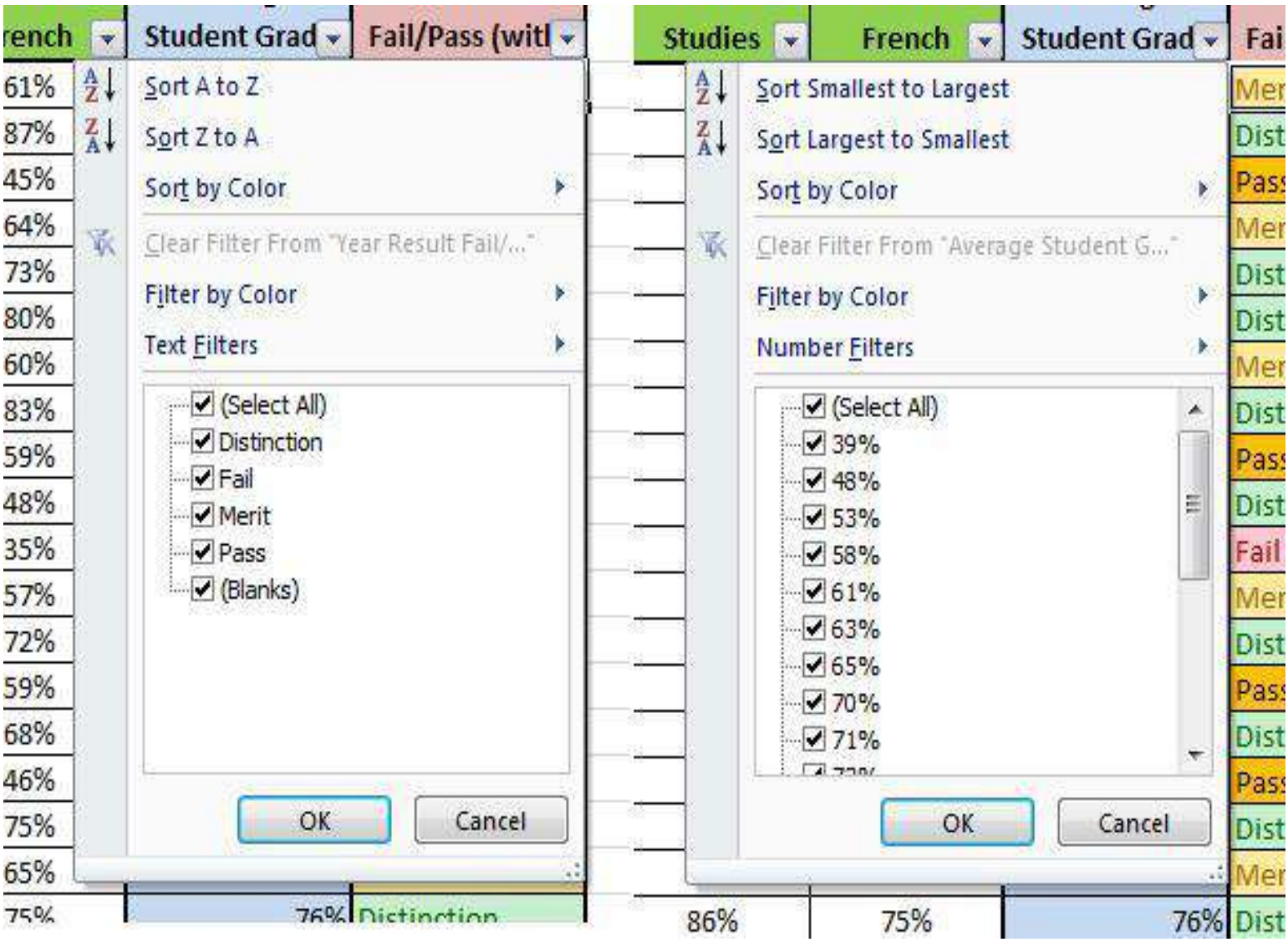
A school administrator sorts learner records alphabetically by surname to prepare an organised admission register.

B. FILTERING DATA

Definition

Filtering is the process of displaying only records that satisfy specified conditions while temporarily hiding records that do not meet those conditions.

Filtering enables users to focus on particular information without necessarily deleting other records.



Types of filtering

1. Text filters

Used to display records according to text conditions.

Examples:

- Names beginning with A.
- Records containing the word Narok.
- Products with a particular category.

2. Number filters

Used to display records according to numerical conditions.

Examples:

- Marks greater than 70.
- Sales below KSh 5,000.
- Stock equal to zero.

3. Date filters

Used to display records based on dates.

Examples:

- Payments made in January.
- Transactions completed in 2026.
- Records from a particular date range.

4. Multiple-condition filtering

This involves applying more than one condition to a dataset.

Example:

A teacher displays learners who scored more than 70 marks in Mathematics and belong to Grade 11.

Procedure for filtering data in Microsoft Excel

1. Open the worksheet.
2. Ensure the dataset has clear column headings.
3. Select the dataset.
4. Click the Data tab.
5. Select Filter.
6. Dropdown arrows appear beside the column headings.
7. Click the dropdown arrow for the required column.
8. Select the condition or values to display.
9. Apply the filter.

Importance of filtering

1. Helps locate specific records.
2. Reduces unnecessary information displayed.
3. Makes data analysis easier.
4. Saves time.
5. Supports decision-making.
6. Improves the management of large datasets.

Difference between sorting and filtering

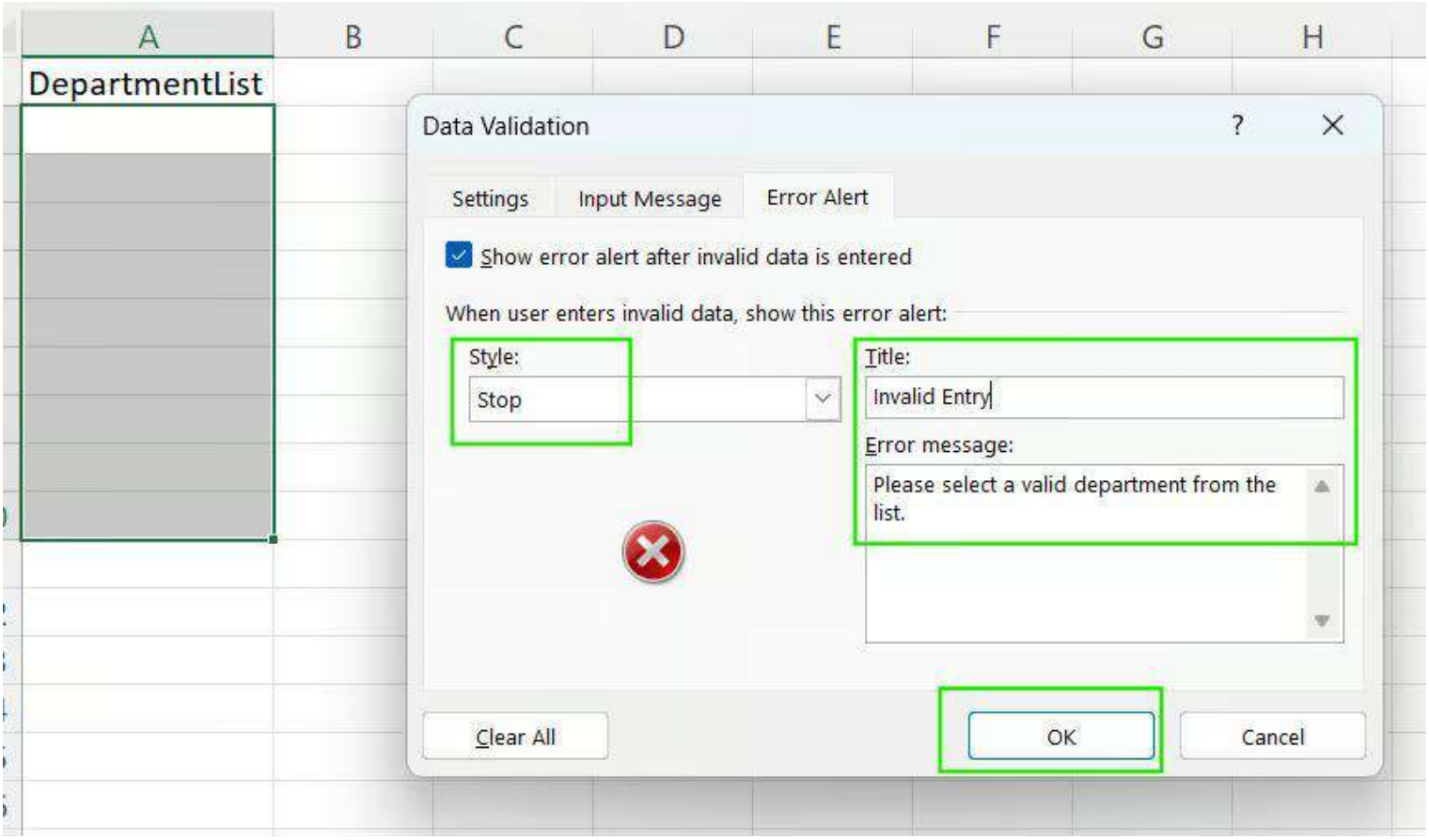
Sorting	Filtering
Arranges data in a specified order.	Displays records that meet specified conditions.
Changes the order of records.	Temporarily hides records that do not meet the conditions.
Can display the entire dataset.	Displays a selected subset of records.
Example: Marks from highest to lowest.	Example: Only learners scoring above 70.

C. DATA VALIDATION

Definition

Data validation is a spreadsheet feature that controls the type of information or values that users can enter into specified cells.

It helps ensure that entered information meets predetermined requirements.



Types of data validation

1. Whole number validation

Restricts cell entries to whole numbers within specified limits.

Example: A school restricts examination marks to whole numbers between 0 and 100.

2. Decimal validation

Allows only decimal numbers within specified conditions.

Example: A business allows product weights between 0.5 kg and 50 kg.

3. List validation

Provides a dropdown list of predefined options.

Example: A school creates a dropdown list containing:

- Grade 9.
- Grade 10.
- Grade 11.
- Grade 12.

4. Date validation

Restricts entries to valid dates within a specified range.

Example: A school only allows dates within the 2026 academic year.

5. Time validation

Restricts entries to specific time values or ranges.

Example: A school allows lesson starting times between 7:00 AM and 5:00 PM.

6. Text length validation

Controls the number of characters entered into a cell.

Example: A school may require a learner's admission number to contain a specified number of characters.

7. Custom formula validation

Uses a formula to determine whether data entered into a cell is acceptable.

Example: A spreadsheet may be designed to prevent duplicate admission numbers.

Procedure for applying data validation in Excel

1. Open the worksheet.
2. Select the cells to be controlled.
3. Click the Data tab.
4. Select Data Validation.
5. Choose the required validation type.
6. Set the conditions.
7. Configure an input message if necessary.
8. Configure an error alert.
9. Click OK.

Importance of data validation

1. Reduces data entry errors.
2. Promotes consistency.
3. Ensures that data meets specified conditions.
4. Improves the quality of datasets.
5. Prevents some forms of incorrect data entry.
6. Simplifies data collection.

Kenyan school example:

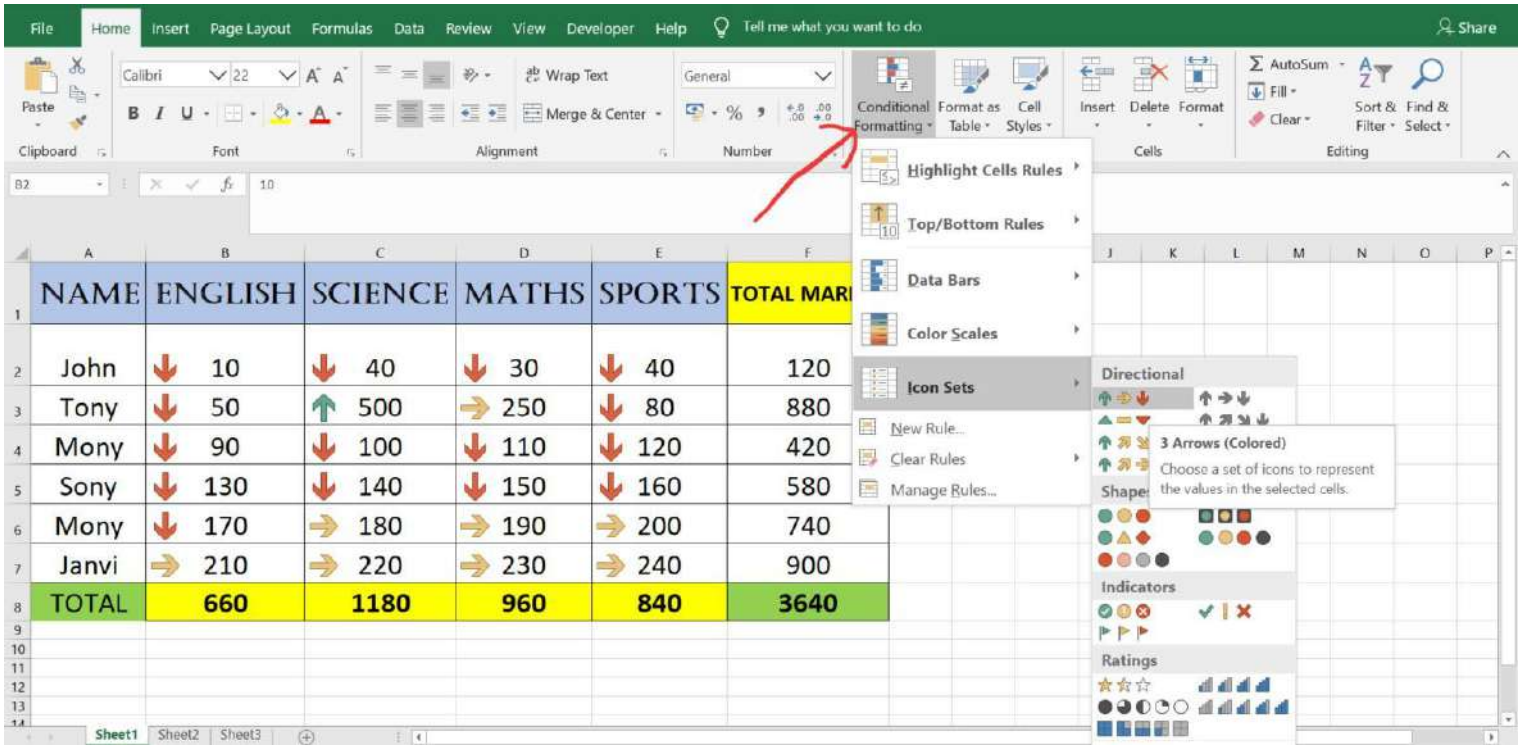
A school uses a dropdown list to restrict the entry of learner gender categories or class names to approved options in an administrative record, while ensuring that the categories are appropriate for the intended purpose.

D. CONDITIONAL FORMATTING

Definition

Conditional formatting is a spreadsheet feature that automatically changes the appearance of cells when specified conditions are satisfied.

It helps users identify important values and patterns without examining every cell individually.



NAME	ENGLISH	SCIENCE	MATHS	SPORTS	TOTAL MARI
John	10	40	30	40	120
Tony	50	500	250	80	880
Mony	90	100	110	120	420
Sony	130	140	150	160	580
Mony	170	180	190	200	740
Janvi	210	220	230	240	900
TOTAL	660	1180	960	840	3640

Examples of conditional formatting

1. Highlighting marks below 40 in red.
2. Highlighting marks of 70 and above in green.
3. Using colour scales to compare sales values.
4. Displaying data bars to represent stock levels.
5. Highlighting duplicate records.
6. Identifying dates that are overdue.
7. Identifying outstanding payments.

Common conditional formatting options

1. Highlight cell rules

Applies formatting based on conditions such as:

- Greater than.
- Less than.
- Equal to.
- Between.
- Text that contains.
- Duplicate values.

2. Top/bottom rules

Highlights:

- Top 10 values.
- Bottom 10 values.
- Top percentages.
- Bottom percentages.
- Above-average values.
- Below-average values.

3. Data bars

Displays coloured bars inside cells to represent the relative size of values.

4. Colour scales

Uses different colours to show variations in numerical values.

5. Icon sets

Uses symbols such as arrows, flags or traffic lights to indicate different performance levels.

Procedure for applying conditional formatting

1. Select the required cells.
2. Open the Home tab.
3. Click Conditional Formatting.
4. Choose a suitable rule.
5. Enter the required condition.
6. Select the desired formatting style.
7. Apply the rule.

Importance of conditional formatting

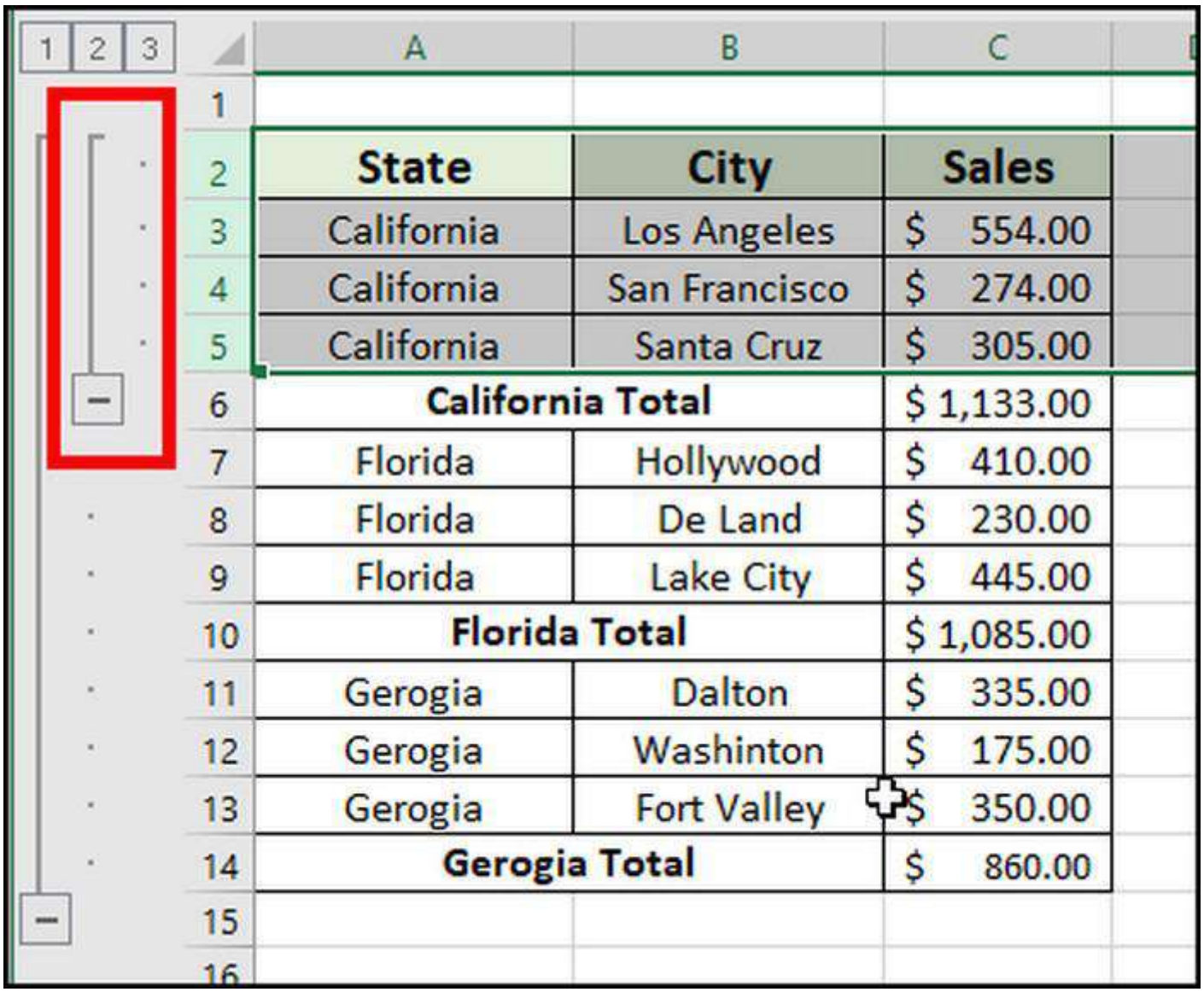
1. Makes important information easy to identify.
2. Improves visual presentation.
3. Helps compare values.
4. Identifies unusual records.
5. Supports performance analysis.
6. Reduces the time needed to interpret data.

E. GROUPING DATA

Definition

Grouping is a spreadsheet feature that allows related rows or columns to be organised together so that users can temporarily expand or collapse detailed information.

Grouping makes large worksheets easier to manage and navigate.



	State	City	Sales
3	California	Los Angeles	$ 554.00
4	California	San Francisco	$ 274.00
5	California	Santa Cruz	$ 305.00
6	**California Total**		$ 1,133.00
7	Florida	Hollywood	$ 410.00
8	Florida	De Land	$ 230.00
9	Florida	Lake City	$ 445.00
10	**Florida Total**		$ 1,085.00
11	Gerogia	Dalton	$ 335.00
12	Gerogia	Washinton	$ 175.00
13	Gerogia	Fort Valley	$ 350.00
14	**Gerogia Total**		$ 860.00

Types of grouping

1. Row grouping

Involves grouping related rows so that the details can be expanded or collapsed.

Example:

A school groups individual learner records under each class.

2. Column grouping

Involves grouping related columns to simplify the display of information.

Example:

A business groups columns containing monthly sales figures.

3. Hierarchical grouping

Involves creating several levels of groups to organise complex datasets.

Example:

A county agricultural report may organise information by:

- County.

- Subcounty.
- Ward.
- Farm.

Procedure for grouping data in Excel

1. Select the rows or columns to group.
2. Open the Data tab.
3. Locate the Outline section.
4. Select Group.
5. Choose Rows or Columns where prompted.
6. Use the outline controls to expand or collapse the grouped data.

Importance of grouping

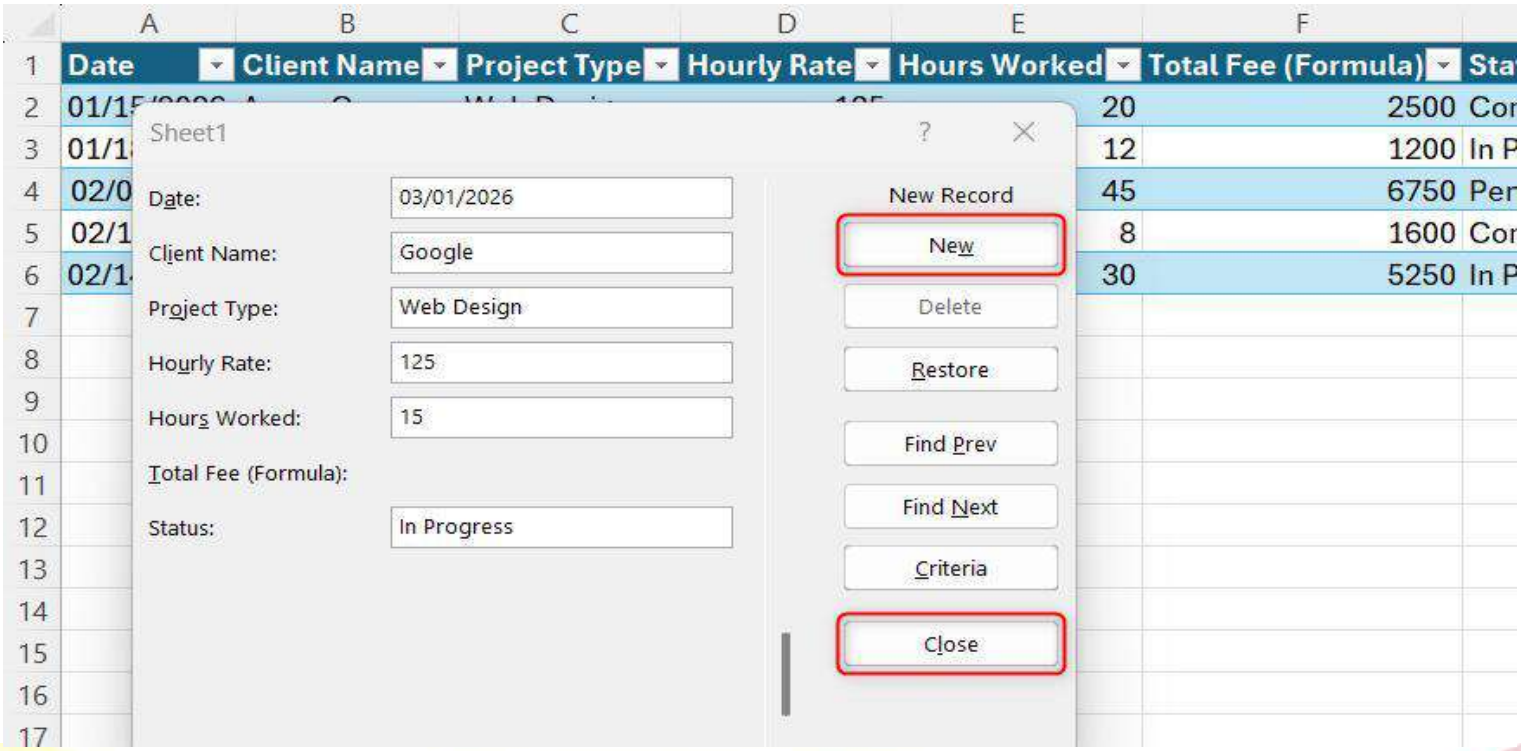
1. Simplifies large worksheets.
2. Improves navigation.
3. Makes reports easier to read.
4. Helps organise related information.
5. Allows users to focus on summary information.
6. Supports hierarchical data analysis.

F. SPREADSHEET FORMS

Definition

A spreadsheet form is a structured data entry interface or layout used to enter, view or manage records in a spreadsheet or its associated data system.

Forms make data entry easier by presenting fields in an organised manner.



Common fields in a spreadsheet form

A school admission form may contain:

1. Admission number.
2. Learner's name.
3. Date of birth.
4. Grade.
5. Gender.
6. Parent or guardian contact.
7. Date of admission.

Types of spreadsheet forms

1. Data entry forms

Used to enter new records into a spreadsheet table.

2. Data collection forms

Used to collect information from individuals.

Example: Google Forms responses can be stored in Google Sheets.

3. Search and retrieval forms

Used to locate particular records in a dataset.

4. Reporting forms

Used to present selected information in an organised layout.

Procedure for using a data entry form

The exact steps depend on the spreadsheet application and its version.

In supported versions of Microsoft Excel:

1. Create a properly headed data table.
2. Ensure the table has consistent column headings.
3. Add the Form command where necessary.
4. Select a cell within the data table.
5. Open the data entry form.
6. Enter the required information in the fields.
7. Add the record.
8. Use the navigation controls to review existing records.

Importance of spreadsheet forms

1. Simplify data entry.
2. Reduce direct interaction with complex worksheets.
3. Improve consistency.

4. Support organised record keeping.
5. Make it easier to add and review records.
6. Improve data collection.

1.18 EXTRACTING A DATASET FROM A DATA RANGE

Definition of a dataset

A dataset is an organised collection of related data arranged in a structured format for storage, processing and analysis.

A dataset may contain information about learners, business transactions, agricultural production, employees, customers or other subjects.

Definition of a data range

A data range is a selected group of cells in a spreadsheet that contains information to be used for a particular operation.

For example, A1:D20 represents a range covering columns A to D and rows 1 to 20.

A. Meaning of extracting a dataset

Extracting a dataset from a data range involves selecting and retrieving specific records or information from a larger spreadsheet dataset according to particular requirements.

It enables users to obtain only the information needed for a particular analysis or report.

Examples of dataset extraction

1. Extracting learners who scored above 70 marks.
2. Extracting sales transactions made in November.
3. Extracting products whose stock levels are below 10.
4. Extracting records of farmers growing maize.
5. Extracting customers from a particular county.
6. Extracting employees belonging to a particular department.

B. Methods of extracting datasets

1. Using filters

Filters display only records that satisfy specified conditions.

Example:

A teacher filters a class examination dataset to display learners who scored 80 marks and above.

2. Using sorting

Sorting arranges records in a specified order to make the required information easier to locate.

3. Using conditional functions

Functions such as IF, COUNTIF and SUMIF can be used to identify or summarise records that meet specified conditions.

4. Using lookup functions

Functions such as VLOOKUP can retrieve related information from a reference table.

5. Using advanced filtering tools

Some spreadsheet applications provide advanced filtering options that allow users to extract records using several criteria.

C. Procedure for extracting a dataset using filtering

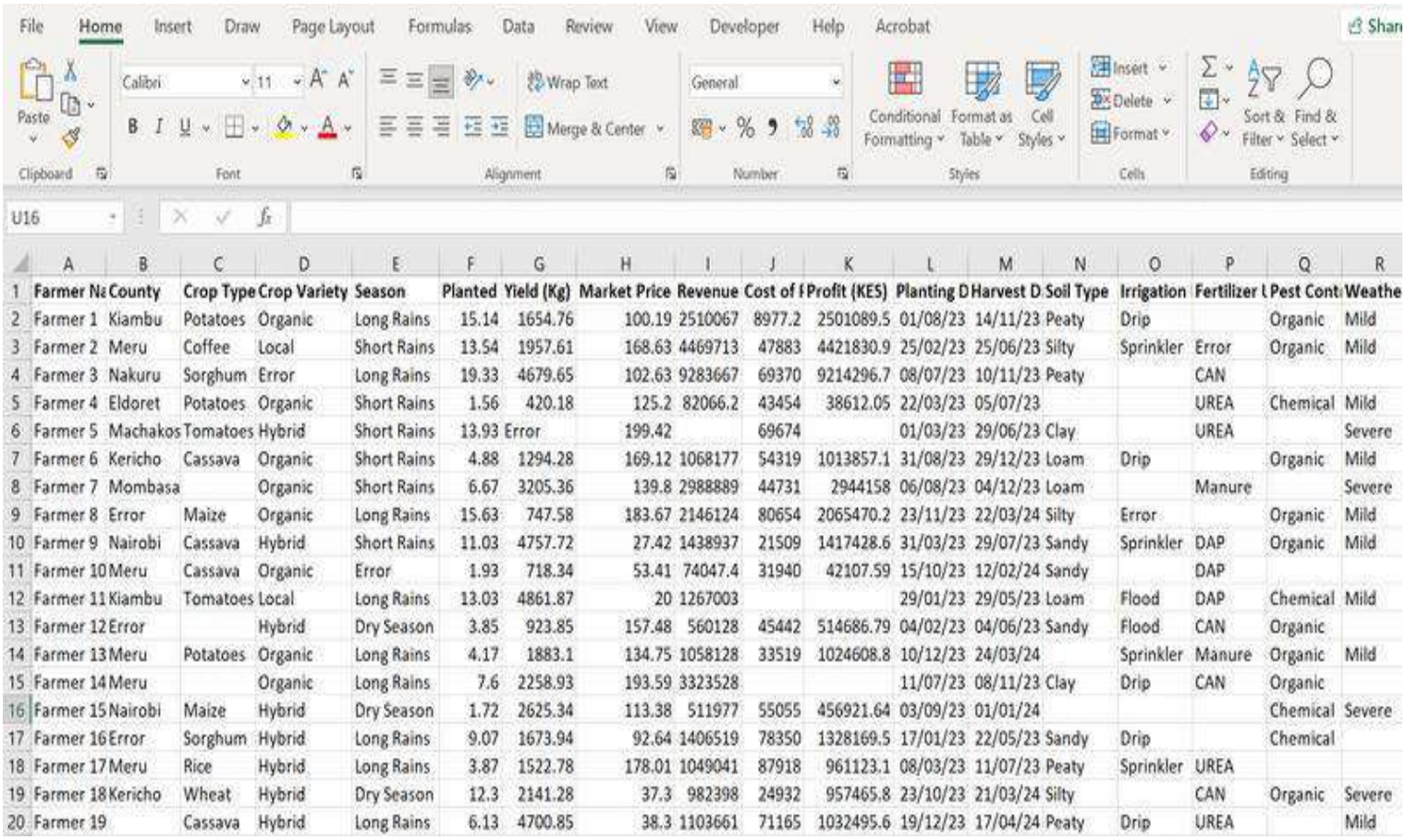
Consider the following agricultural dataset:

Farmer	Crop	Quantity (kg)	County
Amina	Maize	500	Narok
Brian	Beans	200	Nakuru
Carol	Maize	700	Narok
David	Wheat	400	Uasin Gishu
Esther	Maize	300	Nakuru
Felix	Beans	250	Narok

Task: Extract records of farmers growing maize.

Procedure:

1. Open the spreadsheet containing the agricultural records.
2. Select the dataset.
3. Click the Data tab.
4. Select Filter.
5. Click the dropdown arrow in the Crop column.
6. Deselect unnecessary entries.
7. Select Maize.
8. Apply the filter.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Farmer Na	County	Crop Type	Crop Variety	Season	Planted	Yield (Kg)	Market Price	Revenue	Cost of F	Profit (KES)	Planting D	Harvest D	Soil Type	Irrigation	Fertilizer U	Pest Cont	Weathe
2	Farmer 1	Kiambu	Potatoes	Organic	Long Rains	15.14	1654.76	100.19	2510067	8977.2	2501089.5	01/08/23	14/11/23	Peaty	Drip		Organic	Mild
3	Farmer 2	Meru	Coffee	Local	Short Rains	13.54	1957.61	168.63	4469713	47883	4421830.9	25/02/23	25/06/23	Silty	Sprinkler	Error	Organic	Mild
4	Farmer 3	Nakuru	Sorghum	Error	Long Rains	19.33	4679.65	102.63	9283667	69370	9214296.7	08/07/23	10/11/23	Peaty		CAN		
5	Farmer 4	Eldoret	Potatoes	Organic	Short Rains	1.56	420.18	125.2	82066.2	43454	38612.05	22/03/23	05/07/23			UREA	Chemical	Mild
6	Farmer 5	Machakos	Tomatoes	Hybrid	Short Rains	13.93	Error	199.42		69674		01/03/23	29/06/23	Clay		UREA		Severe
7	Farmer 6	Kericho	Cassava	Organic	Short Rains	4.88	1294.28	169.12	1068177	54319	1013857.1	31/08/23	29/12/23	Loam	Drip		Organic	Mild
8	Farmer 7	Mombasa		Organic	Short Rains	6.67	3205.36	139.8	2988889	44731	2944158	06/08/23	04/12/23	Loam		Manure		Severe
9	Farmer 8	Error	Maize	Organic	Long Rains	15.63	747.58	183.67	2146124	80654	2065470.2	23/11/23	22/03/24	Silty	Error		Organic	Mild
10	Farmer 9	Nairobi	Cassava	Hybrid	Short Rains	11.03	4757.72	27.42	1438937	21509	1417428.6	31/03/23	29/07/23	Sandy	Sprinkler	DAP	Organic	Mild
11	Farmer 10	Meru	Cassava	Organic	Error	1.93	718.34	53.41	74047.4	31940	42107.59	15/10/23	12/02/24	Sandy		DAP		
12	Farmer 11	Kiambu	Tomatoes	Local	Long Rains	13.03	4861.87	20	1267003			29/01/23	29/05/23	Loam	Flood	DAP	Chemical	Mild
13	Farmer 12	Error		Hybrid	Dry Season	3.85	923.85	157.48	560128	45442	514686.79	04/02/23	04/06/23	Sandy	Flood	CAN	Organic	
14	Farmer 13	Meru	Potatoes	Organic	Long Rains	4.17	1883.1	134.75	1058128	33519	1024608.8	10/12/23	24/03/24		Sprinkler	Manure	Organic	Mild
15	Farmer 14	Meru		Organic	Long Rains	7.6	2258.93	193.59	3323528			11/07/23	08/11/23	Clay	Drip	CAN	Organic	
16	Farmer 15	Nairobi	Maize	Hybrid	Dry Season	1.72	2625.34	113.38	511977	55055	456921.64	03/09/23	01/01/24				Chemical	Severe
17	Farmer 16	Error	Sorghum	Hybrid	Long Rains	9.07	1673.94	92.64	1406519	78350	1328169.5	17/01/23	22/05/23	Sandy	Drip		Chemical	
18	Farmer 17	Meru	Rice	Hybrid	Long Rains	3.87	1522.78	178.01	1049041	87918	961123.1	08/03/23	11/07/23	Peaty	Sprinkler	UREA		
19	Farmer 18	Kericho	Wheat	Hybrid	Dry Season	12.3	2141.28	37.3	982398	24932	957465.8	23/10/23	21/03/24	Silty		CAN	Organic	Severe
20	Farmer 19		Cassava	Hybrid	Long Rains	6.13	4700.85	38.3	1103661	71165	1032495.6	19/12/23	17/04/24	Peaty	Drip	UREA		Mild

The extracted dataset will contain:

Farmer	Crop	Quantity (kg)	County
Amina	Maize	500	Narok
Carol	Maize	700	Narok
Esther	Maize	300	Nakuru

D. Importance of extracting datasets

1. Reduces the amount of information displayed.
2. Helps users concentrate on relevant records.
3. Simplifies data analysis.
4. Improves report preparation.
5. Supports informed decision-making.
6. Saves time when handling large datasets.
7. Enables comparison of specific categories.
8. Improves the management of organisational information.

1.19 CREATING GRAPHS AND CHARTS IN SPREADSHEETS

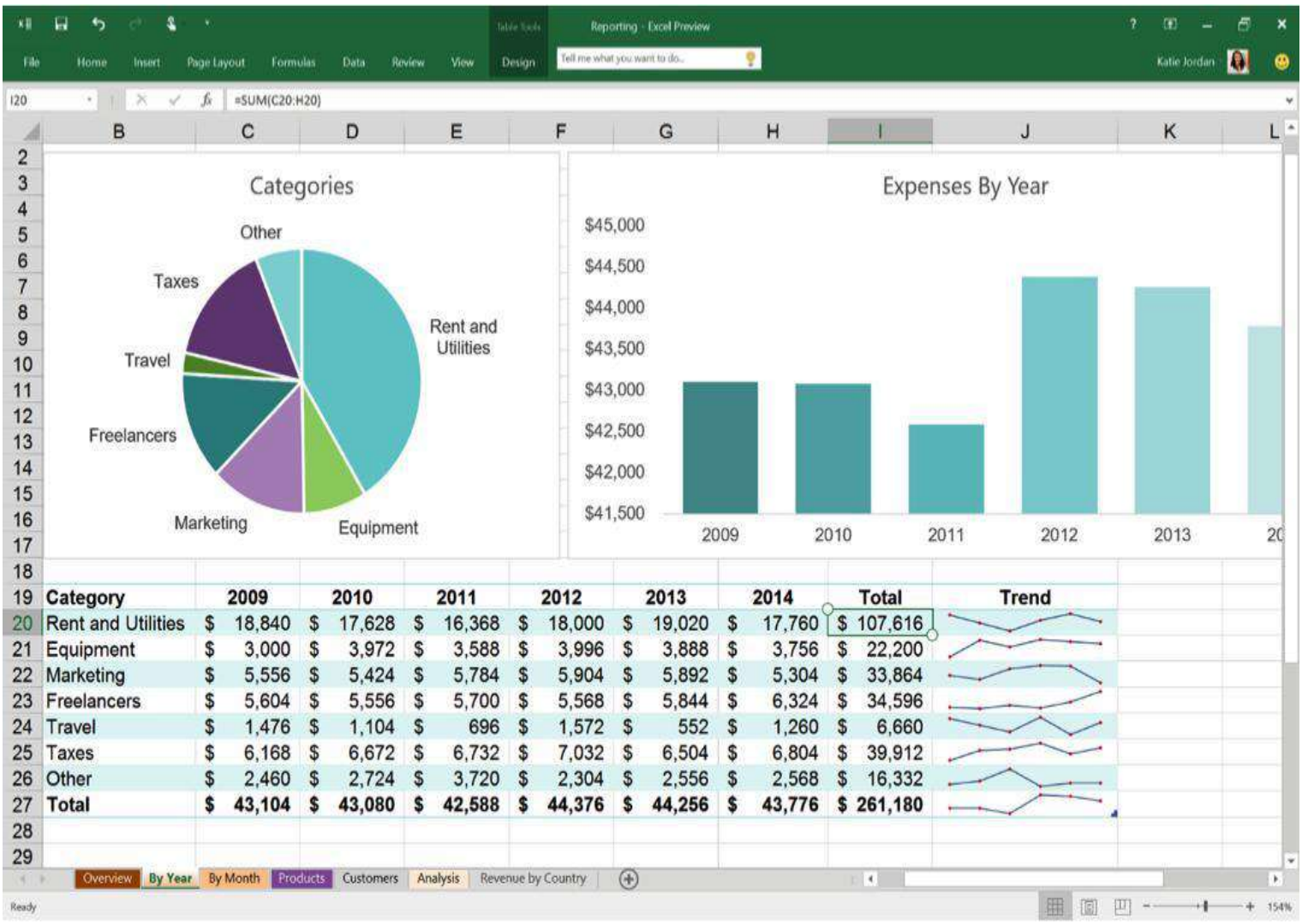
Definition of a chart

A chart is a graphical representation of data used to communicate numerical information visually.

Definition of a graph

A graph is a visual representation of numerical information that shows relationships, comparisons, patterns or changes in data.

Spreadsheet applications provide charting tools that transform numerical data into visual presentations.



Category	2009	2010	2011	2012	2013	2014	Total	Trend
Rent and Utilities	$ 18,840	$ 17,628	$ 16,368	$ 18,000	$ 19,020	$ 17,760	$ 107,616	
Equipment	$ 3,000	$ 3,972	$ 3,588	$ 3,996	$ 3,888	$ 3,756	$ 22,200	
Marketing	$ 5,556	$ 5,424	$ 5,784	$ 5,904	$ 5,892	$ 5,304	$ 33,864	
Freelancers	$ 5,604	$ 5,556	$ 5,700	$ 5,568	$ 5,844	$ 6,324	$ 34,596	
Travel	$ 1,476	$ 1,104	$ 696	$ 1,572	$ 552	$ 1,260	$ 6,660	
Taxes	$ 6,168	$ 6,672	$ 6,732	$ 7,032	$ 6,504	$ 6,804	$ 39,912	
Other	$ 2,460	$ 2,724	$ 3,720	$ 2,304	$ 2,556	$ 2,568	$ 16,332	
Total	**$ 43,104**	**$ 43,080**	**$ 42,588**	**$ 44,376**	**$ 44,256**	**$ 43,776**	**$ 261,180**	

A. Importance of charts and graphs

1. **Simplify complex information:** Charts make large amounts of numerical information easier to understand.
2. **Support comparisons:** Users can compare values across different categories.
3. **Identify trends:** Graphs show how information changes over time.
4. **Support decision-making:** Visual information helps managers and administrators make informed decisions.
5. **Improve presentations:** Charts make reports more attractive and understandable.
6. **Identify patterns:** Charts help users identify relationships and variations in datasets.
7. **Communicate findings:** Charts provide a simple way of presenting research findings.
8. **Highlight important information:** Charts make unusual values and major differences easier to identify.

B. Types of spreadsheet charts

1. Column chart

	A	B
1	Month	Sales
2	January	$ 1,283
3	February	$ 5,700
4	March	$ 5,652
5	April	$ 6,391
6	May	$ 6,287
7	June	$ 4,562
8	July	$ 4,562
9	August	$ 4,562



Definition: A column chart uses vertical rectangular bars to represent values in different categories.

Uses:

- Comparing examination performance across subjects.
- Comparing monthly business sales.
- Comparing crop production among different farms.
- Comparing population figures.

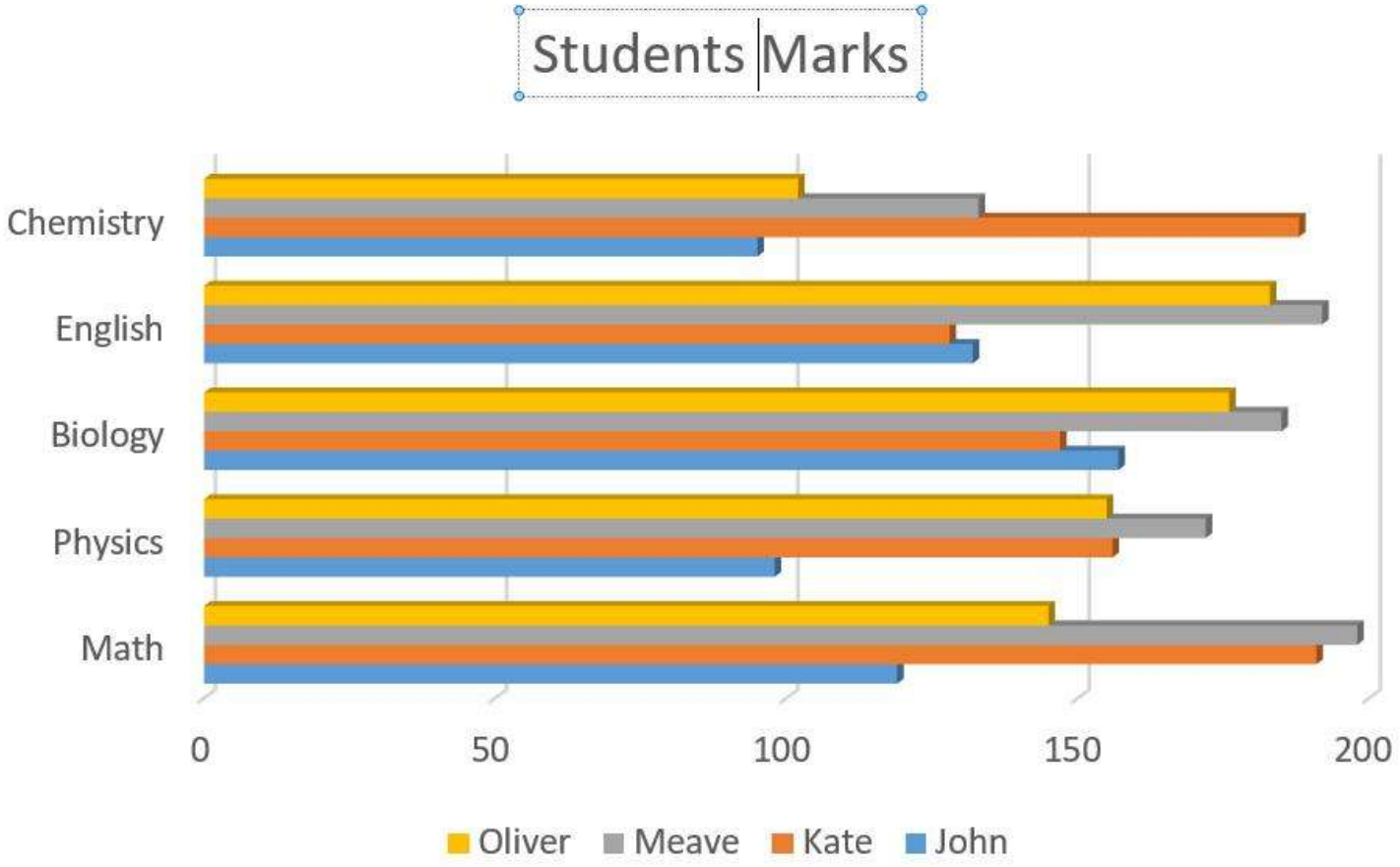
Example:

A school compares the average marks obtained in Mathematics, English, Biology and Chemistry.

Advantages:

1. Easy to interpret.
2. Suitable for comparing categories.
3. Displays differences clearly.
4. Can present several data series.

2. Bar chart



Definition: A bar chart uses horizontal rectangular bars to represent values in different categories.

Uses:

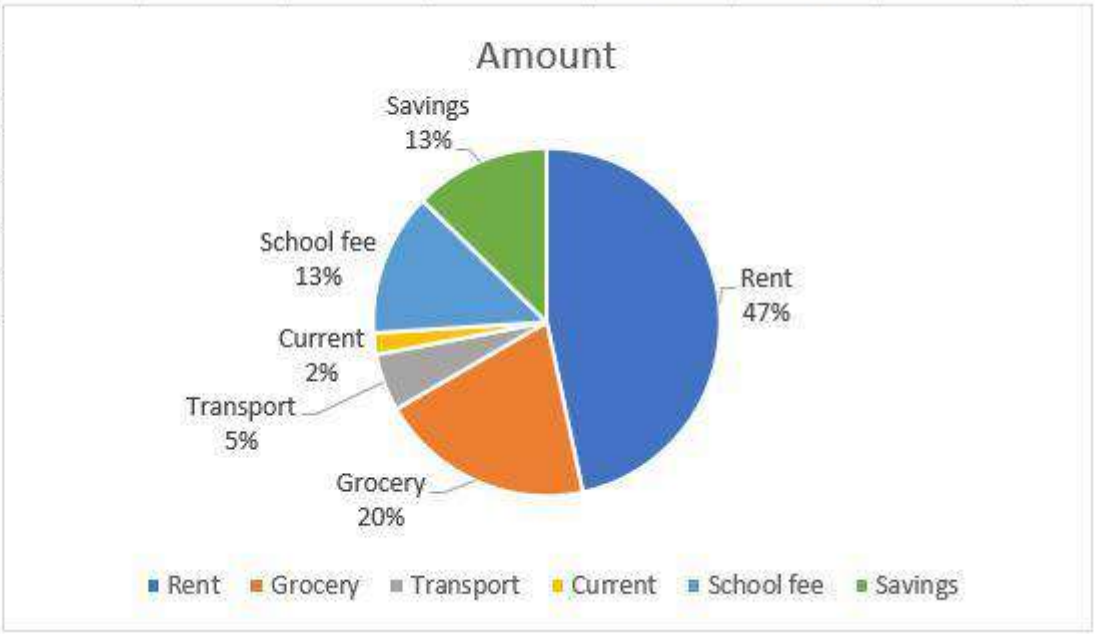
- Comparing sales among shops.
- Comparing the performance of different classes.
- Comparing agricultural production across counties.

Advantages:

1. Easy to read.
2. Suitable for comparing categories.
3. Useful when category names are long.
4. Makes differences between values clear.

3. Pie chart

Expenses	Amount
Rent	7000
Grocery	3000
Transport	800
Current	300
School fee	2000
Savings	1900



Definition: A pie chart is a circular chart divided into sectors, with each sector representing a proportion of the whole dataset.

Uses:

- Displaying household expenditure.
- Showing budget allocations.
- Presenting market share.
- Showing proportions of learners in different categories.

Example:

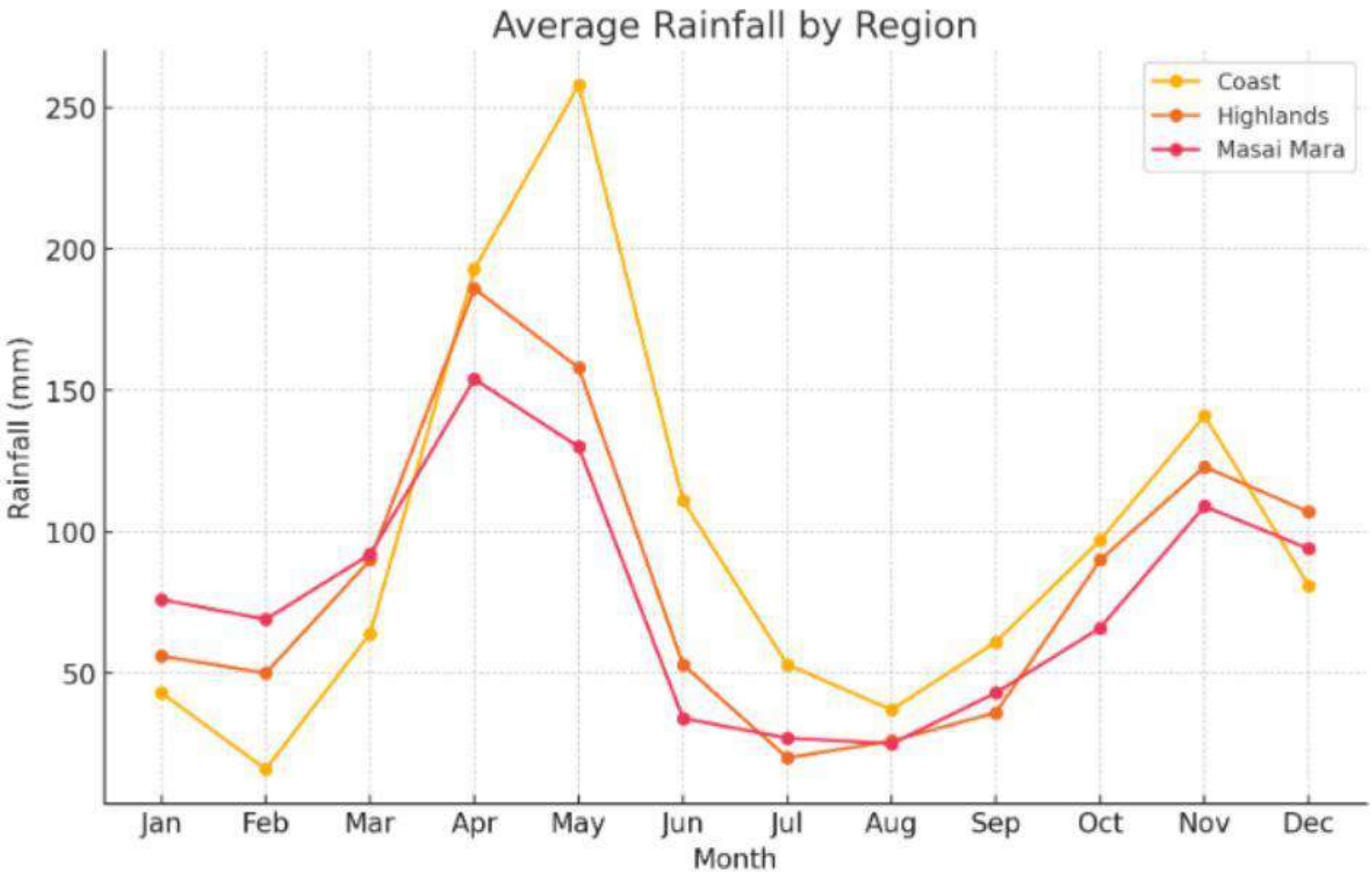
A household in Kenya prepares a monthly budget showing the proportion spent on food, transport, education and electricity.

Advantages:

1. Shows proportions clearly.
2. Easy to interpret when there are few categories.
3. Suitable for percentage-based information.
4. Useful in financial reporting.

Limitation: A pie chart becomes difficult to interpret when it contains too many categories or very similar values.

4. Line graph



Definition: A line graph displays data points connected by straight lines to show changes or trends over time or across an ordered sequence.

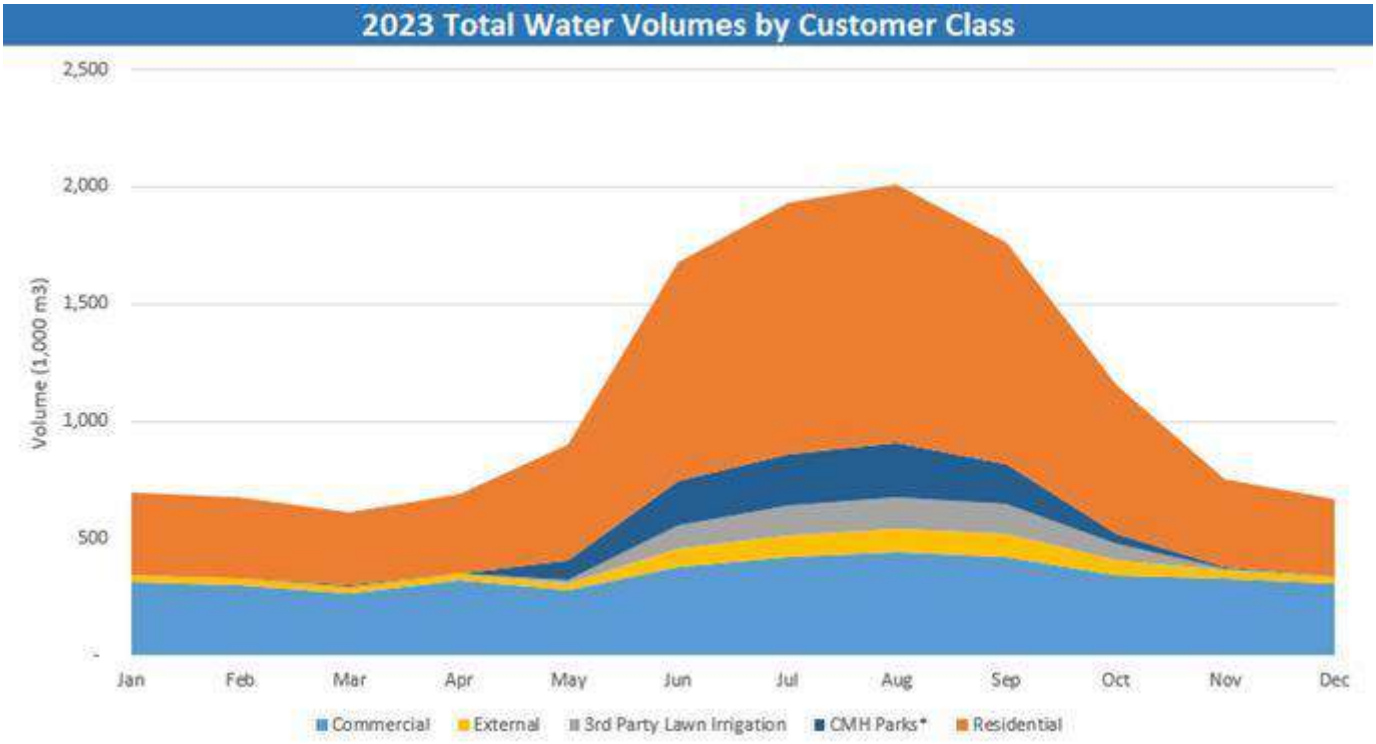
Uses:

- Monitoring monthly rainfall.
- Tracking business sales.
- Analysing temperature changes.
- Monitoring learner performance across several assessments.
- Tracking agricultural production over time.

Advantages:

1. Shows trends clearly.
2. Helps identify increases and decreases.
3. Supports comparisons over time.
4. Helps identify fluctuations.

5. Area chart



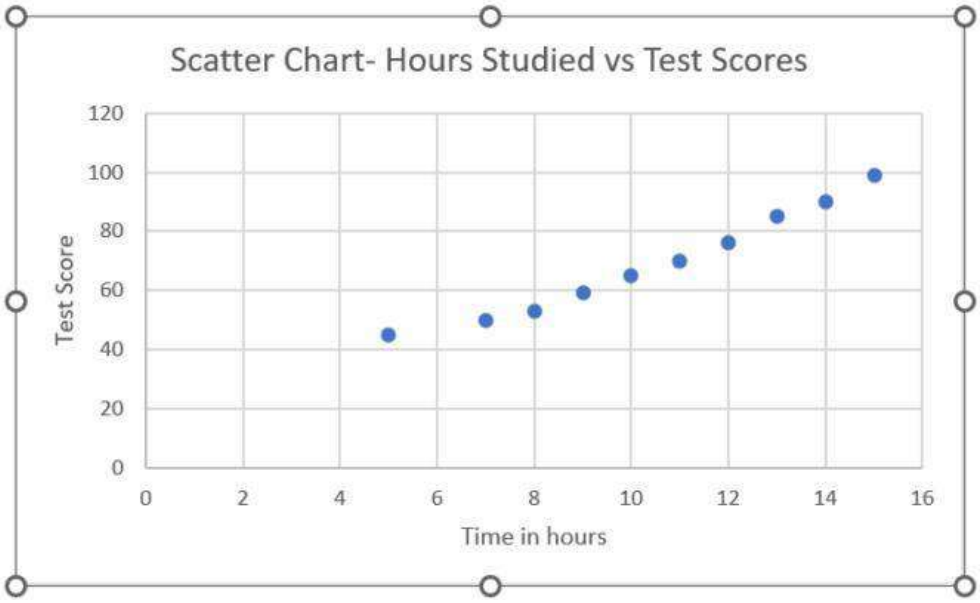
Definition: An area chart is a graphical representation that uses filled areas beneath lines to show the magnitude of values over time or across categories.

Uses:

- Showing changes in electricity consumption.
- Monitoring production levels.
- Presenting cumulative financial information.
- Comparing changes in quantities over time.

6. Scatter chart

	A	B
1	Hours Studied	Test Score Out Of 100
2	10	65
3	13	85
4	5	45
5	11	70
6	14	90
7	9	59
8	7	50
9	15	99
10	12	76
11	8	53



Definition: A scatter chart displays individual data points on horizontal and vertical axes to show the relationship between two numerical variables.

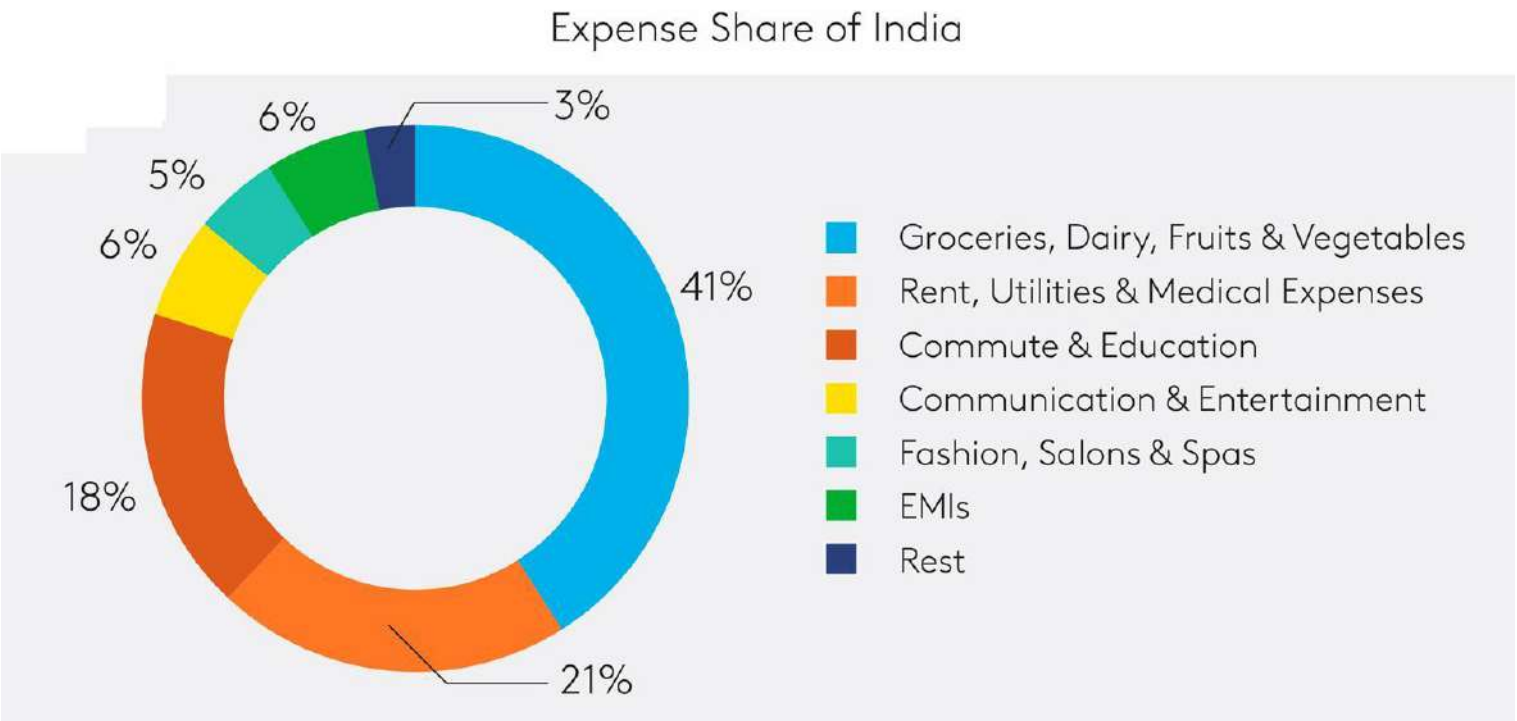
Uses:

- Investigating the relationship between study time and examination performance.
- Comparing rainfall and crop yields.
- Analysing the relationship between product prices and sales.

Advantages:

1. Shows relationships between numerical variables.
2. Helps identify patterns.
3. Can reveal clusters and unusual observations.
4. Supports statistical analysis.

7. Doughnut chart

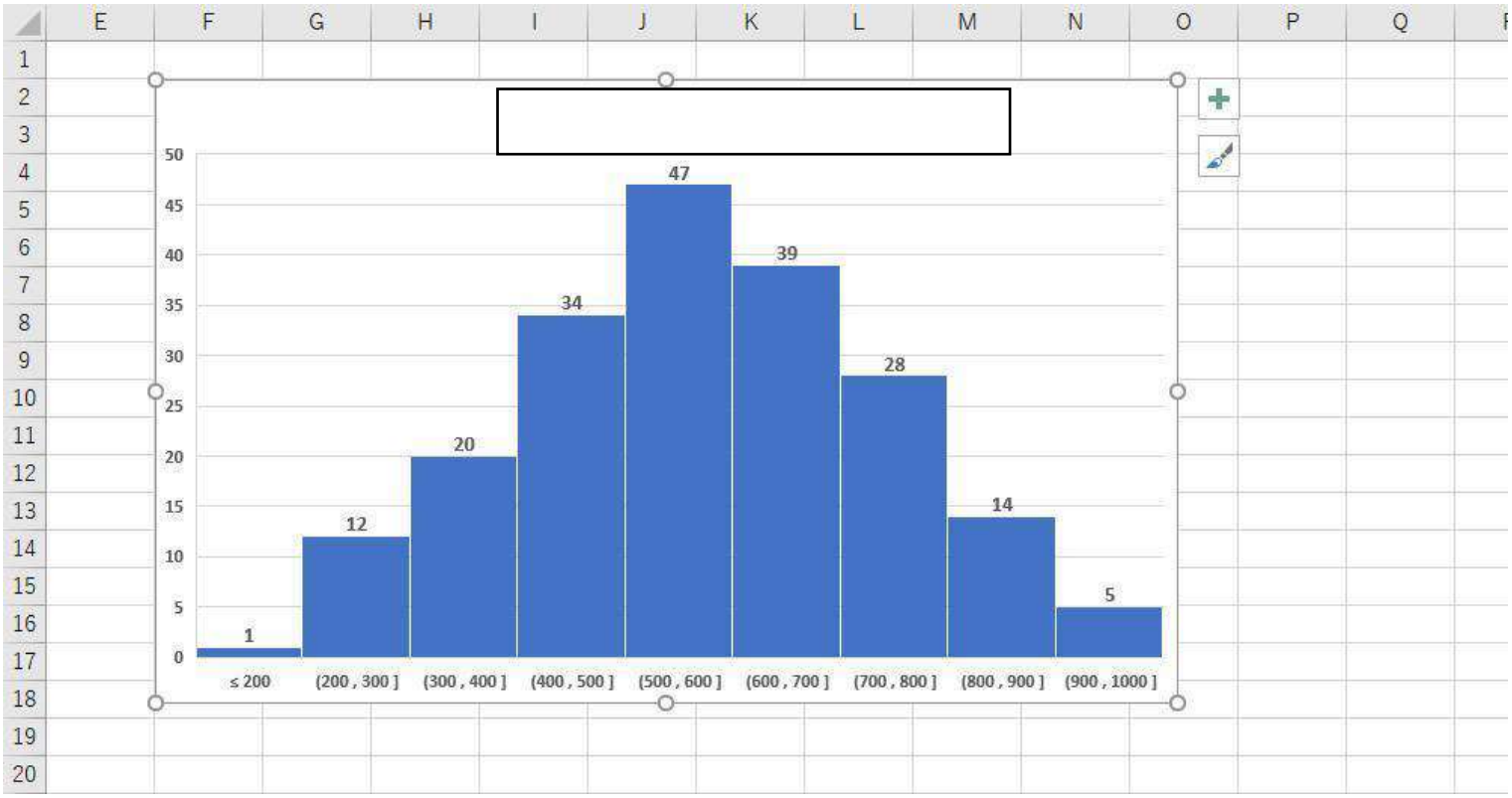


Definition: A doughnut chart is a circular chart divided into segments, similar to a pie chart, but with an empty centre.

Uses:

- Displaying budget proportions.
- Comparing categories within a whole.
- Presenting organisational expenditure.

8. Histogram



Definition: A histogram is a chart that displays the frequency distribution of numerical data grouped into intervals.

Uses:

- Analysing examination score distributions.
- Studying household income distributions.
- Analysing agricultural production measurements.

Advantages:

1. Shows how values are distributed.
2. Identifies common value intervals.
3. Helps identify the spread of data.
4. Supports statistical analysis.

C. Components of a chart

A spreadsheet chart may contain the following components:

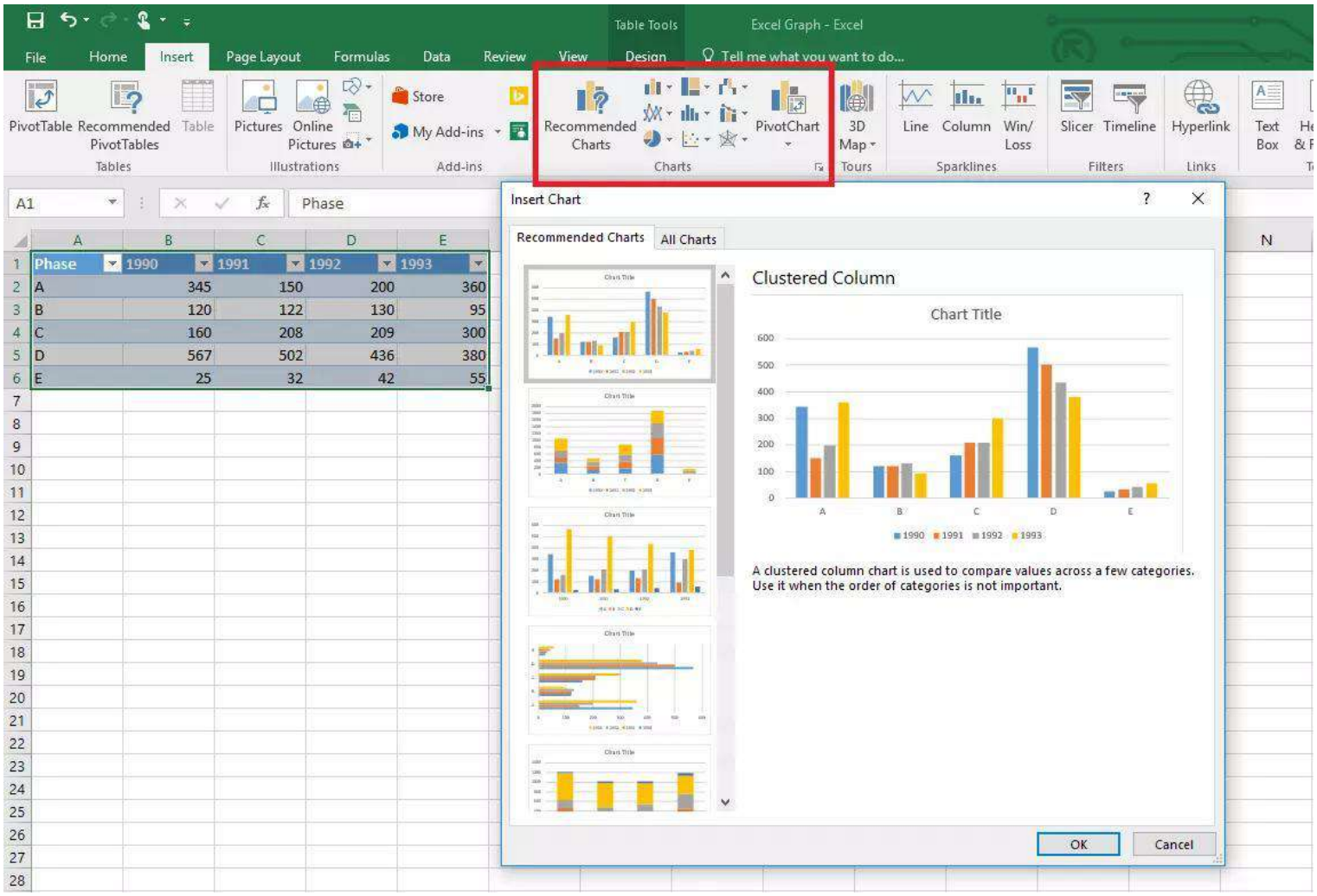
1. **Chart title:** Describes the information being represented.
2. **Horizontal axis (X-axis):** Usually displays categories or independent variable values.
3. **Vertical axis (Y-axis):** Usually displays numerical values or frequencies.
4. **Legend:** Explains the different data series displayed in the chart.
5. **Data series:** A group of related numerical values represented in the chart.
6. **Data labels:** Display specific numerical values on or near chart elements.
7. **Gridlines:** Help users estimate and compare values.

8. **Plot area:** The area where the actual data is represented.

9. **Chart area:** The entire region occupied by the chart and its components.

10. **Data markers:** Visual symbols representing individual data points in certain chart types.

D. Procedure for creating a chart in Microsoft Excel



Phase	1990	1991	1992	1993
A	345	150	200	360
B	120	122	130	95
C	160	208	209	300
D	567	502	436	380
E	25	32	42	55

1. Open the spreadsheet containing the dataset.
2. Ensure that the data is properly organised.
3. Select the required data range, including column headings.
4. Click the Insert tab.
5. Locate the Charts section.
6. Select the appropriate chart type.
7. Choose the preferred chart design.
8. Insert the chart.
9. Add a meaningful chart title.
10. Add axis titles where appropriate.
11. Add data labels or a legend if necessary.
12. Resize and position the chart appropriately.
13. Save the workbook.

E. Selecting appropriate charts for different tasks

Task	Recommended chart
Comparing examination marks in subjects	Column chart
Comparing sales in different shops	Bar chart
Showing monthly rainfall trends	Line graph
Displaying household expenditure proportions	Pie chart
Studying the relationship between study hours and marks	Scatter chart
Showing frequency distribution of marks	Histogram
Displaying budget proportions	Doughnut chart
Showing cumulative production over time	Area chart

Important: The selection of a chart should depend on the type of data and the message the user wants to communicate.

1.20 SHARING SPREADSHEET OUTPUTS

Definition

Sharing spreadsheet outputs refers to the process of distributing, transferring or making spreadsheet information available to other individuals or organisations through different communication and storage methods.

Spreadsheet outputs can be shared electronically or in printed form.

A. Sharing through hard-copy printing



Definition: Hard-copy sharing involves producing a physical printed copy of spreadsheet information for distribution or record keeping.

Procedure for printing a spreadsheet

1. Open the spreadsheet.
2. Select the required worksheet or data range.
3. Click File.
4. Select Print.

5. Choose the printer.
6. Set the required paper size.
7. Select page orientation.
8. Adjust margins.
9. Set the print area where necessary.
10. Preview the document.
11. Select Print.

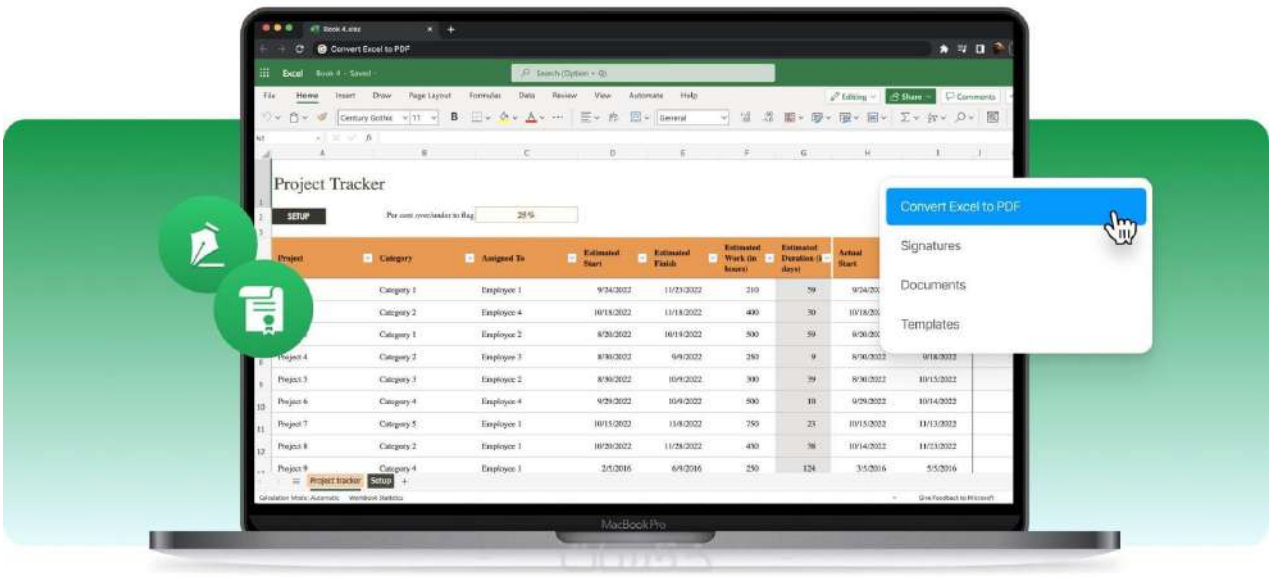
Importance of hard-copy sharing

1. Provides physical records.
2. Enables people without computers to access information.
3. Supports official documentation.
4. Can be used in meetings.
5. Provides a convenient reference copy.

Limitations

- Printing consumes paper and ink.
- Physical copies can be misplaced.
- Updating printed records is difficult.
- Printing large datasets may be expensive.

B. Sharing through PDF format



Definition

PDF (Portable Document Format) is a file format used to present documents in a consistent layout across different devices and operating systems.

Spreadsheets can be exported or saved as PDF files for convenient sharing.

Procedure for exporting a spreadsheet as PDF

1. Open the workbook.
2. Click File.
3. Select Save As or Export, depending on the application.
4. Choose PDF as the file format.
5. Select the required pages or worksheets.
6. Set page orientation and scaling.
7. Specify the storage location.
8. Save or export the file.

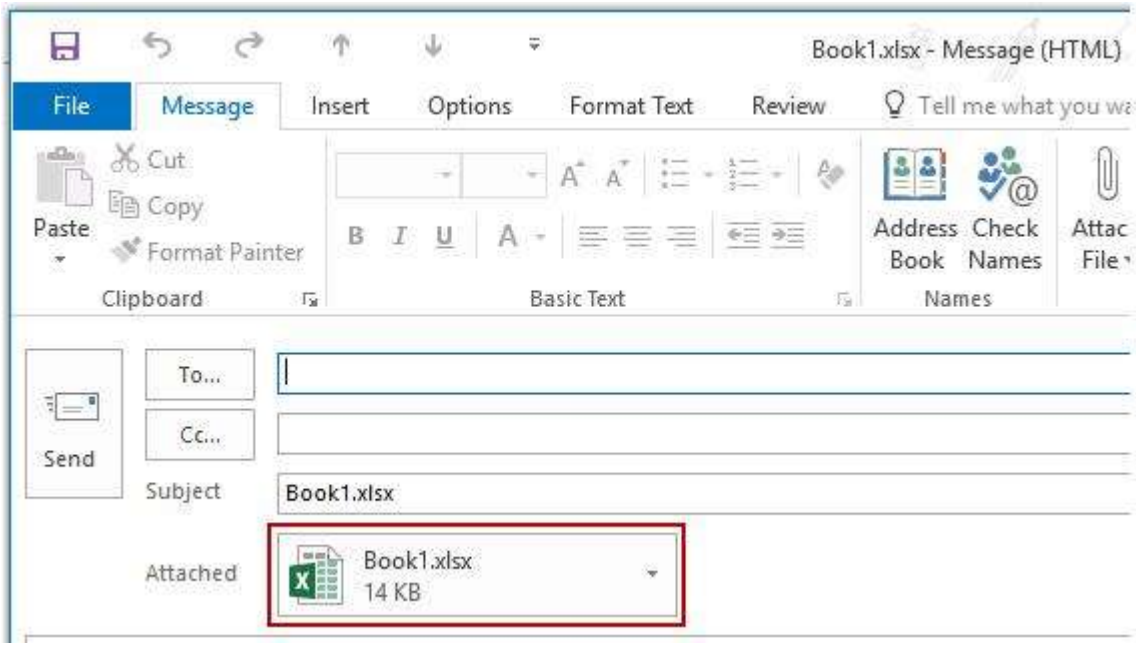
Advantages of PDF sharing

1. Preserves document layout.
2. Can be opened on many devices.
3. Reduces the risk of accidental editing.
4. Is convenient for printing.
5. Supports electronic distribution.
6. Can combine several pages into one document.

Limitations

1. Formula calculations cannot normally be edited directly in a standard PDF viewer.
2. Large PDF files may require compression.
3. Incorrect print settings can produce poorly formatted pages.
4. Users may require spreadsheet software to modify the original data.

C. Sharing through email



Definition

Email sharing involves sending a spreadsheet file as an attachment through an electronic mail service.

Procedure

1. Open an email application.
2. Compose a new message.
3. Enter the recipient's email address.
4. Enter an appropriate subject.
5. Write a brief message.
6. Click the attachment icon.
7. Locate the spreadsheet file.
8. Attach the file.
9. Confirm that the correct file is attached.
10. Send the email.

Advantages

- Enables rapid communication.
- Supports sharing with several recipients.
- Allows the sender to include a message.
- Supports attachment of spreadsheet files and PDFs.
- Provides a record of communication.

Limitations

- Attachment size limits may apply.
- Files may be sent to the wrong recipient.
- Sensitive information may be exposed if not properly protected.
- Internet access is required.

D. Sharing through online platforms

Online spreadsheet platforms allow authorised users to access spreadsheet files through the Internet.

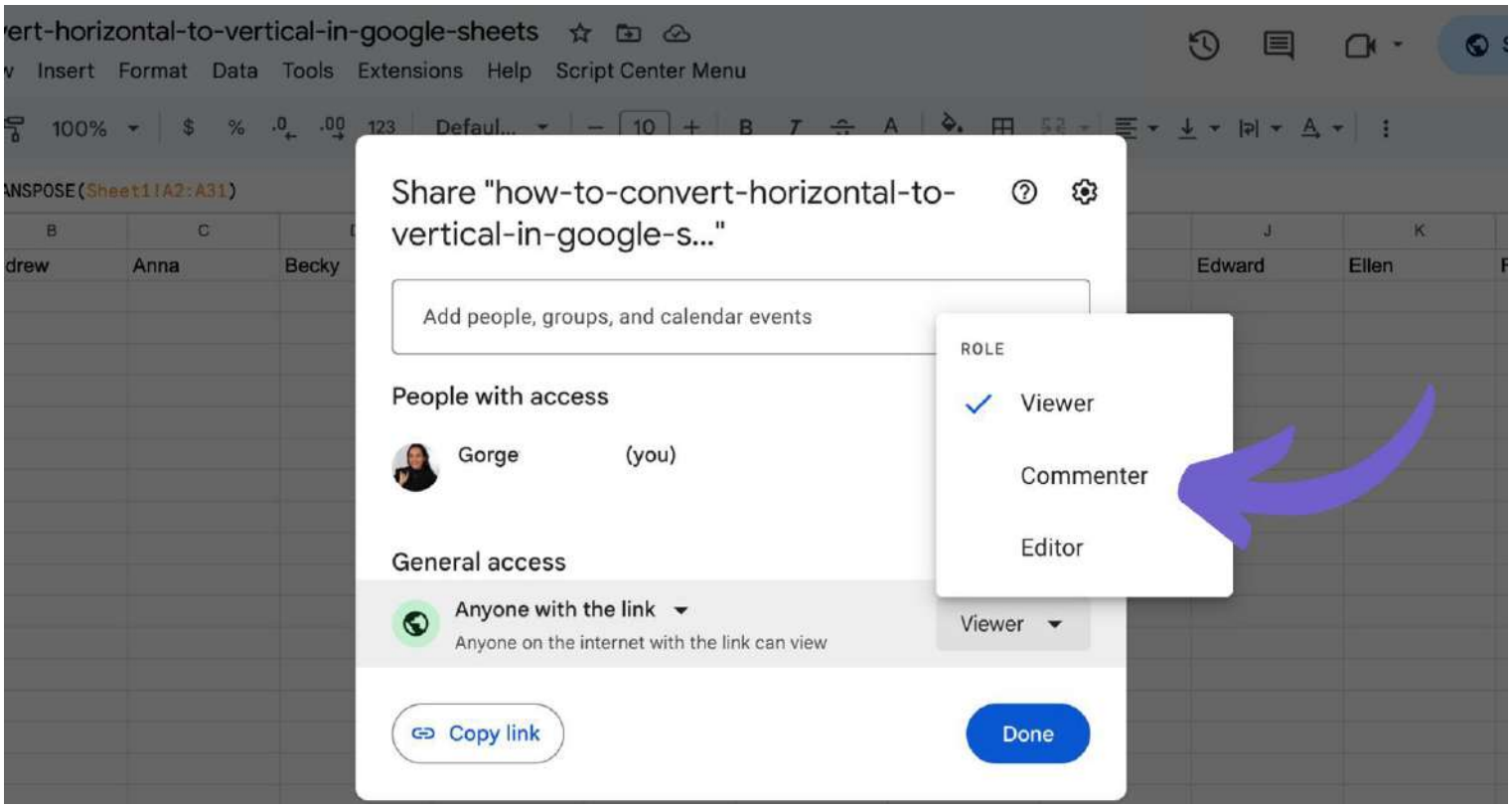
Examples:

- Google Drive.
- Microsoft OneDrive.
- SharePoint.

Procedure for sharing a Google Sheets document

1. Open the spreadsheet.
2. Click Share.
3. Enter the email addresses of intended recipients or choose an appropriate link-sharing option.
4. Assign the required access permissions.

5. Choose whether recipients can view, comment or edit.
6. Add a message if necessary.
7. Send or copy the sharing link.
8. Confirm that access permissions are appropriate.



Types of sharing permissions

1. Viewer

A viewer can open and read the spreadsheet but cannot normally edit its contents.

2. Commenter

A commenter can view the spreadsheet and add comments without directly editing the spreadsheet data.

3. Editor

An editor can make changes to the spreadsheet, subject to the platform's permissions and restrictions.

Advantages of online sharing

1. Supports collaboration.
2. Enables access from different locations.
3. Reduces the need to send repeated file attachments.
4. Supports real-time or near-real-time updates.
5. Provides access control.
6. Can maintain revision histories.
7. Supports remote working.

Limitations

1. Some functions require Internet connectivity.
2. Unauthorised sharing may expose sensitive data.
3. Users may experience access problems.
4. Accidental editing may affect shared records.
5. Dependence on online services may create availability challenges.

E. Sharing through removable storage devices

Examples include:

- USB flash drives.
- External hard disks.
- Memory cards.

Procedure

1. Save the spreadsheet.
2. Connect the removable storage device.
3. Locate the spreadsheet file.
4. Copy the file.
5. Open the storage device.
6. Paste the file.
7. Safely eject the device.
8. Transfer it to the intended recipient.

Advantages

- Can transfer files without Internet access.
- Supports large files, depending on storage capacity.
- Can be useful in areas with limited connectivity.

Limitations

- Devices can be lost.
- They may introduce malware.
- Physical damage can cause data loss.
- Confidential information may be exposed.

F. Comparison of spreadsheet sharing methods

Method	Main advantage	Main limitation
Hard copy	Physical reference	Printing costs
PDF	Preserves layout	Difficult to edit directly
Email	Quick distribution	Attachment restrictions
Online sharing	Collaboration	Requires suitable connectivity
USB storage	Works offline	Risk of loss or malware

1.21 USING SPREADSHEETS TO MAKE DECISIONS

Definition of decision-making

Decision-making is the process of selecting the most appropriate course of action from available alternatives after considering relevant information.

Spreadsheet productivity tools support decision-making by organising, processing, analysing and presenting data in a meaningful manner.

A. How spreadsheets support decision-making

1. **Data analysis:** Spreadsheets help users examine information before making decisions.

2. **Comparison:** Users can compare different alternatives using numerical data.

3. **Trend identification:** Charts and graphs reveal changes in information over time.

4. **Financial planning:** Spreadsheets help organisations prepare budgets and monitor expenditure.

5. **Performance monitoring:** Schools can evaluate learner performance and identify areas requiring improvement.

6. **Forecasting:** Historical data can be used to estimate possible future outcomes.

7. **Problem identification:** Spreadsheet analysis helps users identify unusual values and operational challenges.

8. **Resource allocation:** Organisations can use data to distribute available resources appropriately.

B. Examples of spreadsheet-based decision-making in Kenya

1. School administration

A school administrator uses examination results to identify subjects where learners require additional academic support.

2. Agricultural production

A farmer compares production records from different seasons to determine which crops have performed better.

3. Small businesses

A shopkeeper compares monthly sales and expenses to identify profitable products.

4. Savings groups

A community savings group uses spreadsheets to monitor contributions, loans and repayments.

5. Health institutions

A hospital administrator analyses patient attendance records to plan staffing and service delivery.

6. Transport businesses

A transport operator compares fuel expenses, maintenance costs and revenue to evaluate business performance.

C. Using spreadsheets for financial calculations

Consider the following example of a small business in Narok County.

Item	Quantity	Unit price (KSh)	Total (KSh)
Maize flour	20	180	3,600
Sugar	15	200	3,000
Cooking oil	10	350	3,500
Rice	12	250	3,000
Total			13,100

The business owner can use spreadsheet formulas to calculate:

- Total cost of each product.
- Total sales.
- Total expenses.
- Gross profit.
- Net profit.
- Monthly sales trends.

For example, if quantity is in B2 and unit price is in C2, the total value is calculated using:

=B2*C2

The formula can be copied down to other product records.

Decision: The business owner can compare the sales of different products and determine which items require more stock.

1.22 APPLICATIONS OF SPREADSHEET PRODUCTIVITY TOOLS IN DIFFERENT SECTORS

Spreadsheets are useful in many economic and social activities.

A. Education sector

Spreadsheets are used to:

1. Record learner examination results.
2. Calculate total marks.
3. Determine average performance.
4. Prepare class performance reports.
5. Maintain attendance records.
6. Prepare school budgets.
7. Manage inventories of learning materials.
8. Monitor learner progress.
9. Analyse assessment results.
10. Prepare academic performance charts.

B. Banking and finance

Spreadsheets are used to:

1. Prepare financial reports.
2. Calculate interest.
3. Monitor expenditure.
4. Prepare budgets.
5. Analyse financial transactions.
6. Calculate loan repayment schedules.
7. Monitor savings.
8. Prepare cash flow statements.

C. Agriculture

Spreadsheets are used to:

1. Record crop production.
2. Monitor farm expenses.
3. Calculate profits and losses.
4. Compare seasonal yields.
5. Monitor livestock records.

6. Prepare farm budgets.
7. Analyse market prices.
8. Plan the purchase of farm inputs.

D. Business and trade

Spreadsheets are used to:

1. Record daily sales.
2. Monitor stock levels.
3. Calculate profits.
4. Prepare invoices.
5. Maintain customer records.
6. Prepare employee payment schedules.
7. Analyse business performance.
8. Compare suppliers and prices.

E. Healthcare

Spreadsheets can be used for appropriate administrative and analytical tasks, including:

1. Monitoring medicine stock.
2. Preparing administrative reports.
3. Analysing service attendance statistics.
4. Monitoring operational expenditure.
5. Preparing staff duty schedules.
6. Analysing non-identifiable statistical data.

Sensitive medical information must be handled according to applicable data protection and confidentiality requirements.

F. Government and public administration

Spreadsheets are used to:

1. Organise statistical data.
2. Monitor departmental budgets.
3. Prepare project reports.
4. Analyse public expenditure.
5. Monitor development activities.
6. Organise administrative records.
7. Prepare summary reports.

G. Transport and logistics

Spreadsheets are used to:

1. Record vehicle maintenance expenses.
2. Monitor fuel consumption.
3. Prepare transport schedules.
4. Calculate delivery costs.
5. Record vehicle movements.
6. Compare transport revenue.

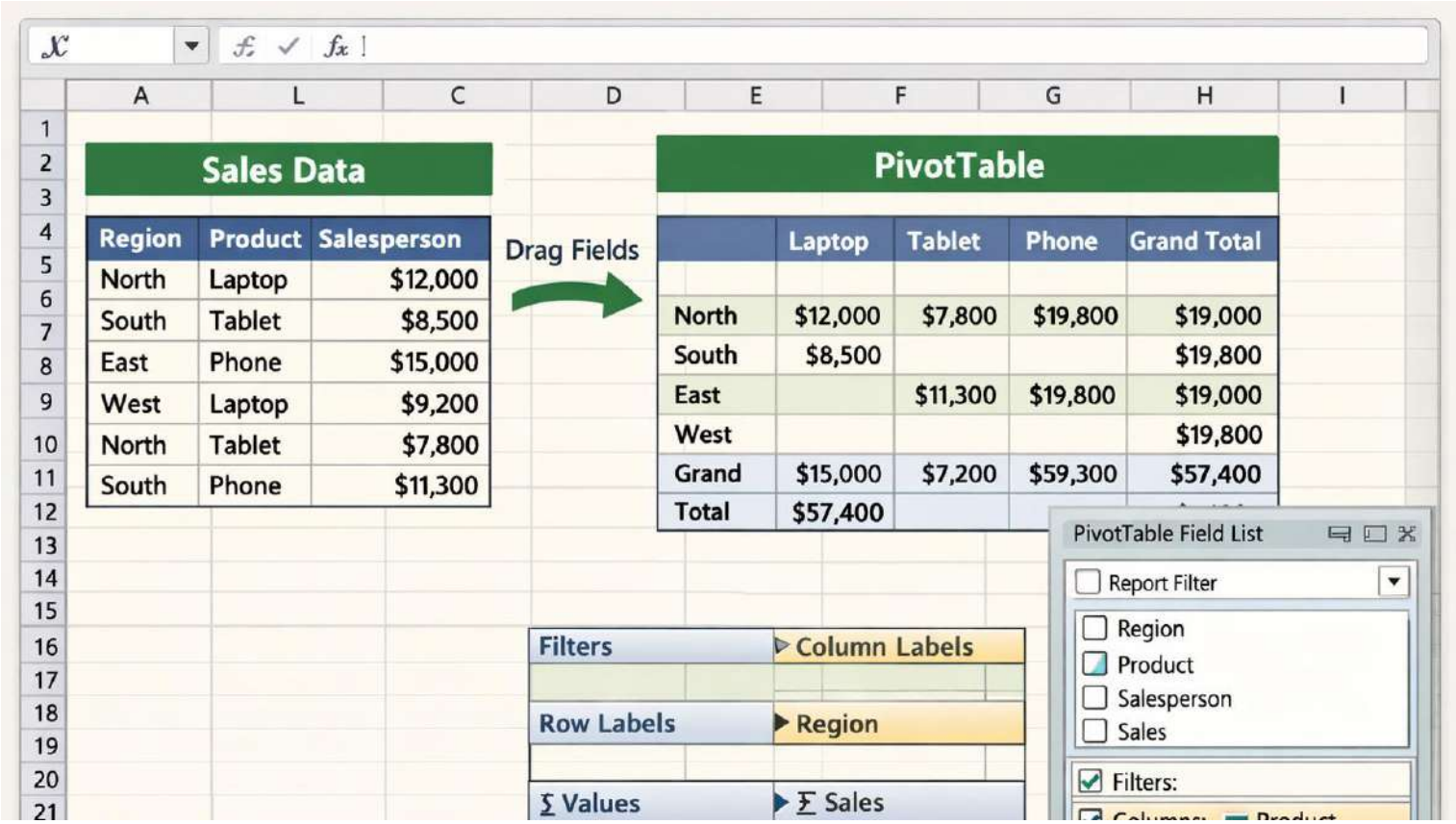
1.23 ADVANCED SPREADSHEET PRODUCTIVITY TOOLS

Some spreadsheet applications provide advanced tools for analysing and managing large amounts of data.

A. Pivot tables

Definition

A PivotTable is a spreadsheet feature that summarises, reorganises and analyses large datasets by arranging information into categories, rows, columns and calculated values.



Uses of PivotTables

1. Summarising large datasets.
2. Comparing sales across regions.
3. Calculating total expenditure by department.
4. Analysing examination results by class.
5. Summarising agricultural production by county.
6. Identifying patterns in business transactions.

Example

A business has 5,000 sales transactions. Instead of examining every transaction individually, it uses a PivotTable to calculate total sales for each product category.

Advantages

- Summarises large amounts of data.
- Reduces manual calculations.
- Supports flexible data analysis.
- Makes comparisons easier.
- Can be used with PivotCharts in supported applications.

B. What-if analysis

Definition

What-if analysis is a spreadsheet technique used to investigate how changes in input values affect calculated results.

It helps users examine different possible situations before making decisions.

Examples

1. Investigating how a change in product prices affects profits.
2. Examining how increased farm input costs affect farming expenses.
3. Determining how different savings contributions affect accumulated savings.
4. Evaluating how a change in examination marks affects average performance.

Common what-if analysis tools in Microsoft Excel

- Scenario Manager.
- Goal Seek.
- Data Tables.

C. Goal Seek

Definition

Goal Seek is a spreadsheet analysis tool that determines the input value required to produce a specified result in a formula.

Example:

A business wants to achieve a particular profit target. Goal Seek can determine the sales quantity required to achieve that target, given the other values in the calculation.

D. Data tables

Definition

A data table is a what-if analysis tool that displays how changing one or two input variables affects a formula's results.

Example:

A business examines how different selling prices and quantities affect total revenue.

E. Macros

Definition

A macro is a recorded or programmed sequence of instructions used to automate repetitive tasks in a spreadsheet application.

Examples of tasks automated using macros

1. Applying standard formatting to reports.
2. Preparing recurring summary reports.
3. Organising records.
4. Performing repeated calculations.
5. Generating standardised worksheets.

Importance:

- Saves time.
- Reduces repetitive work.
- Improves consistency.
- Increases productivity.

Caution: Only use macros from trusted sources. Untrusted macros may introduce security risks.

1.24 PROTECTING SPREADSHEET DATA

Spreadsheet files may contain sensitive personal, educational and financial information. It is therefore important to protect them against accidental damage, unauthorised access and loss.

A. Password protection

A password can be used to restrict access to a spreadsheet file or certain workbook operations, depending on the application.

Examples:

- Protecting financial records.
- Restricting access to confidential school reports.
- Protecting business information.

B. Worksheet protection

Worksheet protection helps restrict changes to selected cells and worksheet elements.

For example, a teacher may protect cells containing examination formulas to prevent accidental modification.

C. Workbook protection

Workbook protection can restrict certain structural changes, such as adding, deleting, moving or renaming worksheets.

D. Access permissions

Online spreadsheet applications allow users to assign different access permissions.

These may include:

- Viewer.
- Commenter.
- Editor.

E. Backing up spreadsheet files

Definition: A backup is an additional copy of important data kept separately so that it can be recovered if the original is lost, damaged or corrupted.

Ways of backing up spreadsheets include:

1. Saving copies on external storage devices.
2. Using approved cloud storage services.
3. Maintaining organised backup folders.
4. Creating regular backup copies.
5. Using institutional backup systems.

F. Other spreadsheet security practices

1. Use strong passwords.
2. Avoid sharing passwords.
3. Restrict access to authorised users.
4. Avoid downloading suspicious spreadsheet attachments.
5. Scan files from untrusted sources.
6. Keep spreadsheet software updated.
7. Protect confidential records.
8. Review sharing permissions regularly.
9. Avoid leaving sensitive spreadsheets open on public computers.
10. Close accounts after using shared devices.

1.25 BEST PRACTICES WHEN WORKING WITH SPREADSHEETS

A well-designed spreadsheet should be accurate, organised, easy to understand and suitable for its intended purpose.

The following practices should be observed.

A. Use clear headings

Each column should have a meaningful heading that describes the information it contains.

B. Maintain consistent data entry

Use the same format for similar information.

For example, use consistent date formats throughout a worksheet.

C. Avoid unnecessary blank rows and columns

Continuous datasets are easier to sort, filter and analyse.

D. Use appropriate formulas

Ensure that formulas perform the intended calculations.

E. Check data accuracy

Verify information before using it for calculations or decision-making.

F. Apply suitable formatting

Avoid excessive colours, unnecessary fonts and complicated layouts.

G. Save files regularly

Save work using meaningful file names and suitable storage locations.

H. Use suitable charts

Select charts that accurately communicate the information.

I. Protect important information

Use suitable security measures to prevent unauthorised access and modification.

J. Document important formulas

Explain complicated calculations where necessary so that other users can understand them.

K. Avoid duplicate records

Check datasets for repeated entries that may affect calculations and analysis.

L. Use appropriate file formats

Choose file formats according to the purpose of the spreadsheet.

1.26 COMMON SPREADSHEET FILE FORMATS

Different spreadsheet applications support different file formats.

File extension	Description
.xlsx	Microsoft Excel workbook format
.xls	Earlier Microsoft Excel workbook format
.ods	OpenDocument Spreadsheet format
.csv	Comma-Separated Values text format
.tsv	Tab-Separated Values text format
.xlsm	Excel macro-enabled workbook format
.pdf	Portable Document Format
.numbers	Apple Numbers spreadsheet format

Explanation of important file formats

1. XLSX

A common Microsoft Excel workbook format that supports worksheets, formulas, charts and formatting.

2. XLS

An older Microsoft Excel workbook format.

3. ODS

An open spreadsheet file format used by applications such as LibreOffice Calc.

4. CSV

A text-based format that stores tabular data using commas as separators.

It is useful for transferring data between different applications.

However, CSV does not normally preserve spreadsheet formulas, charts, formatting or multiple worksheets.

5. PDF

A document format commonly used to distribute spreadsheet reports while maintaining a consistent layout.

1.27 CHALLENGES ASSOCIATED WITH USING SPREADSHEET PRODUCTIVITY TOOLS

Although spreadsheets provide many benefits, their use may present certain challenges.

Challenge	Explanation	Possible solution
Incorrect data entry	Wrong information affects results	Verify entries
Formula errors	Incorrect formulas produce incorrect results	Test formulas
Data loss	Files may be deleted or damaged	Maintain backups
Security risks	Unauthorised people may access information	Apply access controls
Limited skills	Users may struggle with advanced tools	Provide training
Software costs	Some applications require licences or subscriptions	Consider suitable alternatives
Compatibility problems	Files may display differently in different applications	Use compatible file formats
Large datasets	Very large files may affect performance	Use suitable tools and optimise data
Internet limitations	Online collaboration may be disrupted	Use suitable offline alternatives
Accidental modification	Important formulas may be changed	Protect important cells

PRACTICAL PROJECT: USING A SPREADSHEET TO MANAGE A SCHOOL ASSESSMENT

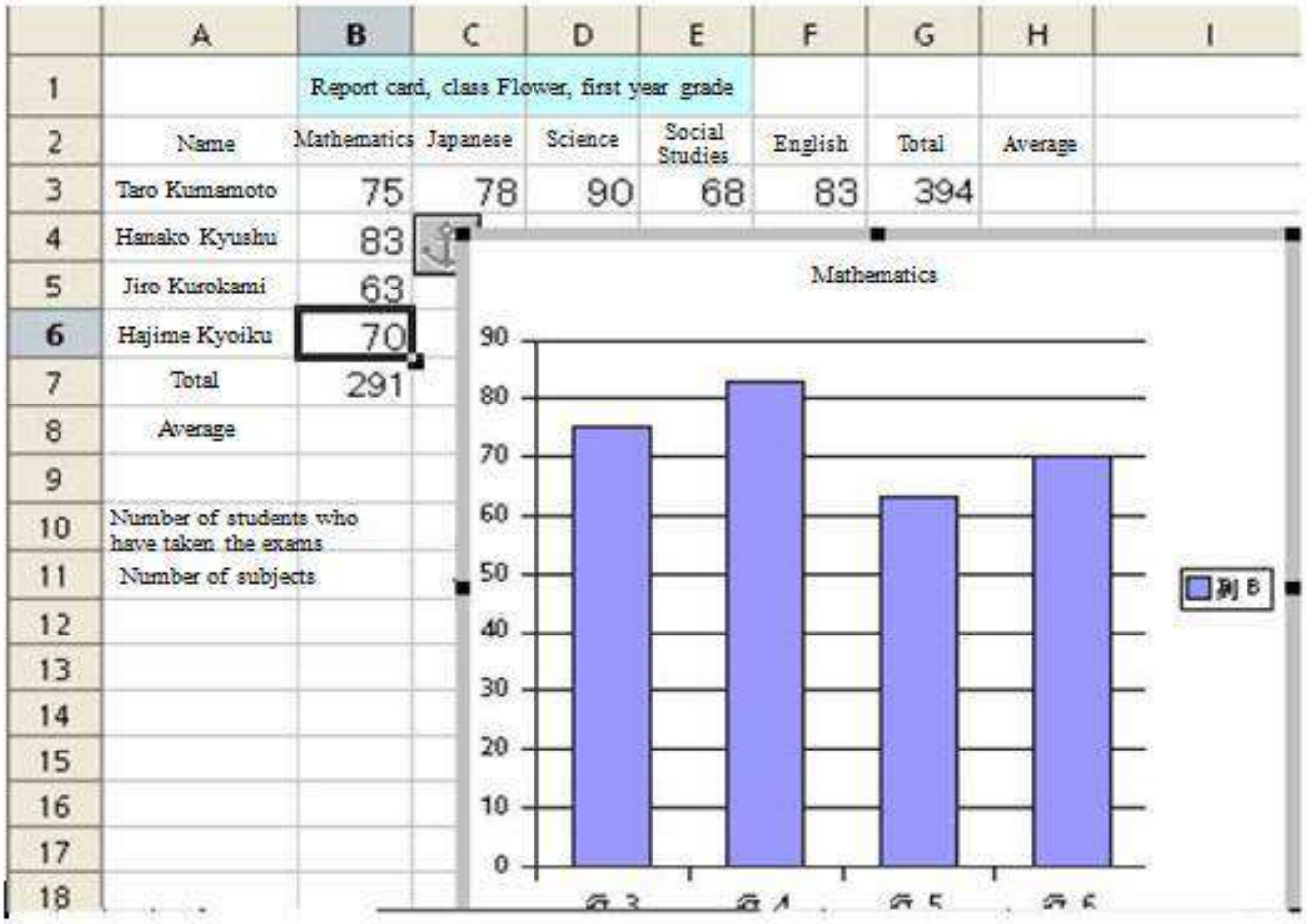
CBE PRACTICAL LEARNING ACTIVITY

Project title: Creating a Grade 11 Examination Performance Spreadsheet.

Scenario:

Tala School wants to organise the examination results of learners using a spreadsheet productivity application.

The school requires a spreadsheet that can record marks, calculate totals and averages, classify performance, sort records and present results graphically.



A. Learning objectives

By the end of the project, the learner should be able to:

1. Create a spreadsheet workbook.
2. Enter and organise examination data.
3. Format a worksheet.
4. Use formulas and functions.
5. Sort and filter data.
6. Apply data validation.
7. Apply conditional formatting.

8. Create charts.
9. Save and share spreadsheet outputs.
10. Interpret spreadsheet results to make decisions.

B. Required resources

- Computer or laptop.
- Microsoft Excel, LibreOffice Calc or Google Sheets.
- Examination data.
- Internet connection where necessary.
- Printer where available.

C. Sample dataset

Adm. No.	Learner	Mathematics	English	ICT	Total
001	Amina	75	80	85	
002	Brian	60	70	65	
003	Carol	90	85	95	
004	David	55	60	70	
005	Esther	85	90	80	
006	Felix	65	75	70	
007	Grace	80	85	90	
008	Henry	50	55	60	

D. Project activities

Activity 1: Create a workbook

Create a new workbook and rename the worksheet Examination Results.

Activity 2: Enter the data

Enter all the information provided in the sample dataset.

Activity 3: Format the worksheet

- Bold the column headings.
- Apply suitable borders.
- Adjust column widths.

- Apply suitable number formatting.
- Give the worksheet a meaningful title.

Activity 4: Calculate total marks

Use the SUM function to calculate each learner's total marks.

Activity 5: Calculate average marks

Create another column and calculate each learner's average.

Activity 6: Identify the highest and lowest marks

Use MAX and MIN to identify the highest and lowest Mathematics marks.

Activity 7: Apply conditional formatting

Highlight learners who scored below 50 in Mathematics.

Activity 8: Apply data validation

Restrict subject marks to whole numbers between 0 and 100.

Activity 9: Sort the records

Arrange learners according to total marks from highest to lowest.

Activity 10: Filter the records

Display only learners whose Mathematics marks are 70 and above.

Activity 11: Create a chart

Create a column chart comparing the average marks in the three subjects.

Activity 12: Save and share the output

Save the workbook using an appropriate file name and export the report as PDF.

E. Project assessment rubric

Assessment criteria	Marks
Workbook creation and organisation	2
Accurate data entry	3
Formatting and presentation	2
Correct formulas and functions	4
Sorting and filtering	2
Data validation and conditional formatting	2
Chart creation	3
Saving and sharing	2
Total	20

F. Expected learning outcomes

The learner should produce a spreadsheet workbook that:

- Contains accurate learner records.
- Uses correct formulas and functions.
- Is properly formatted.

- Allows records to be sorted and filtered.
- Contains suitable charts.
- Can be shared appropriately.
- Supports informed academic decisions.

KEY TERMS AND DEFINITIONS

Term	Definition
Spreadsheet	An electronic document organised into rows and columns for storing and manipulating data
Spreadsheet application	Software used to create, edit and analyse spreadsheet data
Workbook	A spreadsheet file containing one or more worksheets
Worksheet	A spreadsheet page consisting of rows and columns
Row	A horizontal arrangement of cells
Column	A vertical arrangement of cells
Cell	The intersection of a row and a column
Cell address	The unique identification of a cell
Cell reference	A cell address used in a formula
Range	A selected group of cells
Formula	An expression used to perform calculations
Function	A predefined formula that performs a specific operation
Sorting	Arranging data in a specified order
Filtering	Displaying records that satisfy specified conditions
Data validation	Controlling the type of information entered into cells
Conditional formatting	Automatically changing cell appearance according to specified conditions
Grouping	Organising related rows or columns for easier management
Spreadsheet form	A structured interface for entering or managing records
Dataset	An organised collection of related data
Data manipulation	Organising, modifying and processing data
Chart	A graphical representation of data
Graph	A visual representation of numerical information
PivotTable	A tool for summarising and analysing datasets
Macro	A recorded or programmed sequence of instructions used to automate tasks
Data analysis	Examining information to identify patterns, trends and relationships
Data entry	The process of entering information into a spreadsheet
Data extraction	Retrieving selected information from a larger dataset
Data integrity	Maintaining the accuracy and consistency of information
PDF	A document format used to preserve document layout
CSV	A text-based file format used to store tabular data
Data backup	An additional copy of information kept for recovery
Relative reference	A cell reference that changes when a formula is copied
Absolute reference	A cell reference that remains fixed when copied
Mixed reference	A cell reference in which either the row or column remains fixed
Digital collaboration	Working together using digital platforms and tools
What-if analysis	Investigating how changes in input values affect results

SECTION 2: GRADE 11 ICT REVISION QUESTIONS

REVISION AND ASSESSMENT

STRAND 2.0: PRODUCTIVITY TOOLS

Sub-strand 2.1: Spreadsheet

Section	Assessment	Marks
A	30 Multiple Choice Questions	30
B	Structured Questions 1–6	50
Total	80 marks	80

Instructions to learners

1. Answer all questions.
2. Select the most appropriate answer in Section A.
3. Write clear and well-organised answers in Section B.
4. Show appropriate working where calculations are required.
5. Use relevant examples where necessary.

SECTION A: MULTIPLE CHOICE QUESTIONS (30 MARKS)

Choose the correct answer from the alternatives A, B, C and D.

Question 1. Which of the following best describes a spreadsheet?

A. Software used only for designing pictures.

B. An electronic document organised into rows and columns for manipulating data.

C. Software used exclusively for browsing the Internet.

D. A computer application used only for typing letters.

Question 2. Which of the following is an example of an open-source spreadsheet application?

A. Microsoft Excel.

B. Apple Numbers.

C. LibreOffice Calc.

D. Microsoft PowerPoint.

Question 3. A spreadsheet file containing several worksheets is referred to as a:

A. Workbook.

B. Database.

C. Presentation.

D. Document.

Question 4. The intersection of a row and a column in a spreadsheet is known as a:

A. Range.

B. Workbook.

C. Worksheet.

D. Cell.

Question 5. Which of the following cell addresses represents the intersection of column C and row 5?

A. 5C.

B. C5.

C. C:5.

D. 5:C.

Question 6. Which component of a spreadsheet interface displays the contents or formula of the active cell?

A. Status bar.

B. Sheet tab.

C. Formula bar.

D. Scroll bar.

Question 7. Which of the following is the correct formula for adding values in cells A1 and B1?

A. =A1+B1

B. A1+B1=

C. +A1=B1

D. ADD(A1,B1)

Question 8. Which mathematical operator is used for multiplication in spreadsheet formulas?

A. +

B. /

C. -

D. *

Question 9. Which of the following functions is used to calculate the average of numerical values?

A. SUM.

B. AVERAGE.

C. MAX.

D. COUNT.

Question 10. A teacher wants to identify the highest examination mark in cells B2 to B30. Which function should be used?

A. MIN.

B. COUNT.

C. MAX.

D. SUM.

Question 11. Which function counts numerical values in a selected range?

A. COUNT.

B. CONCAT.

C. IF.

D. ROUND.

Question 12. Which of the following represents an absolute cell reference?

A. A1.

B. A$1.

C. $A1.

D. $A$1.

Question 13. A formula is copied from cell C2 to C3. The formula =A2+B2 changes to =A3+B3. This demonstrates the use of:

A. Absolute referencing.

B. Relative referencing.

C. Mixed referencing.

D. Data validation.

Question 14. Which spreadsheet feature arranges numerical data from the smallest to the largest value?

A. Filtering.

B. Grouping.

C. Ascending sorting.

D. Conditional formatting.

Question 15. A school administrator wants to display only learners who scored 80 marks and above. Which feature should be used?

A. Filtering.

B. Merging.

C. Grouping.

D. Wrapping.

Question 16. Which spreadsheet feature restricts examination marks to whole numbers between 0 and 100?

A. Sorting.

B. Charting.

C. Grouping.

D. Data validation.

Question 17. A teacher wants to automatically highlight examination marks below 40 in red. Which feature should be used?

A. Data validation.

B. Conditional formatting.

C. Sorting.

D. Data extraction.

Question 18. Which spreadsheet feature allows related rows or columns to be expanded and collapsed?

A. Filtering.

B. Sorting.

C. Grouping.

D. Data validation.

Question 19. Which of the following is the most suitable chart for displaying changes in monthly rainfall?

A. Line graph.

B. Pie chart.

C. Doughnut chart.

D. Histogram.

Question 20. A business wants to display the proportions of its monthly expenditure on food, transport and rent. Which chart is most suitable?

A. Scatter chart.

B. Line graph.

C. Column chart.

D. Pie chart.

Question 21. Which chart is most suitable for examining the relationship between study hours and examination marks?

A. Pie chart.

B. Scatter chart.

C. Doughnut chart.

D. Area chart.

Question 22. Which of the following spreadsheet functions is used to test a condition and return different results depending on whether the condition is TRUE or FALSE?

A. SUM.

B. MAX.

C. IF.

D. COUNT.

Question 23. Which of the following functions can be used to count learners who scored at least 50 marks?

A. COUNTIF.

B. SUM.

C. CONCAT.

D. ROUND.

Question 24. Which spreadsheet feature is most suitable for summarising thousands of business transactions by product category?

A. Text wrapping.

B. Cell merging.

C. Font formatting.

D. PivotTable.

Question 25. What is the main purpose of exporting a spreadsheet into PDF format?

A. To convert all formulas into editable spreadsheet formulas.

B. To distribute the information while preserving its document layout.

C. To automatically increase the number of worksheets.

D. To remove all numerical information.

Question 26. Which of the following Google Sheets permissions allows a user to read a spreadsheet without directly editing its contents?

A. Editor.

B. Administrator.

C. Viewer.

D. Owner.

Question 27. Which file extension represents an OpenDocument Spreadsheet?

A. .ods

B. .docx

C. .pptx

D. .jpg

Question 28. A spreadsheet formula displays the error #DIV/0!. What is the most likely cause?

A. An invalid chart type.

B. An incorrect font size.

C. A missing worksheet title.

D. Division by zero or an empty divisor.

Question 29. Which of the following best describes what-if analysis?

A. Changing the appearance of worksheet headings.

B. Examining how changes in input values affect calculated results.

C. Printing a worksheet.

D. Deleting unnecessary columns.

Question 30. A school wants teachers to collaborate on a shared examination performance spreadsheet from different locations. Which application would be particularly suitable?

A. A basic offline text editor.

B. A calculator application.

C. Google Sheets.

D. A picture editing application.

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

Answer ALL questions.

Question 1. Introduction to Spreadsheet Productivity Tools (8 marks)

a) Define the term spreadsheet. (2 marks)

b) State three examples of spreadsheet productivity applications. (3 marks)

c) Explain three reasons why spreadsheets are important in managing organisational data. (3 marks)

Question 2. Spreadsheet Components and Formulas (8 marks)

a) Differentiate between a workbook and a worksheet. (2 marks)

b) Explain three components of a spreadsheet interface and state their functions. (3 marks)

c) Differentiate between relative and absolute cell referencing, giving one example of each. (3 marks)

Question 3. Spreadsheet Functions and Data Manipulation (8 marks)

a) State the spreadsheet function used to perform each of the following operations: (4 marks)

i. Calculating the sum of numerical values.

ii. Finding the highest value in a range.

iii. Calculating the average of values.

iv. Counting cells containing numerical values.

b) Explain two differences between sorting and filtering data. (2 marks)

c) State two advantages of using data validation in a spreadsheet. (2 marks)

Question 4. Data Organisation and Visualisation (9 marks)

a) Define the term conditional formatting. (2 marks)

b) Explain three advantages of using charts and graphs in spreadsheet data presentation. (3 marks)

c) Identify the most suitable chart for each of the following activities. (4 marks)

i. Displaying the proportion of a household budget spent on different items.

ii. Monitoring monthly rainfall changes.

iii. Comparing examination performance across different subjects.

iv. Investigating the relationship between hours spent studying and examination marks.

Question 5. Spreadsheet Applications and Sharing (9 marks)

a) Explain three ways in which spreadsheets are used in the agricultural sector in Kenya. (3 marks)

b) Describe three methods through which spreadsheet outputs can be shared with other users. (3 marks)

c) State three measures that can be used to protect confidential spreadsheet information. (3 marks)

Question 6. Practical Application of Spreadsheet Productivity Tools (8 marks)

A secondary school in Narok County uses a spreadsheet to manage examination results for Grade 11 learners.

The spreadsheet contains the following information:

Learner	Mathematics	English	ICT
Amina	75	80	85
Brian	60	70	65
Carol	90	85	95
David	55	60	70
Esther	85	90	80

Answer the following questions.

a) Write a spreadsheet formula that can be entered in cell E2 to calculate Amina's total marks. (2 marks)

b) Write a spreadsheet function that can be used to determine the highest Mathematics mark in the dataset, assuming the marks are in cells B2:B6. (1 mark)

c) State the spreadsheet feature that can be used to display learners who scored 70 marks and above in Mathematics. (1 mark)

d) Explain two steps involved in creating a column chart to compare performance in the three subjects. (2 marks)

e) State two benefits of using spreadsheets to manage examination records in a school. (2 marks)

MARKING SCHEME

GRADE 11 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

STRAND 2.0: PRODUCTIVITY TOOLS

SUB-STRAND 2.1: SPREADSHEET

REVISION AND ASSESSMENT

TOTAL: 80 MARKS

SECTION A: MULTIPLE-CHOICE QUESTIONS (30 MARKS)

Each question carries 1 mark.

Question	Answer
1	B
2	C
3	A
4	D
5	B
6	C
7	A
8	D
9	B
10	C
11	A
12	D
13	B
14	C
15	A
16	D
17	B
18	C
19	A
20	D
21	B
22	C
23	A
24	D

25	B
26	C
27	A
28	D
29	B
30	C

SECTION A TOTAL: 30 MARKS

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

QUESTION 1: INTRODUCTION TO SPREADSHEET PRODUCTIVITY TOOLS (8 MARKS)

a) Define the term spreadsheet. (2 marks)

A spreadsheet is an electronic document or application that organises data in rows and columns, allowing users to enter, store, calculate, analyse and present information.

- Electronic document/application – 1 mark.
- Organises and manipulates data in rows and columns – 1 mark.

b) State three examples of spreadsheet productivity applications. (3 marks)

Award 1 mark each for any three:

1. Microsoft Excel.
2. Google Sheets.
3. LibreOffice Calc.
4. Apple Numbers.
5. WPS Spreadsheets.

c) Explain three reasons why spreadsheets are important in managing organisational data. (3 marks)

Award 1 mark each for any three well-explained points:

1. Data organisation: They arrange information systematically in rows and columns, making it easier to retrieve.
2. Automatic calculations: They use formulas and functions to perform calculations quickly and accurately.
3. Data analysis: They help organisations analyse information using sorting, filtering and statistical functions.
4. Data presentation: They present information using charts, graphs and tables.
5. Record keeping: They help organisations maintain financial, employee, inventory and performance records.
6. Decision-making: They provide analysed information that supports informed organisational decisions.

Total: 8 marks

QUESTION 2: SPREADSHEET COMPONENTS AND FORMULAS (8 MARKS)

a) Differentiate between a workbook and a worksheet. (2 marks)

- Workbook: A spreadsheet file containing one or more worksheets. (1 mark)
- Worksheet: An individual spreadsheet page made up of rows and columns where data is entered and manipulated. (1 mark)

b) Explain three components of a spreadsheet interface and state their functions. (3 marks)

Award 1 mark for each correctly identified component and its function.

Component	Function
Formula bar	Displays and allows editing of the contents or formula in the active cell.
Name box	Displays the address of the active cell and allows users to navigate to specific cells.
Ribbon	Contains tabs and commands used to perform spreadsheet operations.
Row headings	Identify rows using numbers.
Column headings	Identify columns using letters.
Sheet tabs	Allow users to switch between worksheets.
Status bar	Displays information about the current worksheet and selected data.
Active cell	Indicates the cell currently selected for data entry or editing.

Accept any three correctly explained components.

c) Differentiate between relative and absolute cell referencing, giving one example of each. (3 marks)

- Relative cell referencing: A cell reference that changes automatically when a formula is copied to another cell. Example: A1. (1½ marks)
- Absolute cell referencing: A cell reference that remains fixed when a formula is copied to another cell. It uses dollar signs before the column and row. Example: $A$1. (1½ marks)

Total: 8 marks

QUESTION 3: SPREADSHEET FUNCTIONS AND DATA MANIPULATION (8 MARKS)

a) State the spreadsheet function used to perform each operation. (4 marks)

Award 1 mark each.

Operation	Correct function
i. Calculating the sum of numerical values	SUM
ii. Finding the highest value in a range	MAX
iii. Calculating the average of values	AVERAGE
iv. Counting cells containing numerical values	COUNT

b) Explain two differences between sorting and filtering data. (2 marks)

Award 1 mark each for any two differences.

1. Sorting arranges data in a particular order, such as ascending or descending, while filtering displays only records that meet specified conditions.

2. Sorting changes the order in which records appear, while filtering temporarily hides records that do not meet the selected criteria.
3. Sorting can arrange names alphabetically or marks numerically, while filtering can display only learners who scored 70 marks and above.

c) State two advantages of using data validation in a spreadsheet. (2 marks)

Award 1 mark each for any two:

1. Restricts the type of data entered into cells.
2. Reduces data-entry errors.
3. Ensures consistency and accuracy of information.
4. Prevents users from entering values outside specified limits.
5. Provides drop-down lists for selecting approved entries.
6. Improves the reliability of spreadsheet records.

Total: 8 marks

QUESTION 4: DATA ORGANISATION AND VISUALISATION (9 MARKS)

a) Define the term conditional formatting. (2 marks)

Conditional formatting is a spreadsheet feature that automatically changes the appearance of cells based on specified conditions or rules.

- Identifies conditional formatting as a spreadsheet feature – 1 mark.
- Explains that it changes cell appearance according to specified conditions – 1 mark.

b) Explain three advantages of using charts and graphs in spreadsheet data presentation. (3 marks)

Award 1 mark each for any three:

1. Simplifies information: Makes complex numerical information easier to understand.
2. Facilitates comparison: Makes it easier to compare values across different categories.
3. Identifies trends: Helps users identify patterns and changes over time.
4. Improves communication: Presents information in a clear and attractive visual form.
5. Supports decision-making: Helps managers interpret information and make informed decisions.
6. Highlights differences: Makes significant variations in data easier to identify.

c) Identify the most suitable chart for each activity. (4 marks)

Award 1 mark each.

Activity	Suitable chart
i. Displaying the proportion of a household budget spent on different items	Pie chart
ii. Monitoring monthly rainfall changes	Line graph
iii. Comparing examination performance across different subjects	Column chart
iv. Investigating the relationship between study hours and examination marks	Scatter chart

Total: 9 marks

QUESTION 5: SPREADSHEET APPLICATIONS AND SHARING (9 MARKS)

a) Explain three ways in which spreadsheets are used in the agricultural sector in Kenya. (3 marks)

Award 1 mark each for any three well-explained points.

1. Farm budgeting: Used to prepare farm budgets and monitor expenditure on seeds, fertilisers, labour and machinery.
2. Crop production records: Used to record planting dates, crop varieties, yields and harvesting information.
3. Livestock management: Used to maintain records of animal identification, feeding, vaccination and milk production.
4. Sales and profit calculations: Used to calculate income from selling agricultural products and determine profits.
5. Stock management: Used to monitor quantities of seeds, fertilisers, animal feeds and other farm supplies.
6. Market analysis: Used to compare agricultural product prices and monitor market trends.

b) Describe three methods through which spreadsheet outputs can be shared with other users. (3 marks)

Award 1 mark each for any three correctly described methods.

1. Email: A spreadsheet can be attached to an email and sent to other users.
2. PDF export: A spreadsheet can be converted into PDF format and shared while preserving its layout.
3. Cloud sharing: Users can share spreadsheets through cloud platforms such as Google Sheets and Microsoft OneDrive.
4. Printing: Spreadsheet information can be printed as hard copies and distributed.
5. Removable storage devices: Spreadsheet files can be copied onto flash disks and transferred to other users.
6. Shared network folders: Spreadsheet files can be saved in shared folders accessible to authorised users.

c) State three measures that can be used to protect confidential spreadsheet information. (3 marks)

Award 1 mark each for any three:

1. Use strong passwords to restrict unauthorised access.
2. Encrypt confidential spreadsheet files.
3. Restrict access by assigning appropriate user permissions.
4. Protect worksheets and workbooks against unauthorised changes.
5. Avoid sharing confidential files through untrusted platforms.
6. Use secure storage and reliable backup systems.
7. Log out of shared computers after accessing confidential information.

Total: 9 marks

QUESTION 6: PRACTICAL APPLICATION OF SPREADSHEET PRODUCTIVITY TOOLS (8 MARKS)

a) Write a spreadsheet formula that can be entered in cell E2 to calculate Amina's total marks. (2 marks)

Correct formula:

=SUM(B2:D2)

Alternative formula:
=B2+C2+D2

- Correct use of SUM function or addition operator – 1 mark.
- Correct cell references B2, C2 and D2 – 1 mark.

b) Write a spreadsheet function that can be used to determine the highest Mathematics mark in the dataset, assuming the marks are in cells B2:B6. (1 mark)

Correct answer:

=MAX(B2:B6)

c) State the spreadsheet feature that can be used to display learners who scored 70 marks and above in Mathematics. (1 mark)

Answer: Filtering (AutoFilter).

d) Explain two steps involved in creating a column chart to compare performance in the three subjects. (2 marks)

Award 1 mark each for any two correctly explained steps.

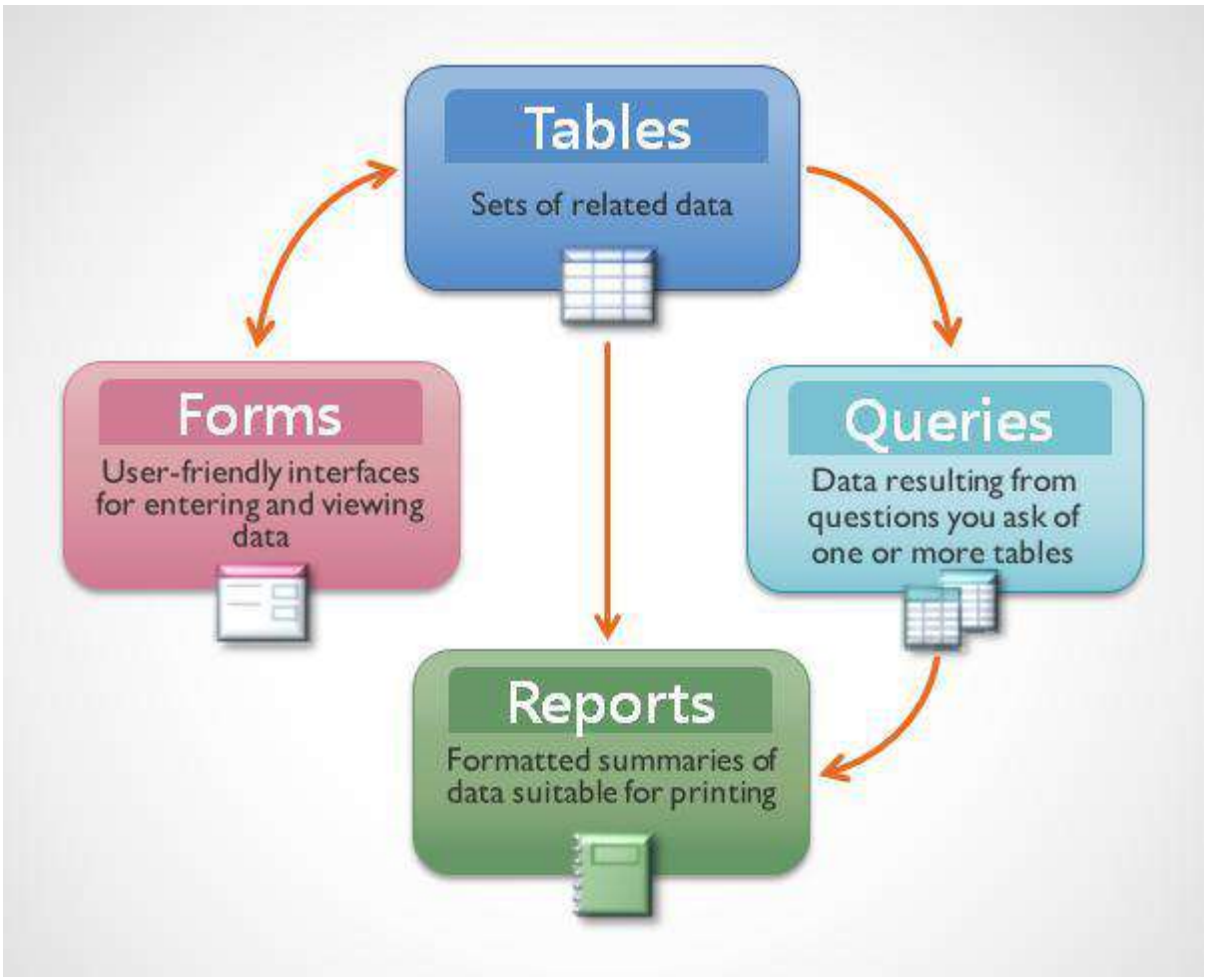
1. Select the relevant data containing the subject headings and learners' marks.
2. Click the Insert tab and choose the Column Chart option.
3. Select an appropriate column chart type.
4. Add a suitable chart title, axis labels and legend.
5. Format the chart to improve readability.

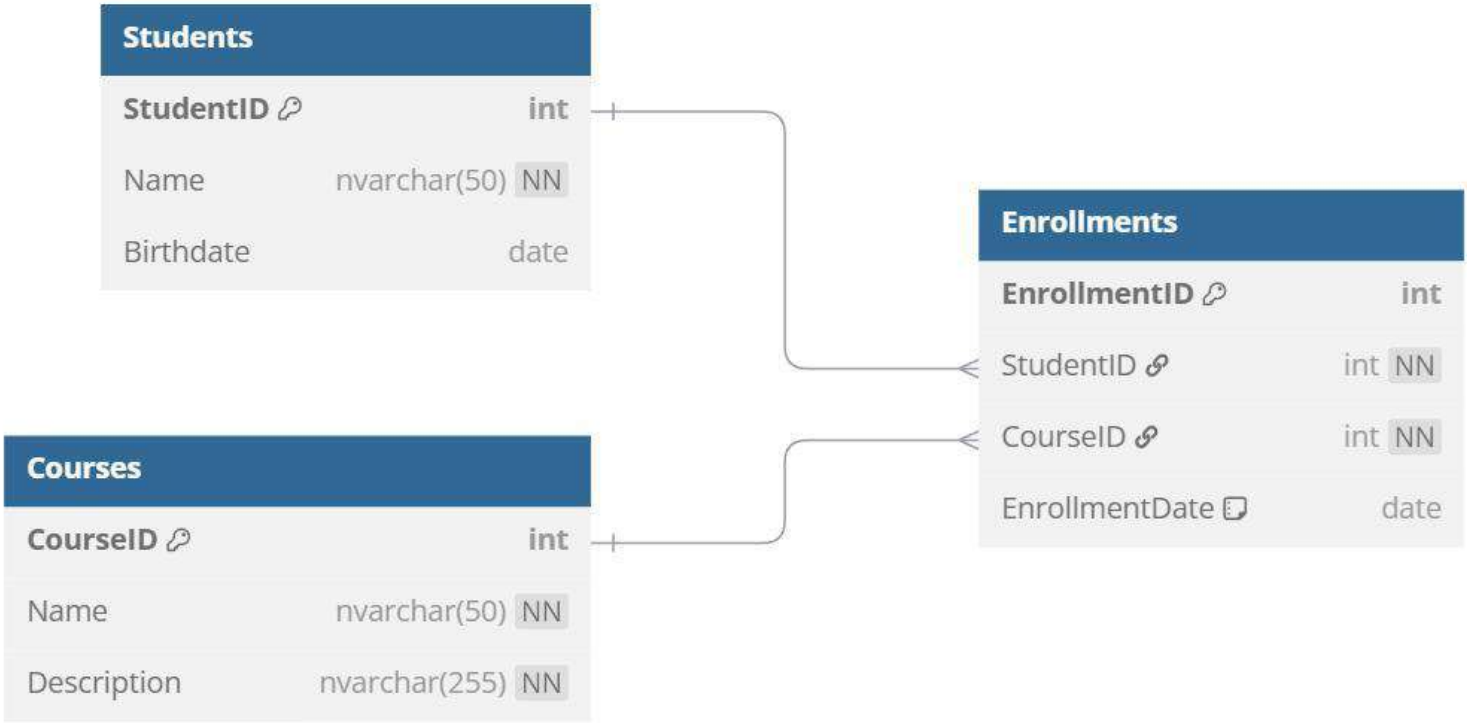
e) State two benefits of using spreadsheets to manage examination records in a school. (2 marks)

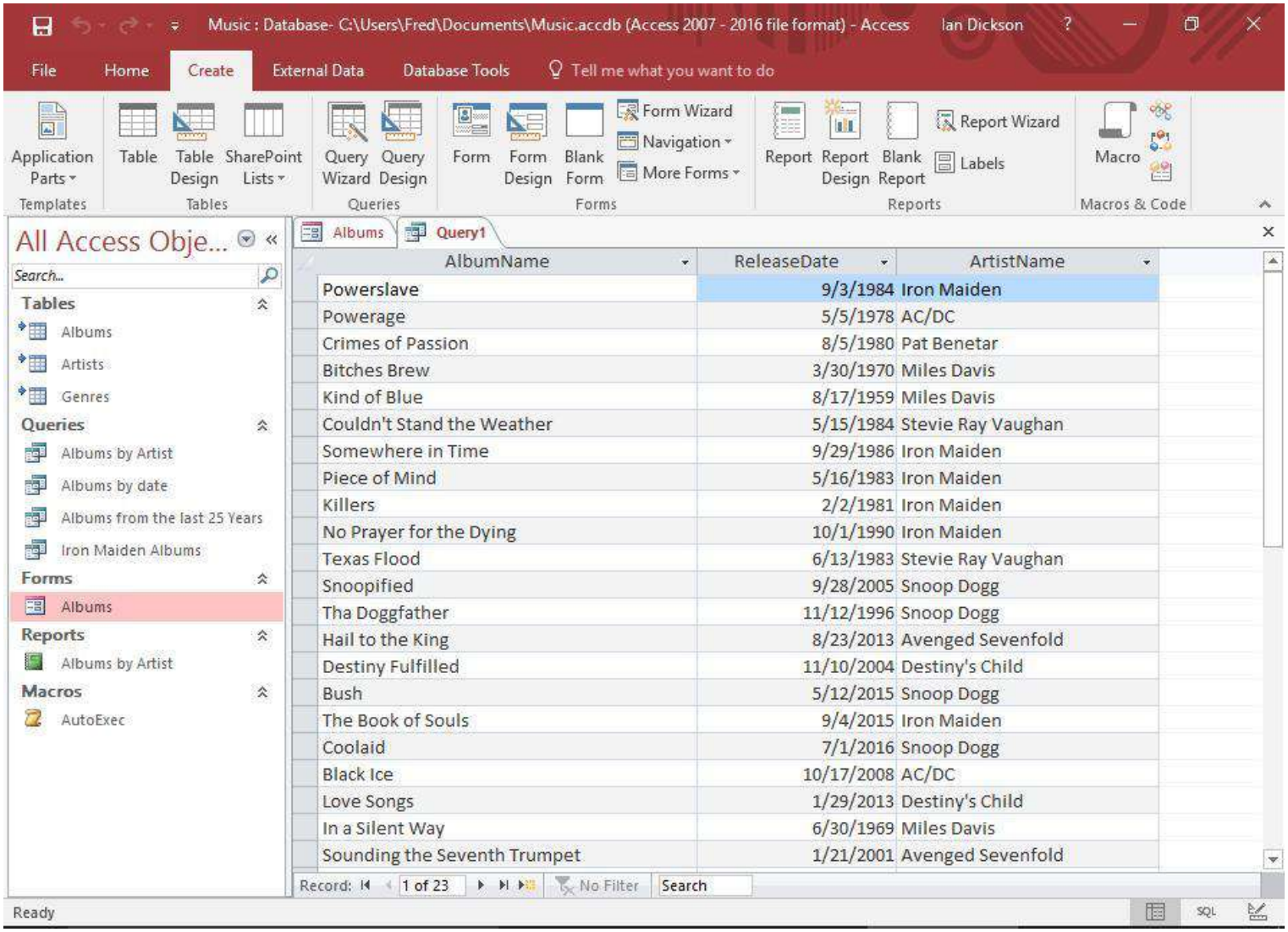
Award 1 mark each for any two:

1. They automatically calculate learners' totals and averages.
2. They reduce errors in examination calculations.
3. They make it easier to rank learners according to performance.
4. They allow teachers to identify learners who need academic support.
5. They simplify storage and retrieval of examination records.
6. They enable teachers to generate charts and reports.
7. They make it easier to compare performance across subjects and examinations.

Total: 8 marks


Tables
Sets of related data
Forms
User-friendly interfaces for entering and viewing data
Queries
Data resulting from questions you ask of one or more tables
Reports
Formatted summaries of data suitable for printing


Students
StudentID int
Name nvarchar(50) NN
Birthdate date
Enrollments
EnrollmentID int
StudentID int NN
CourseID int NN
EnrollmentDate date
Courses
CourseID int
Name nvarchar(50) NN
Description nvarchar(255) NN



COMPREHENSIVE TEACHING AND LEARNING NOTES

Learning area: Information and Communication Technology (ICT) **Grade:** 11 **Strand:** 2.0 Productivity Tools **Sub-strand:** 2.2 Database Management System (DBMS)

1.0 Introduction to Database Management Systems

1.1 Meaning of data

Data refers to raw facts, figures, symbols, observations or measurements collected for reference, processing or analysis.

Data may exist in different forms, including:

1. **Text data:** Words, names, addresses and descriptions.
    - Example: A learner's name, such as *Amina Naserian*.
2. **Numeric data:** Numbers representing quantities or measurements.
    - Example: Age 17, examination score 78 or school fees of KSh 15,000.
3. **Date data:** Information representing dates.
    - Example: 7 November 2026.
4. **Time data:** Information representing time.
    - Example: 8:30 a.m.

5. **Boolean data:** Data with two possible values, such as Yes/No or True/False.
    - Example: Whether a learner has paid school fees.
6. **Image data:** Photographs, scanned documents and other pictures.
    - Example: A learner's passport photograph.
7. **Audio and video data:** Recorded sound and moving pictures.
    - Example: Recorded interviews or video evidence collected during a community project.

1.2 Meaning of information

Information is data that has been processed, organised or interpreted to give it meaning and make it useful for decision-making.

Example:

A teacher records the following examination marks:

65, 72, 80, 55, 88

These are raw data values. When the marks are processed to show that the average score is 72, the result becomes useful information.

1.3 Differences between data and information

Data	Information
Consists of raw facts and figures.	Consists of processed and meaningful data.
May not have a clear meaning on its own.	Has meaning and can be interpreted.
Used as an input during processing.	Produced as an output after processing.
May be unorganised.	Usually organised into a meaningful form.
Example: 45, 60, 75, 90.	Example: The average score is 67.5.

1.4 Meaning of a database

A **database** is an organised collection of related data stored electronically or in another structured form so that it can be easily accessed, managed, updated, retrieved and analysed.

A database stores information about people, places, objects, activities or transactions.

Examples of databases in Kenya

1. **Schools:** Learner registration details, examination results, attendance and fee records.
2. **Hospitals:** Patient details, appointments, laboratory results and treatment records.
3. **Banks:** Customer details, account information, deposits and withdrawals.

4. **County governments:** Revenue collection, staff records, licences and service delivery records.
5. **Businesses:** Stock, suppliers, customers, sales and purchases.
6. **Libraries:** Books, authors, borrowers and borrowing transactions.
7. **Agriculture:** Farmers, livestock, crop production and farm inputs.
8. **Transport companies:** Vehicles, drivers, passengers and bookings.



1.5 Characteristics of a good database

A well-designed database should have the following characteristics:

1. **Organisation**
   - Data should be arranged systematically.
   - Related information should be stored together.
   - Example: Learner details should be stored in a learner table.
2. **Accuracy**
   - Information stored should be correct and reliable.
   - Incorrect entries should be identified and corrected.
3. **Consistency**
   - Data should follow agreed formats and rules.
   - For example, dates should be entered consistently.
4. **Accessibility**
   - Authorised users should be able to retrieve information when required.

- A teacher should be able to access authorised learner records without unnecessary difficulty.

5. **Security**
   - The database should be protected against unauthorised access, alteration, loss or destruction.
6. **Data integrity**
   - Information should remain accurate, valid and consistent throughout its use.
   - For example, a learner's admission number should uniquely identify that learner.
7. **Reduced duplication**
   - Unnecessary repetition of the same information should be minimised.
8. **Scalability**
   - The database should be able to accommodate increasing amounts of data as an organisation grows.
9. **Backup and recovery**
   - There should be a way of restoring data after accidental deletion, system failure or other problems.
10. **Efficient retrieval**
    - Users should be able to search and retrieve required information quickly.

1.6 Importance of databases in data management

Databases are important because they help organisations manage large amounts of related data efficiently.

1. **Efficient storage of data**
   - Databases allow organisations to store large volumes of information in an organised manner.
   - A school can store information for learners from Grade 1 to Grade 12.
2. **Quick retrieval of information**
   - Users can search for specific records without examining every document manually.
   - A teacher can retrieve the examination record of a particular learner using an admission number.
3. **Reduction of data duplication**
   - A properly designed database reduces unnecessary repetition of information.
   - This saves storage space and reduces inconsistencies.
4. **Improved accuracy**
   - Validation rules help prevent incorrect data entry.
   - For example, a database can restrict examination marks to a range of 0–100.
5. **Easy updating of records**
   - Existing records can be edited when information changes.
   - A school can update a learner's telephone contact or residential details.
6. **Improved decision-making**
   - Reports and queries help managers identify trends and make informed decisions.
   - A school administrator can identify subjects in which learners need additional support.

7. **Data security**

- Access permissions and passwords help protect confidential records.
- Only authorised staff should access sensitive learner or financial information.

8. **Data sharing**

- Authorised users can share relevant information.
- Teachers, school administrators and examination officers may access different parts of a school database according to their responsibilities.

9. **Time saving**

- Routine tasks such as searching, sorting and preparing reports can be performed more quickly.

10. **Improved record keeping**

- Databases provide organised records that can be referred to when needed.
- A business can examine previous sales transactions.

11. **Support for planning**

- Organisations can use stored data to plan future activities.
- A school can use enrolment records to estimate classroom and textbook requirements.

12. **Improved accountability**

- Records of transactions and changes help organisations monitor activities and responsibilities.

2.0 Meaning of Database Management System (DBMS)

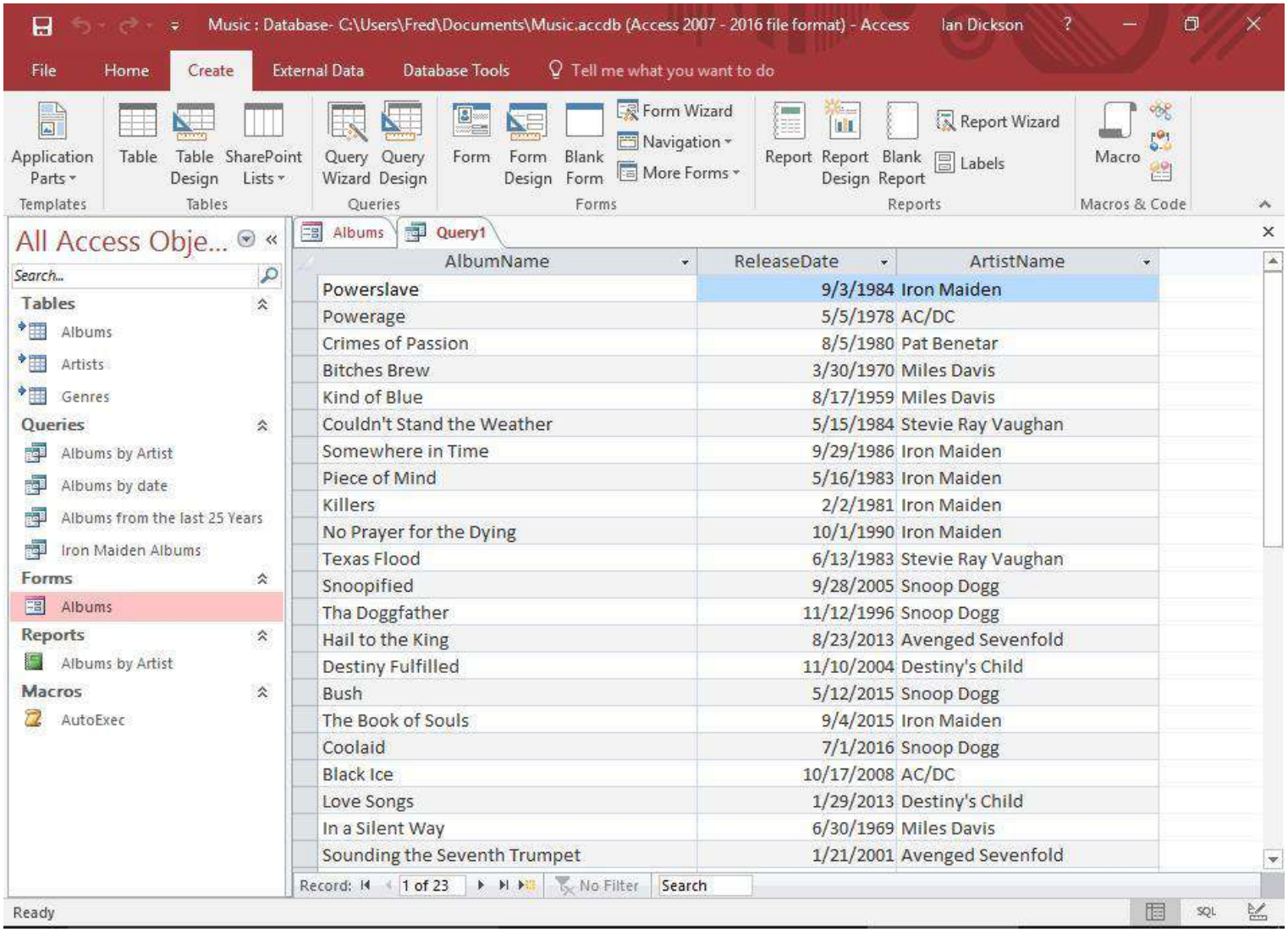
2.1 Definition of a DBMS

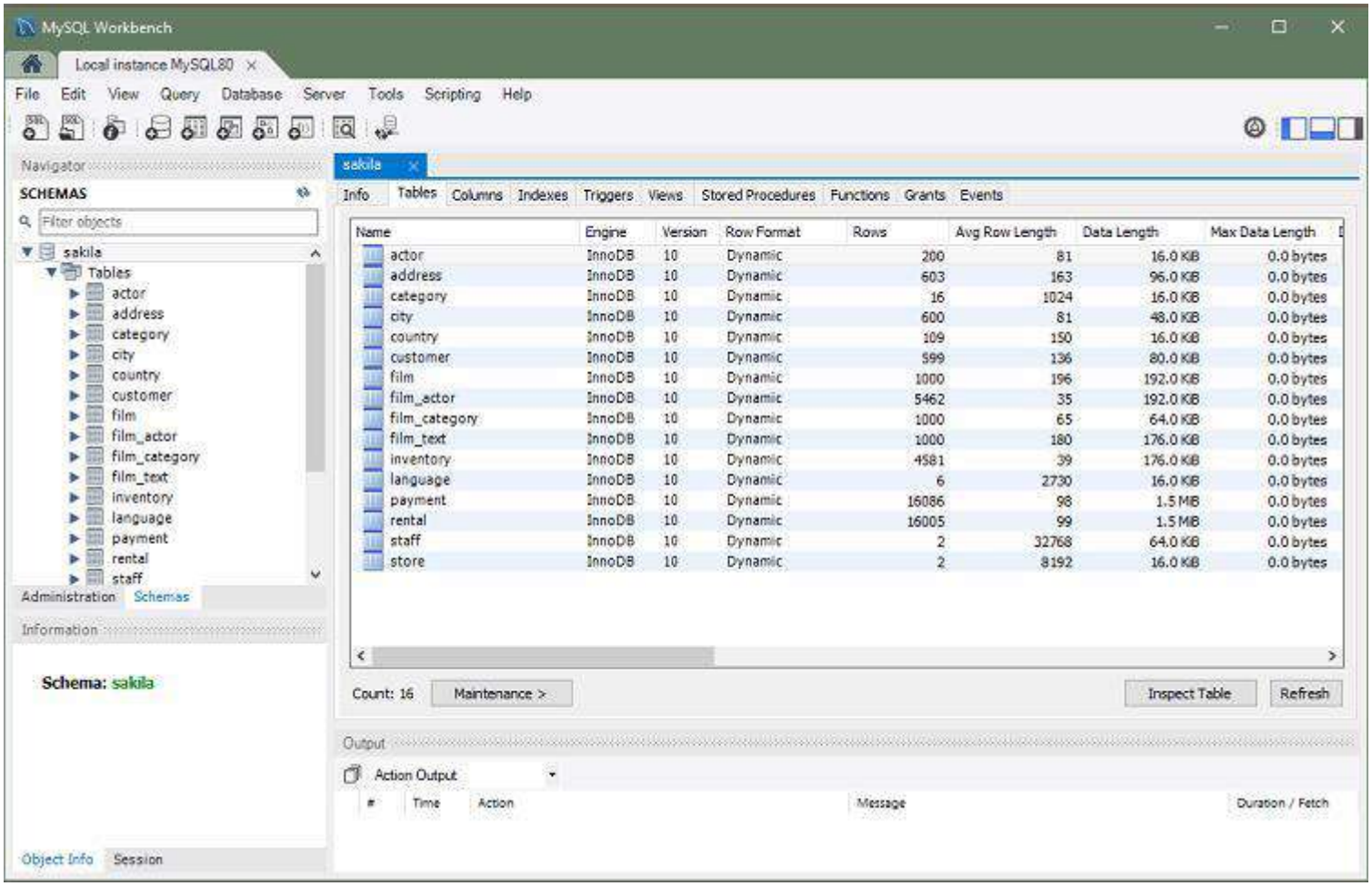
A **Database Management System (DBMS)** is software designed to create, store, organise, retrieve, update, manage and protect data in a database.

A DBMS provides an interface through which users interact with a database without having to manage every storage operation manually.

Examples include:

- Microsoft Access
- MySQL
- MariaDB
- PostgreSQL
- Oracle Database
- Microsoft SQL Server
- Apache OpenOffice Base
- FileMaker Pro
- MongoDB
- Grist
- Knack


Music : Database- C:\Users\Fred\Documents\Music.accdb (Access 2007 - 2016 file format) - Access
Ian Dickson
File
Home
Create
External Data
Database Tools
Tell me what you want to do
Application Parts
Templates
Table
Table Design
SharePoint Lists
Tables
Query Wizard
Query Design
Queries
Form
Form Design
Blank Form
Form Wizard
Navigation
More Forms
Forms
Report
Report Design
Blank Report
Report Wizard
Labels
Reports
Macro
Macros & Code
All Access Obje...
Search...
Tables
Albums
Artists
Genres
Queries
Albums by Artist
Albums by date
Albums from the last 25 Years
Iron Maiden Albums
Forms
Albums
Reports
Albums by Artist
Macros
AutoExec
Albums
Query1
AlbumName
ReleaseDate
ArtistName
Powerslave 9/3/1984 Iron Maiden
Powerage 5/5/1978 AC/DC
Crimes of Passion 8/5/1980 Pat Benetar
Bitches Brew 3/30/1970 Miles Davis
Kind of Blue 8/17/1959 Miles Davis
Couldn't Stand the Weather 5/15/1984 Stevie Ray Vaughan
Somewhere in Time 9/29/1986 Iron Maiden
Piece of Mind 5/16/1983 Iron Maiden
Killers 2/2/1981 Iron Maiden
No Prayer for the Dying 10/1/1990 Iron Maiden
Texas Flood 6/13/1983 Stevie Ray Vaughan
Snoopified 9/28/2005 Snoop Dogg
Tha Doggfather 11/12/1996 Snoop Dogg
Hail to the King 8/23/2013 Avenged Sevenfold
Destiny Fulfilled 11/10/2004 Destiny's Child
Bush 5/12/2015 Snoop Dogg
The Book of Souls 9/4/2015 Iron Maiden
Coolaid 7/1/2016 Snoop Dogg
Black Ice 10/17/2008 AC/DC
Love Songs 1/29/2013 Destiny's Child
In a Silent Way 6/30/1969 Miles Davis
Sounding the Seventh Trumpet 1/21/2001 Avenged Sevenfold
Record: 1 of 23
No Filter
Search
Ready
SQL



2.2 Meaning of database productivity tools

Database productivity tools are software applications and technologies that help users create, organise, manage, process, retrieve, analyse and share data stored in databases.

They improve the speed, accuracy and effectiveness of data management activities.

Examples include:

1. **Microsoft Access:** Used to create and manage relational databases.
2. **MySQL:** An open-source relational database management system.
3. **MariaDB:** An open-source relational database management system.
4. **PostgreSQL:** A relational database system with advanced data management capabilities.
5. **Microsoft SQL Server:** A database management system used by organisations to manage structured data.
6. **Apache OpenOffice Base:** A database application for creating and managing databases.
7. **FileMaker Pro:** A database application used to develop customised data management solutions.
8. **MongoDB:** A document-oriented NoSQL database system.
9. **Grist:** A data management tool that combines spreadsheet-like working with database features.
10. **Knack:** A platform used to build online database applications without extensive programming.

2.3 Differences between a database and a DBMS

Database	Database Management System
An organised collection of related data.	Software used to manage databases.
Contains stored records and information.	Provides tools for creating, updating and retrieving records.
It is the data being managed.	It is the software used to manage the data.
Example: A school learner database.	Example: Microsoft Access or MySQL.

Example:

A school may have a database containing learner names, admission numbers, classes and examination marks. Microsoft Access or MySQL may be used as the DBMS to create and manage that database.

2.4 Main functions of a DBMS

A DBMS performs several important functions.

1. **Database creation**
   - It enables users to create new databases.
   - Example: Creating a database named Olalui_Junior_School.
2. **Data entry**
   - It provides facilities for entering information into database tables.
   - Example: Recording learner names and admission numbers.
3. **Data storage**
   - It stores information in an organised structure.
   - Data can be stored in tables, documents or other supported structures.
4. **Data retrieval**
   - It allows users to search for and obtain required information.
   - Example: Finding all Grade 11 learners in a school.
5. **Data modification**
   - It enables users to edit existing records.
   - Example: Updating a learner's contact details.
6. **Data deletion**
   - It allows authorised users to remove records that are no longer required.
   - Deletion should be controlled to avoid accidental loss of important information.

7. **Data sorting**
   - It arranges records according to a specified order.
   - Example: Sorting learners alphabetically by surname.
8. **Data filtering**
   - It displays records that meet specified conditions.
   - Example: Displaying only learners who scored 70 marks and above.
9. **Report generation**
   - It produces organised summaries of database information.
   - Example: Generating a class performance report.
10. **Data security**
   - It controls access to information through user accounts, passwords and permissions.
11. **Data validation**
   - It checks whether entered information follows specified rules.
   - Example: Restricting a learner's examination score to 0–100.
12. **Backup and recovery**
   - It supports the creation of backup copies and restoration of data after failure.
13. **Data integrity management**
   - It helps maintain correct relationships and valid records.
14. **Multi-user access**
   - Some DBMS applications allow several authorised users to work with the same database.
15. **Transaction management**
   - It manages database operations so that related changes are completed reliably.

2.5 Importance of DBMS productivity tools

DBMS tools are important in organisations because they:

1. Reduce manual record-keeping work.
2. Improve the accuracy of stored information.
3. Support efficient data retrieval.
4. Reduce unnecessary duplication.
5. Improve data security.
6. Support the preparation of reports.
7. Enable organisations to manage large amounts of information.
8. Improve communication through controlled data sharing.
9. Support evidence-based decision-making.
10. Improve the management of daily organisational activities.

11. Help maintain records over long periods.
12. Support monitoring, evaluation and planning.

3.0 Types of Database Management Systems

Database management systems can be classified according to how they organise and manage data.

3.1 Hierarchical Database Management System

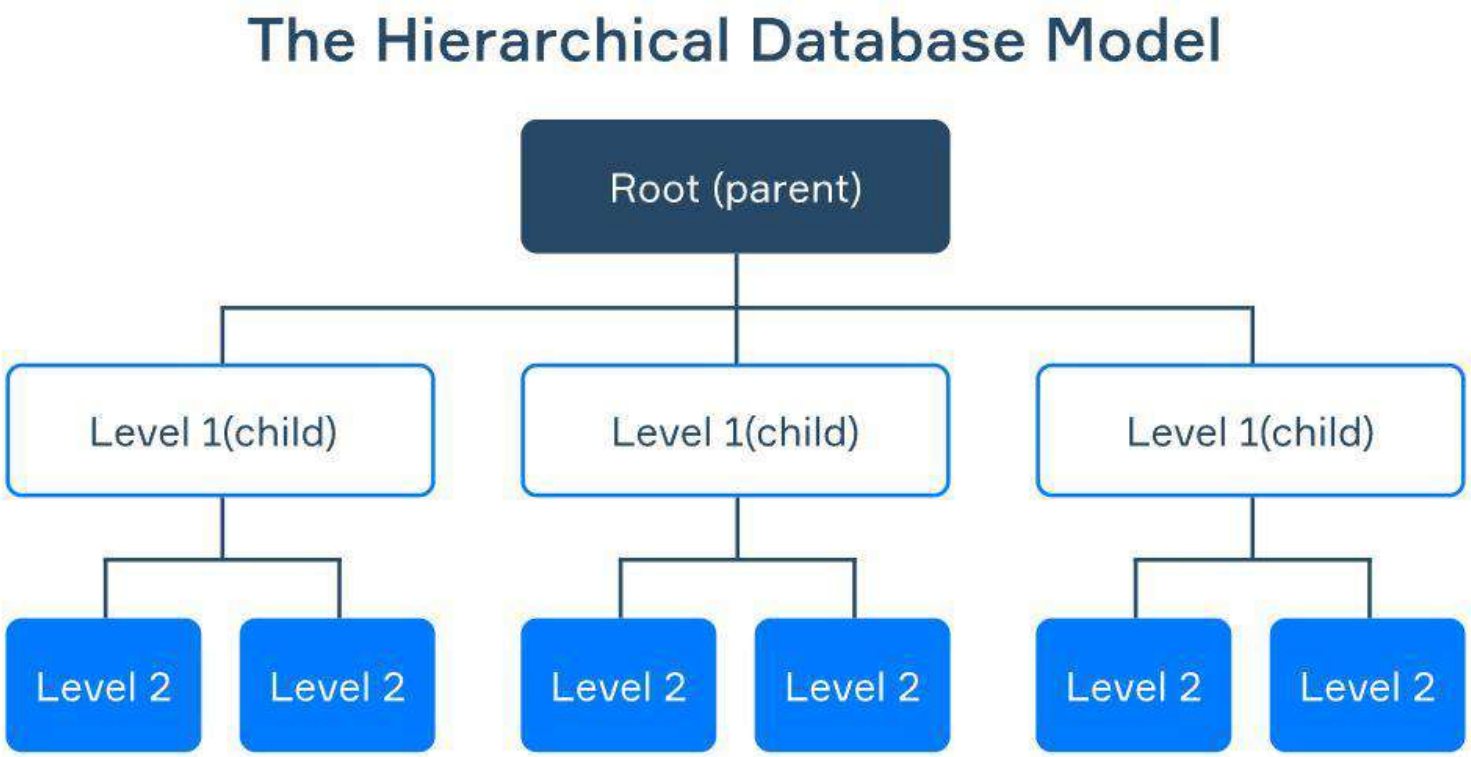
A **hierarchical DBMS** organises data in a tree-like structure in which records are arranged in parent-child relationships.

- A parent record can have several child records.
- Each child record normally has one parent record.
- Information is accessed by following a defined path through the structure.

Example:

A school may organise information as follows:

- School
  - Departments
    - Subjects
      - Classes



Advantages

1. Provides a clear structure for naturally hierarchical data.
2. Can retrieve data efficiently when access paths are predictable.
3. Makes parent-child relationships easy to understand.
4. Can provide good performance for certain specialised applications.

Limitations

1. It is difficult to represent many-to-many relationships.
2. Changes to the structure may be complicated.
3. Data access may depend on predefined paths.
4. It may be less flexible for complex information needs.

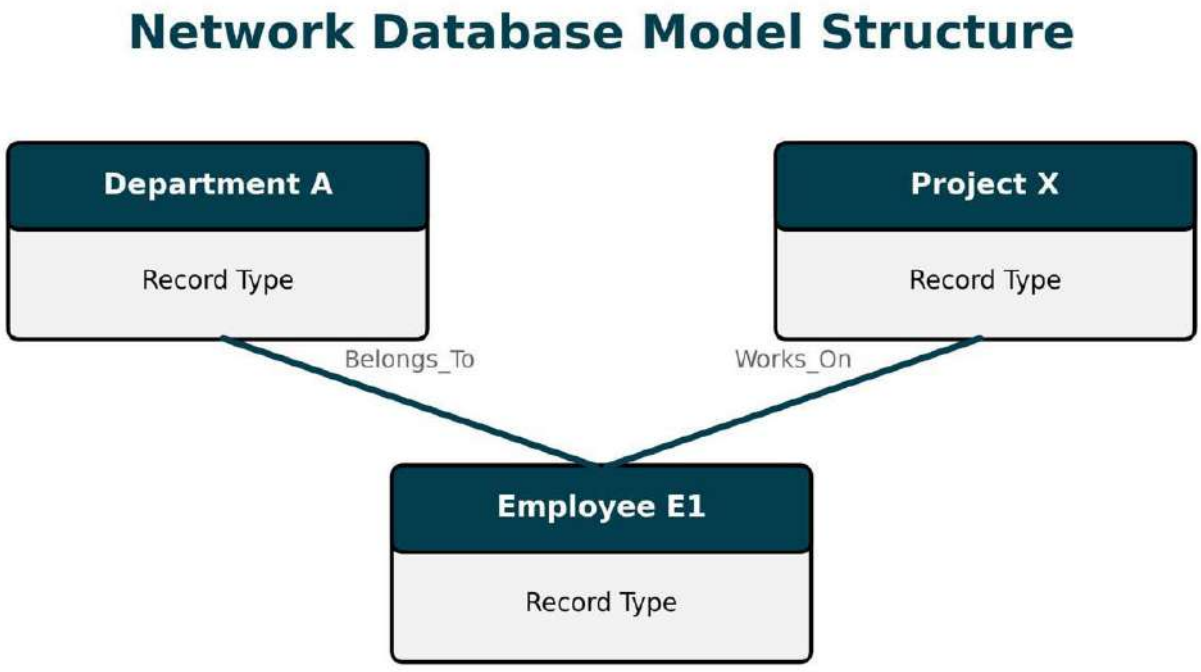
3.2 Network Database Management System

A **network DBMS** organises data in a structure where a record can have relationships with multiple other records.

- It supports more complex relationships than a hierarchical DBMS.
- A child record can be connected to more than one parent record.
- It can represent many-to-many relationships.

Example:

A learner can enrol in several subjects, while each subject can be studied by many learners.



A record can participate in multiple relationship sets (multiple "parents").

Advantages

1. Supports complex data relationships.
2. Allows a record to be connected to several other records.
3. Can provide efficient access through established links.

Limitations

1. Its structure can be difficult to design and maintain.
2. Users may need technical knowledge to navigate relationships.
3. Changes can affect several connected records.

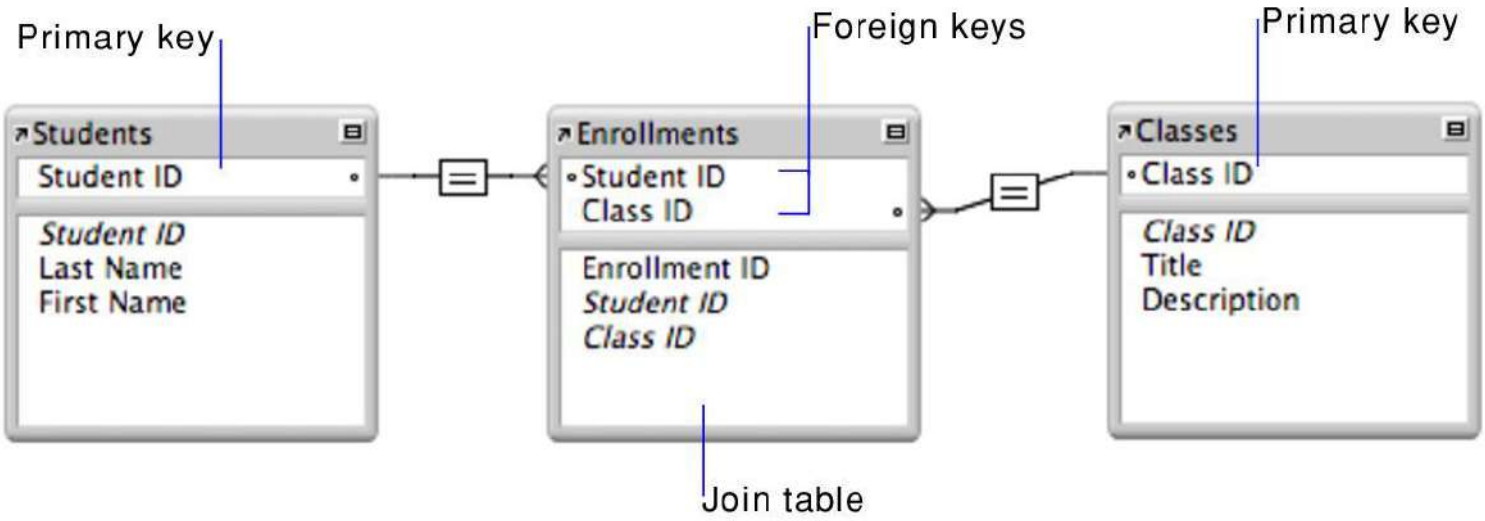
3.3 Relational Database Management System (RDBMS)

A **Relational Database Management System (RDBMS)** is a type of DBMS that organises data into tables made up of rows and columns.

- Tables represent related subjects or entities.
- Rows represent individual records.
- Columns represent fields or attributes.
- Tables are linked using keys.

Examples:

- Microsoft Access
- MySQL
- MariaDB
- PostgreSQL
- Microsoft SQL Server
- Oracle Database



Advantages

1. Organises data in a clear tabular structure.
2. Supports relationships between tables.
3. Reduces unnecessary duplication through good design.
4. Supports queries for retrieving specific information.
5. Supports data integrity through keys and constraints.
6. Allows data to be sorted and filtered.

7. Supports the preparation of reports.

Limitations

1. Designing complex relational databases requires planning.
2. Large databases may require specialised administration.
3. Poorly designed tables can cause duplication and inconsistency.
4. Some highly flexible or unstructured data may be easier to manage using other database models.

3.4 Object-oriented Database Management System

An **object-oriented DBMS** stores data in the form of objects, which combine data and the operations associated with that data.

- Objects represent real-world entities.
- Objects may contain attributes and methods.
- It is useful for applications involving complex data structures.

Examples of possible applications

1. Computer-aided design systems.
2. Scientific research applications.
3. Engineering applications.
4. Multimedia systems.

Advantages

- Can represent complex objects.
- Supports object-oriented programming concepts.
- Can be useful for specialised applications.

Limitations

- May require specialised technical skills.
- It may be less familiar to users accustomed to relational databases.
- It may not be the most suitable choice for ordinary record-keeping tasks.

3.5 NoSQL Database Management System

A **NoSQL database** is a database system designed to manage data using models other than the traditional relational table structure, or to provide specialised non-relational data management capabilities.

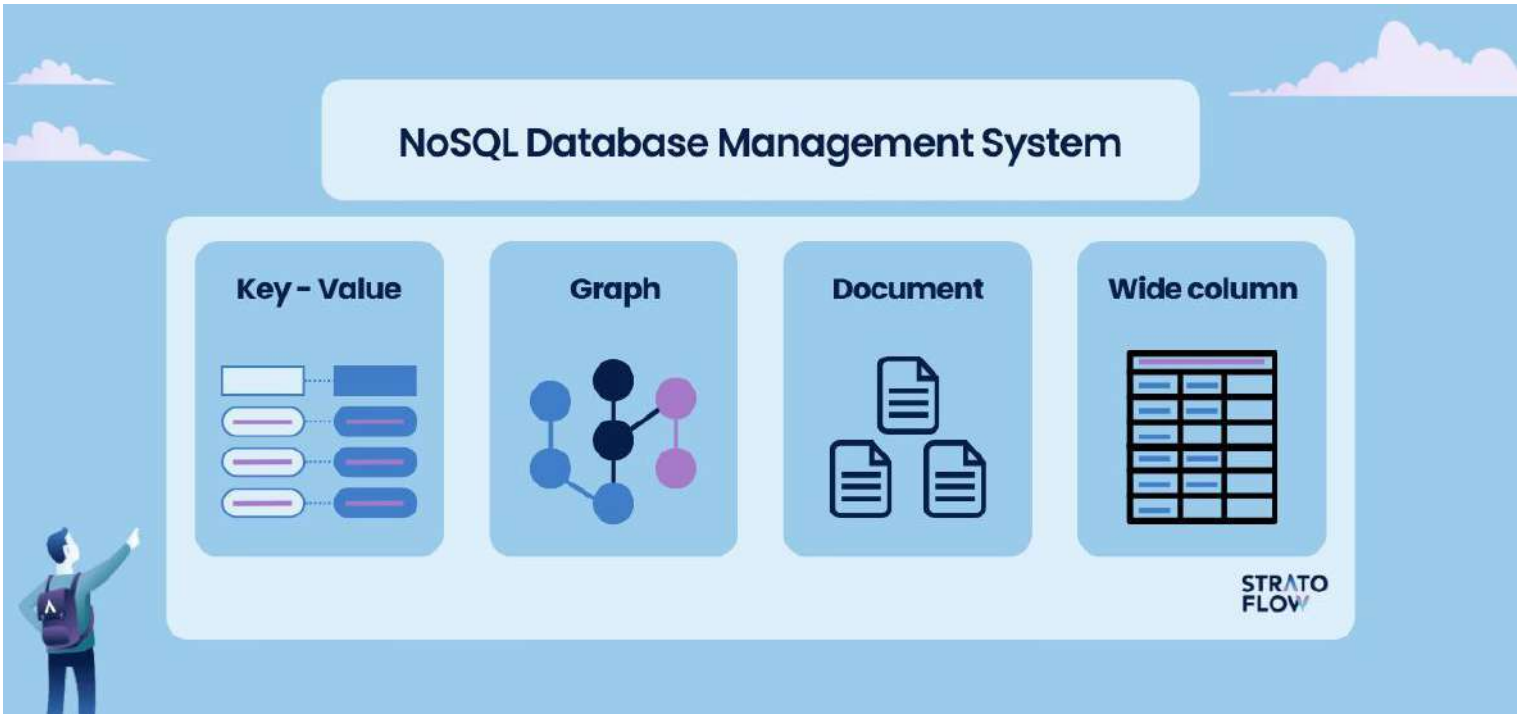
NoSQL systems are useful for some applications that handle large amounts of flexible, distributed or rapidly changing data.

Examples include:

- MongoDB
- Apache Cassandra
- Redis
- CouchDB

Common categories of NoSQL databases include:

1. **Document databases**
   - Store information as documents, often using JSON-like structures.
   - Example: MongoDB.
2. **Key-value databases**
   - Store information as pairs consisting of a key and its corresponding value.
   - Example: Redis.
3. **Wide-column databases**
   - Organise data using column families.
   - Example: Apache Cassandra.
4. **Graph databases**
   - Store information as nodes and relationships.
   - Example: Neo4j.



Advantages

1. Can manage flexible data structures.
2. Some systems support large distributed applications.
3. Can be suitable for rapidly changing data.
4. Different models can support specialised applications.

Limitations

1. Different NoSQL systems use different data models.
2. Data consistency and transaction features vary between products.
3. Users may need specialised technical skills.

4. Some applications require additional planning to maintain data relationships.

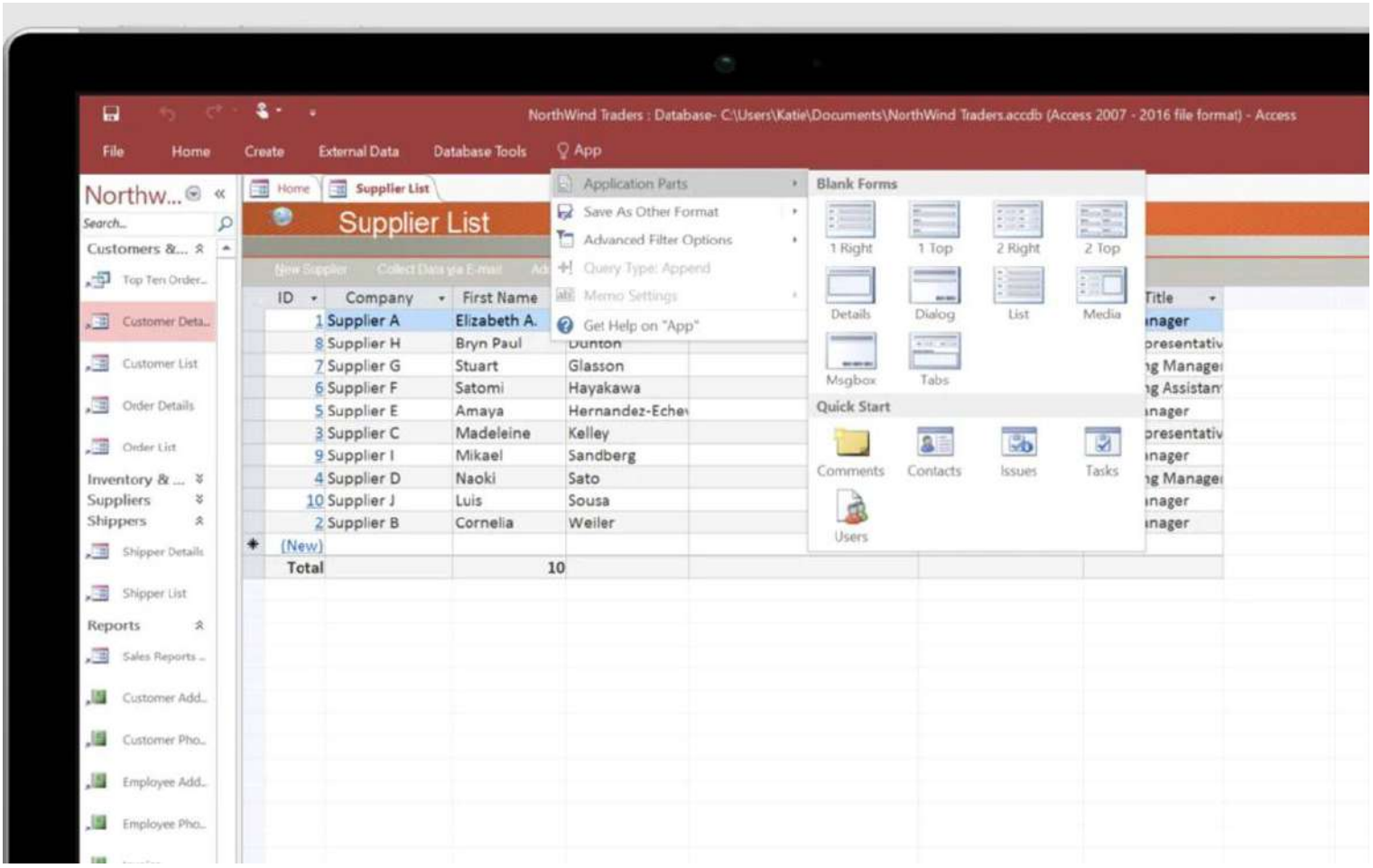
3.6 Comparison of database management system types

Type	Organisation of data	Example or application
Hierarchical	Tree-like parent-child structure	Organisational hierarchies
Network	Interconnected records	Complex linked records
Relational	Tables, rows and columns	School and business records
Object-oriented	Objects	Engineering and multimedia applications
NoSQL	Documents, key-value pairs, columns or graphs	Large flexible data applications

Important: The most appropriate database model depends on the type of data, relationships, security needs, cost, expected number of users and intended application.

4.0 Database Management System Productivity Tools

4.1 Microsoft Access



Microsoft Access is a relational database management application developed by Microsoft. It enables users to create databases using tables, queries, forms, reports and other database objects.

Main features of Microsoft Access

1. **Tables**
   - Used to store data in rows and columns.
   - Example: A Learners table stores learner details.
2. **Queries**
   - Used to search, filter, calculate and retrieve information.
   - Example: Finding learners who scored more than 70 marks.
3. **Forms**
   - Provide a user-friendly interface for entering and viewing records.
   - Example: A learner registration form.
4. **Reports**
   - Present database information in an organised format for viewing or printing.
   - Example: A class examination performance report.
5. **Relationships**
   - Connect related tables using common fields.
   - Example: Connecting a learner table to an examination results table using an admission number.
6. **Data validation**
   - Helps restrict entries to acceptable values.
   - Example: Preventing a negative examination score.
7. **Import and export**
   - Enables users to bring data from other sources or transfer data to other formats.

Uses of Microsoft Access

- Managing school records.
- Managing customer information.
- Keeping stock records.
- Recording sales and purchases.
- Managing library records.
- Managing employee information.

Advantages

1. Has a graphical user interface that is relatively easy to use.
2. Supports relational database design.
3. Provides tools for creating forms and reports.
4. Integrates with other Microsoft Office applications.
5. Supports queries for retrieving information.

6. Is suitable for many small and medium-sized database applications.

Limitations

1. It may not be suitable for very large enterprise databases.
2. It is a proprietary product with licensing requirements.
3. It has platform and deployment limitations compared with some server-based systems.
4. Poor database design can still lead to duplication and errors.

4.2 MySQL



MySQL is an open-source relational database management system that uses Structured Query Language (SQL) to manage data.

Features of MySQL

1. Stores data in relational tables.
2. Supports SQL commands.
3. Supports multiple users and client applications.
4. Provides user authentication and access privileges.
5. Supports database backup and recovery tools.
6. Can be used in web-based applications.
7. Supports relationships between tables through keys.
8. Can handle databases used by businesses and institutions.

Applications of MySQL

- E-commerce websites.
- Online school management systems.
- Business transaction systems.
- Inventory management.

- Online booking applications.
- Web applications.

Advantages

1. It is widely used in web development.
2. It has a large developer community.
3. It supports structured queries.
4. It can be used on different operating systems.
5. It can manage large amounts of structured data.

Limitations

1. Database administration requires technical knowledge.
2. Installation and configuration may be challenging for beginners.
3. Performance depends on proper database design and server resources.

4.3 MariaDB



MariaDB is an open-source relational database management system developed as a community-driven continuation of MySQL.

Features

1. Uses SQL to manage relational data.
2. Supports tables, indexes and relationships.
3. Supports multiple storage engines.
4. Provides database security features.
5. Supports backup and recovery.
6. Can be used for web and business applications.

Applications

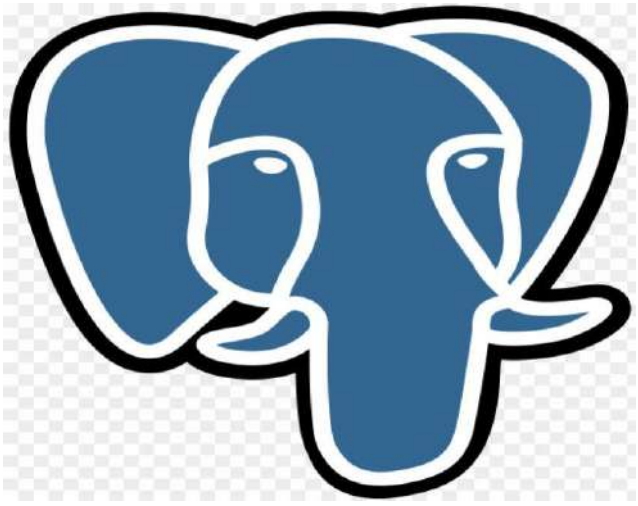
- School information systems.
- Online business platforms.
- Customer management systems.

- Inventory management.
- Website databases.

Advantages

- Open-source availability.
- Active development and community support.
- Supports relational database management.
- Offers compatibility with many MySQL applications, although compatibility should be checked for particular features and versions.

4.4 PostgreSQL



PostgreSQL is an open-source relational database management system known for its advanced features, reliability and support for complex data operations.

Features

1. Supports relational tables.
2. Uses SQL.
3. Supports complex queries.
4. Provides transaction management.
5. Supports data integrity rules.
6. Can handle different types of data.
7. Supports extensions for specialised applications.

Applications

- Financial management systems.
- Geographic information systems.
- Research databases.
- Government information systems.
- Business applications.

4.5 Microsoft SQL Server



Microsoft SQL Server is a relational database management system developed by Microsoft for storing, processing and managing organisational data.

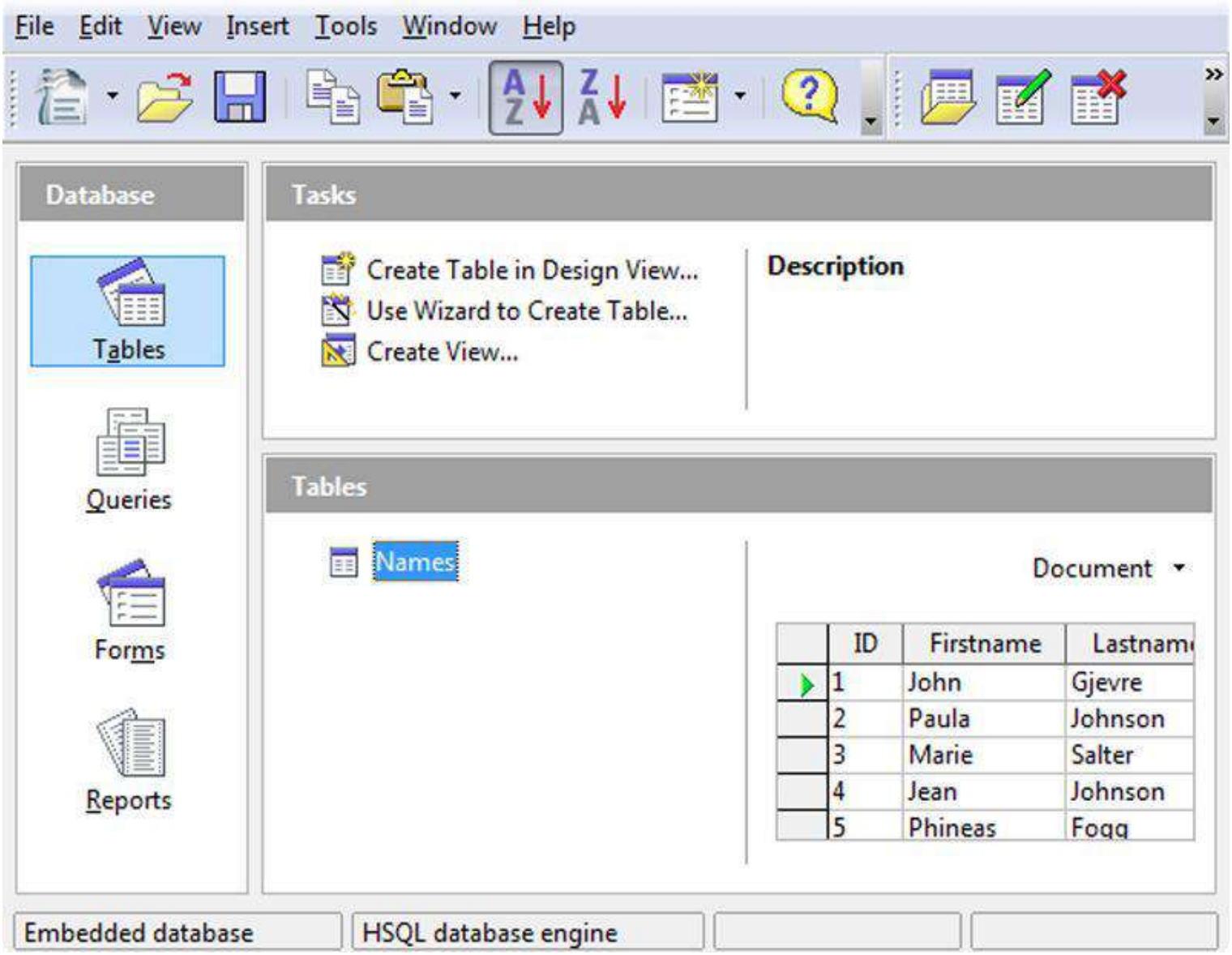
Features

1. Supports relational databases.
2. Uses Transact-SQL (T-SQL).
3. Provides security and user access controls.
4. Supports backup and recovery.
5. Supports transaction processing.
6. Provides tools for reporting and data analysis.
7. Can support enterprise applications.

Applications

- Banking systems.
- Hospital management systems.
- Large business information systems.
- Government records.
- Enterprise resource planning systems.

4.6 Apache OpenOffice Base



Apache OpenOffice Base is a database application within the Apache OpenOffice productivity suite. It provides tools for creating and managing databases.

Features

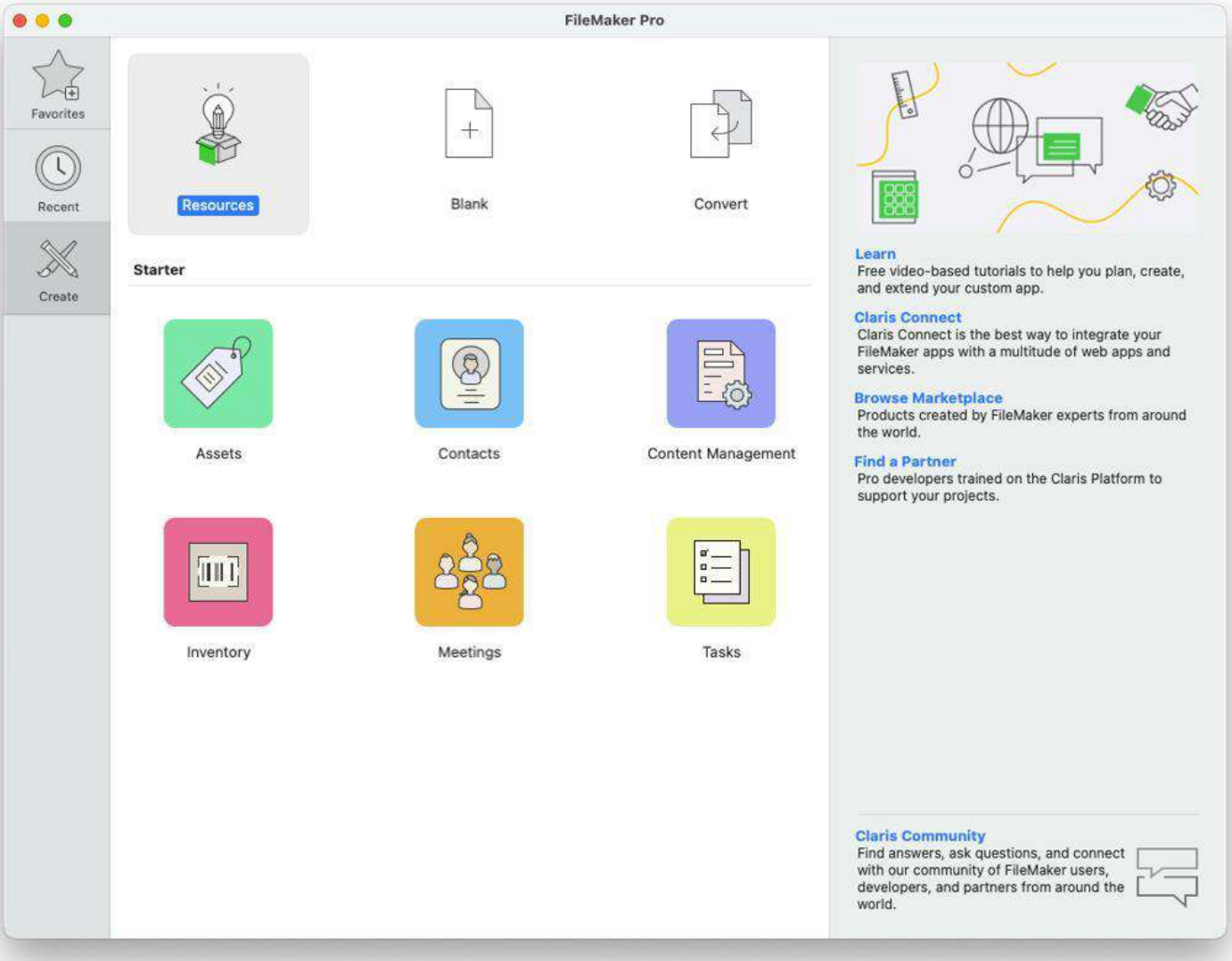
1. Enables users to create database tables.
2. Supports queries.
3. Provides forms for data entry.
4. Supports reports.
5. Can connect to supported external database systems.
6. Provides a graphical interface for database tasks.

Applications

- Small business records.
- School records.
- Personal databases.
- Library records.

- Small inventory systems.

4.7 FileMaker Pro



FileMaker Pro is a database application used to create customised solutions for collecting, organising, analysing and sharing information.

Features

1. Supports customised database applications.
2. Provides tools for designing layouts and forms.
3. Supports data entry and retrieval.
4. Enables users to create reports.
5. Supports automation of selected tasks.
6. Provides options for sharing database solutions.

Applications

- Customer relationship management.
- School administration.

- Project management.
- Stock control.
- Employee records.

4.8 MongoDB



MongoDB is a document-oriented NoSQL database management system that stores data in flexible document structures.

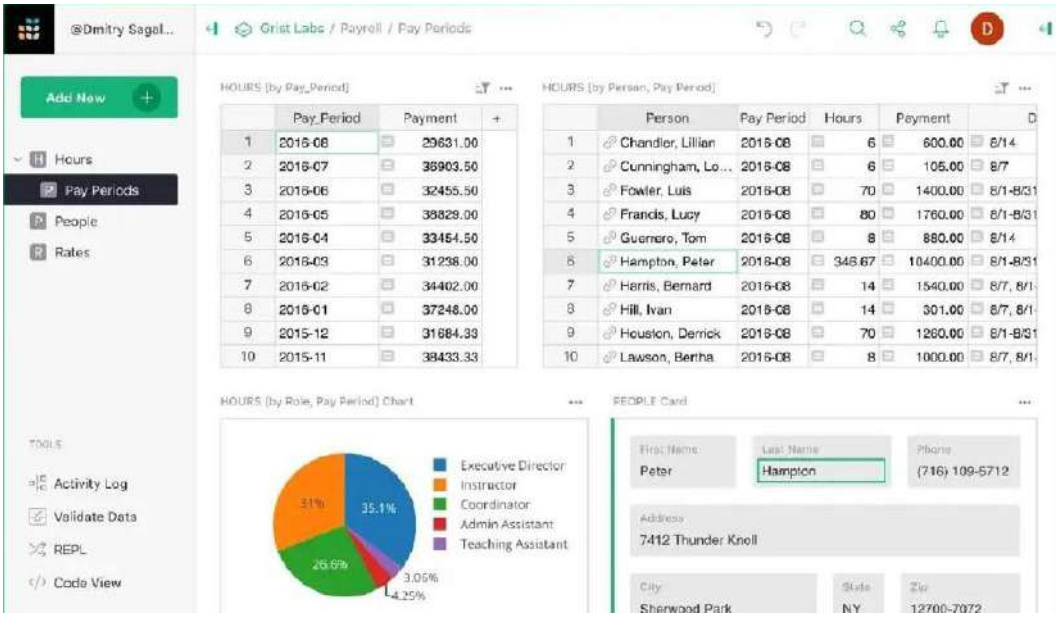
Features

1. Stores information in documents.
2. Uses flexible document structures.
3. Supports indexing for data retrieval.
4. Supports data aggregation.
5. Can be deployed across multiple servers.
6. Supports applications with changing data requirements.

Applications

- Online applications.
- Product catalogues.
- Content management systems.
- Customer information platforms.
- Applications that handle flexible records.

4.9 Grist

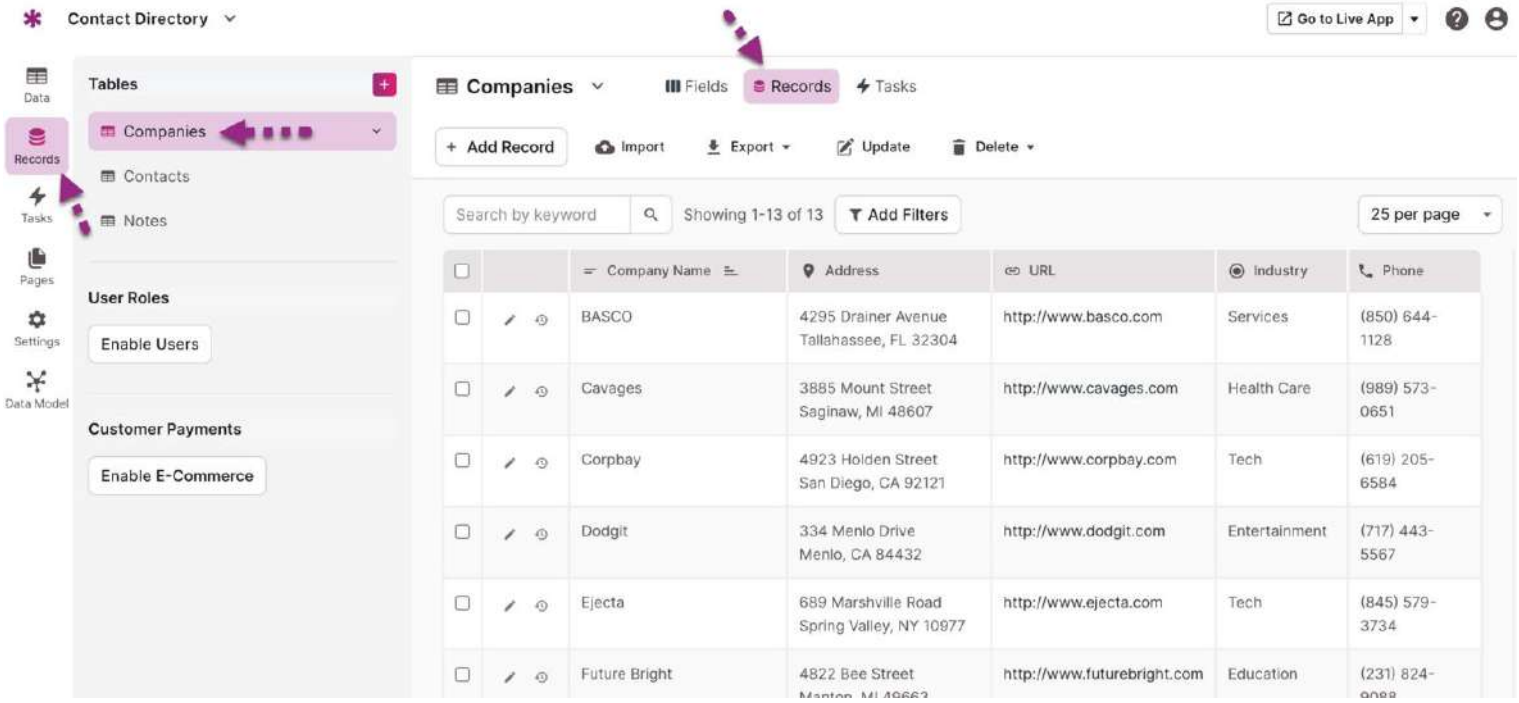


Grist is a data management application that combines spreadsheet-style working with database features. It enables users to organise related data, create linked records and build views for different purposes.

Applications

- Project tracking.
- School administration.
- Budget management.
- Inventory tracking.
- Organising community project information.

4.10 Knack



Knack is a low-code/no-code platform used to build online database applications with forms, records, views and workflows.

Applications

- Online registration systems.
- Membership management.
- Customer records.
- Project tracking.
- Inventory management.

4.11 Comparison of selected DBMS productivity tools

Tool	Main database model or approach	Typical use
Microsoft Access	Relational	Small and medium database applications
MySQL	Relational	Web and business databases
MariaDB	Relational	Web and organisational databases
PostgreSQL	Relational	Complex data and enterprise applications
SQL Server	Relational	Enterprise database systems
OpenOffice Base	Database application with relational features	Small database projects
FileMaker Pro	Custom database application platform	Tailored business solutions
MongoDB	Document-oriented NoSQL	Flexible document data
Grist	Spreadsheet-style linked data management	Project and record management
Knack	Low-code database platform	Online database applications

4.12 Factors to consider when selecting a DBMS productivity tool

The choice of a database tool depends on the needs of the organisation and the nature of the information being managed.

1. **Cost**

- Consider the purchase price, subscription fees, maintenance and training costs.
- A school with limited funds may prefer an appropriate open-source solution.

2. **Ease of use**

- Select a tool that users can learn and operate without unnecessary difficulty.
- Microsoft Access may be suitable for a small office that needs forms and reports.

3. **Type of data**

- Consider whether the data is structured, semi-structured or unstructured.
- Relational systems are suitable for many structured records, while document databases may suit flexible documents.

4. **Size of the database**

- Consider the current and expected amount of data.
- A large institution may require a server-based DBMS.

5. **Number of users**

- Determine how many people will access the database at the same time.
- A school with several departments may require a system that supports multiple authorised users.

6. **Security features**

- Consider passwords, access permissions, encryption and audit facilities.
- Sensitive financial or learner information requires appropriate protection.

7. **Data recovery**

- Check whether the tool supports reliable backup and recovery.

8. **Compatibility**

- The DBMS should work with available computers, operating systems and other applications.

9. **Scalability**

- The tool should be capable of accommodating future growth.

10. **Technical support**

- Consider availability of documentation, training and qualified support personnel.

11. **Performance**

- The tool should retrieve, process and update information within acceptable time limits.

12. **Reporting and analysis**

- Consider whether the tool can produce the reports required by the organisation.

13. **Connectivity**

- Consider whether the database needs to work locally, over a school network or online.

14. **Maintenance requirements**

- Consider the skills and resources needed to maintain the database.

15. **Legal and privacy requirements**

- The organisation should consider applicable data protection obligations, including Kenya's Data Protection Act, 2019.

Practical example: Selecting a DBMS for a school

Sameta School wants to manage learner details, class lists, assessment marks, attendance and fee records.

- For a small school office that needs a simple desktop database, Microsoft Access or OpenOffice Base may be considered.
- For a web-based school system accessed by several authorised users, MySQL, MariaDB or PostgreSQL may be considered.
- The final choice should depend on the school's budget, technical skills, security requirements and expected number of users.

5.0 Organisation of Data in a Database

5.1 Meaning of data organisation

Data organisation is the process of arranging data in a systematic structure to make it easy to store, access, update, retrieve and manage.

In a relational database, data is commonly organised using tables, fields, records and values.

5.2 Database file

A **database file** is an electronic file that stores a database and its associated information.

The file may contain tables, queries, forms, reports and other database objects, depending on the DBMS.

Examples of database file extensions

File extension	Description
.accdb	Microsoft Access database file
.mdb	Older Microsoft Access database format
.sqlite	SQLite database file
.db	A general database file extension used by some applications
.sql	A text file containing SQL statements or database scripts
.odb	OpenDocument database file used by OpenOffice/LibreOffice Base

Example:

A school may save its database as Olalui_School.accdb.

5.3 Database table

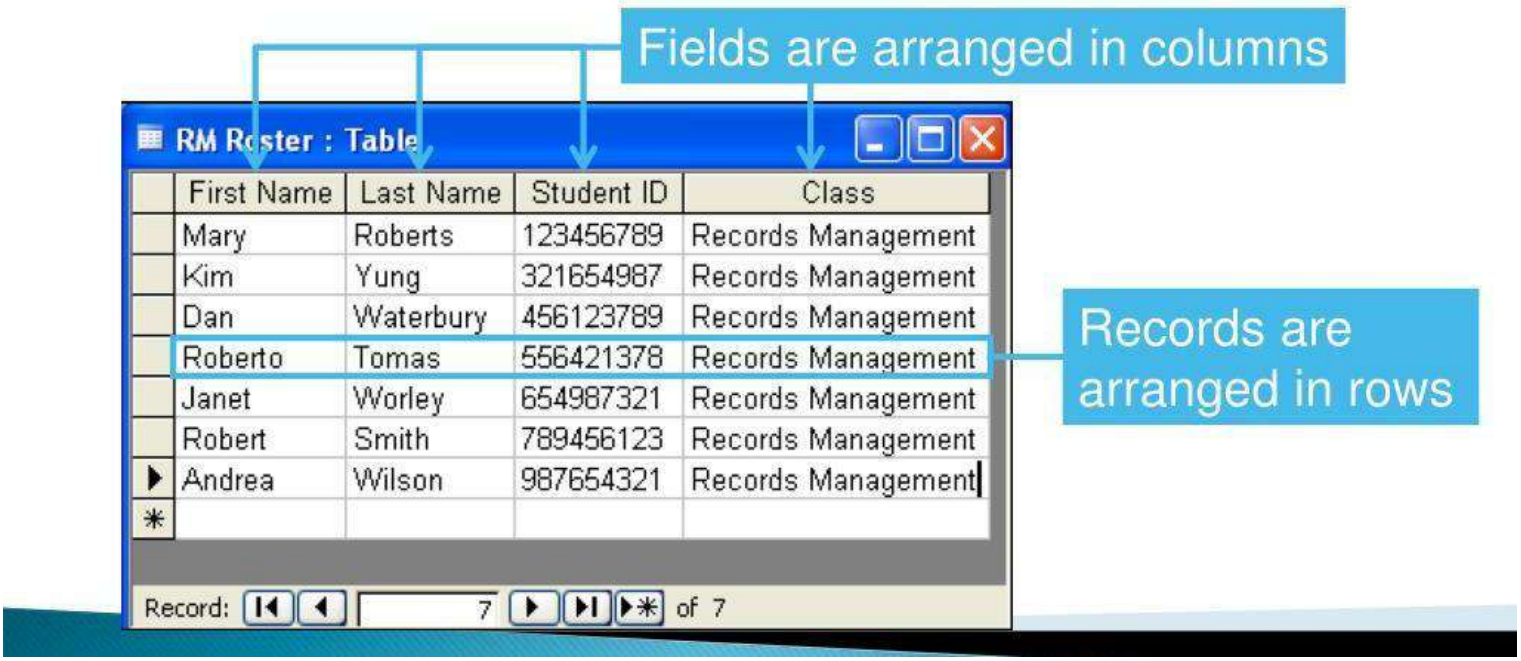
A **table** is a database object that stores related data in rows and columns.

Each table should normally represent one main subject or entity.

Examples of database tables in a school

1. Learners

2. Teachers
3. Subjects
4. Classes
5. Examination Results
6. Attendance
7. Fees
8. Parents and Guardians



5.4 Field

A **field** is a column in a database table that stores one particular category or attribute of information.

Example:

A Learners table may contain the following fields:

- AdmissionNumber
- FirstName
- Surname
- Gender
- DateOfBirth
- Grade
- Class
- GuardianContact

Each field should have a suitable name and data type.

5.5 Record

A **record** is a complete set of related field values describing one particular person, object, event or transaction.

In a table, a record is represented by a row.

Example:

Admission No.	First Name	Surname	Grade
OL001	Amina	Naserian	11

The information in the row forms one learner record.

5.6 Data value

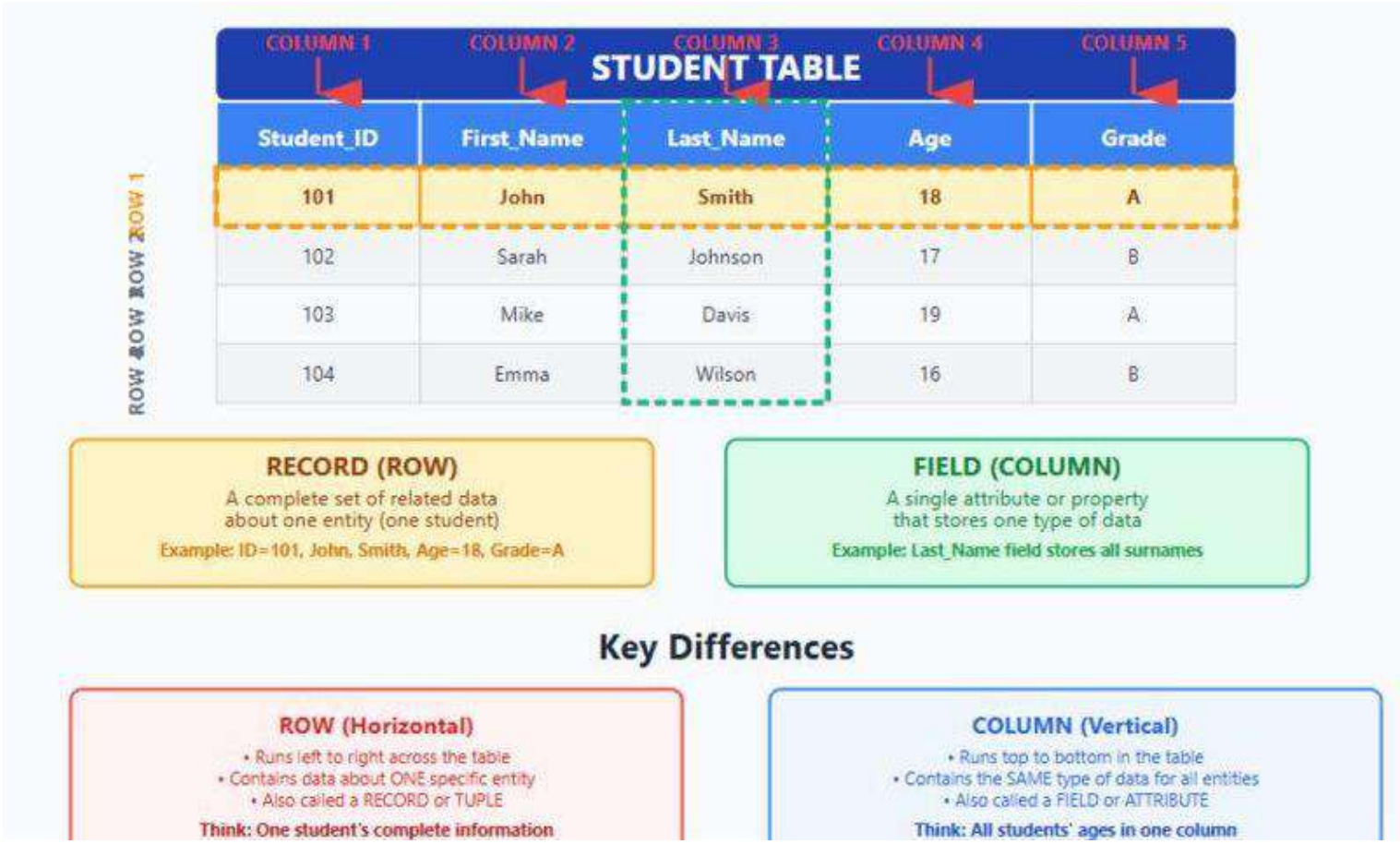
A **data value** is the actual entry stored in a particular field of a record.

For example, in the record above:

- OL001 is a value in the Admission Number field.
- Amina is a value in the First Name field.
- Naserian is a value in the Surname field.
- 11 is a value in the Grade field.

5.7 Differences between a table, field, record and data value

Term	Meaning	Example
Table	Collection of related records	Learners
Field	Category of information	FirstName
Record	Complete set of field values for one entry	OL001, Amina, Naserian, 11
Data value	Individual entry in a field	Amina



5.8 Data types in a database

A **data type** specifies the kind of value that can be stored in a field.

Common data types include:

1. **Short Text**
   - Stores letters, numbers and symbols as text.
   - Example: Learner name, admission number and telephone number.
   - A telephone number should generally be stored as text because it is not used for arithmetic.
2. **Long Text**
   - Stores lengthy descriptions or paragraphs.
   - Example: A learner's project description or teacher's comments.
3. **Number**
   - Stores numeric values used in calculations.
   - Example: Examination marks, quantity of stock or number of learners.
4. **Date/Time**
   - Stores dates and time values.
   - Example: Date of admission or date of a transaction.
5. **Currency**
   - Stores monetary values.
   - Example: School fees, sales and expenses in Kenya shillings.

6. **AutoNumber**

- Automatically generates a unique value for each new record in systems that support this data type.
- Example: Automatically assigning a record identification number.

7. **Yes/No**

- Stores a two-state value.
- Example: Whether a learner is registered for a particular activity.

8. **Hyperlink**

- Stores a link to a web page or another supported resource.
- Example: A school website address.

9. **Attachment**

- Stores or links files associated with a record in DBMS applications that support attachments.
- Example: A scanned admission document.

10. **Calculated field**

- Produces a value using an expression based on other fields.
- Example: Calculating a balance from fees charged and fees paid.

Note: The names and availability of data types vary from one DBMS application to another.

5.9 Importance of choosing appropriate data types

1. Improves data accuracy.
2. Reduces invalid entries.
3. Makes calculations easier.
4. Improves storage efficiency.
5. Supports sorting and searching.
6. Helps maintain consistency.
7. Supports correct database relationships.

Example:

A school should store examination marks as a numeric data type rather than ordinary text so that calculations such as totals and averages can be performed correctly.

6.0 Database Keys and Relationships

6.1 Meaning of a database key

A **database key** is a field or combination of fields used to identify records or establish relationships between tables.

Keys help maintain data integrity and reduce ambiguity when retrieving information.

6.2 Primary key

A **primary key** is a field, or combination of fields, that uniquely identifies each record in a table.

Characteristics of a primary key

1. Each record must have a unique primary key value.
2. A primary key should not contain duplicate values.
3. A primary key should not be left blank.
4. It should be stable and suitable for identifying records.
5. A table normally has one primary key, although it may consist of multiple fields.

Examples

- AdmissionNumber in a Learners table.
- TeacherID in a Teachers table.
- SubjectCode in a Subjects table.
- BookID in a Books table.

6.3 Foreign key

A **foreign key** is a field in one table that refers to a primary key in another table, helping to establish a relationship between the tables.

Example:

A Learners table has AdmissionNumber as its primary key. An ExaminationResults table may contain AdmissionNumber as a foreign key to show which learner obtained each result.

6.4 Candidate key

A **candidate key** is a field or combination of fields that can uniquely identify each record in a table.

A database designer selects one suitable candidate key to serve as the primary key.

6.5 Composite key

A **composite key** is a key made up of two or more fields that jointly identify a record uniquely.

Example:

In a learner-subject enrolment table, AdmissionNumber and SubjectCode may be combined to identify a learner's enrolment in a particular subject.

6.6 Alternate key

An **alternate key** is a candidate key that was not selected as the primary key.

Example:

If both National ID Number and Employee Number can uniquely identify an employee, one may be selected as the primary key while the other remains an alternate key, subject to appropriate privacy and data protection considerations.

6.7 Unique key

A **unique key** is a constraint that ensures values in a field or combination of fields do not repeat. Some DBMS products allow different treatment of blank or NULL values under unique constraints.

6.8 Differences between primary and foreign keys

Primary key	Foreign key
Uniquely identifies records in its own table.	Refers to a key in another or sometimes the same table.
Must be unique.	May contain repeated values.
Cannot be NULL in a primary key.	May be NULL where the relationship is optional.
Identifies individual records.	Establishes relationships between records.
Example: AdmissionNumber in Learners.	Example: AdmissionNumber in ExaminationResults.

6.9 Database relationships

A **database relationship** is a logical connection between records in two or more tables.

Relationships allow information to be stored in separate but connected tables.

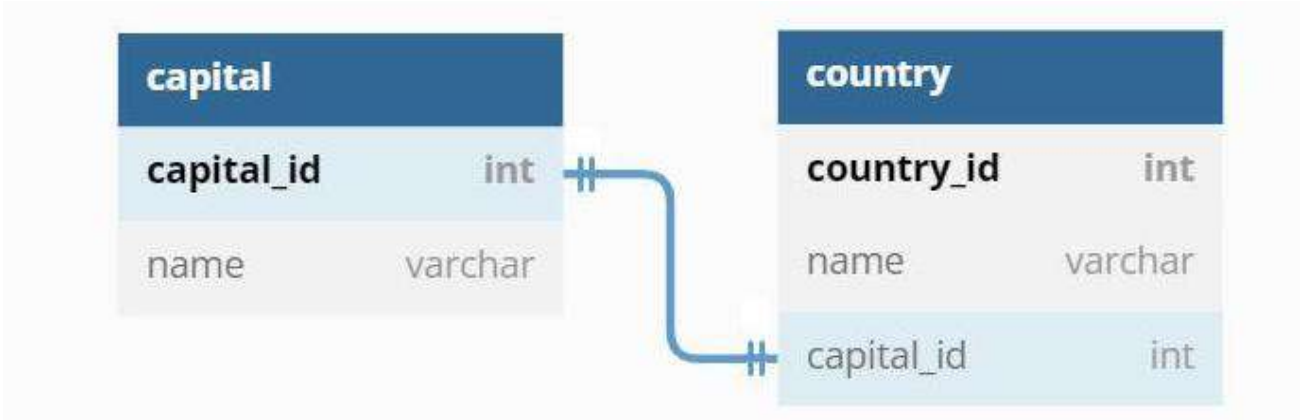
There are three common types of relationships in relational databases.

A. One-to-one relationship

A **one-to-one relationship** occurs when one record in a table is associated with only one corresponding record in another table, and vice versa.

Example:

A school may maintain a learner table and a separate learner medical profile table, where each learner has one corresponding profile.



Applications

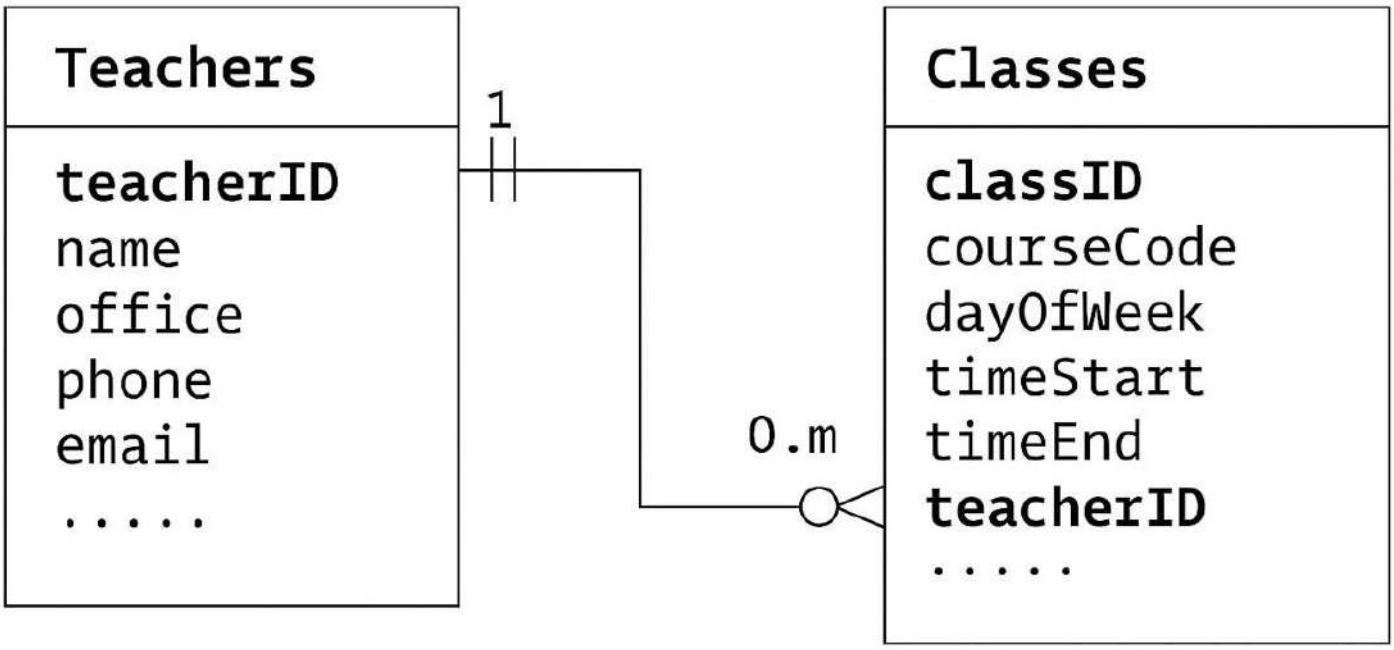
- Employee and employee security profile.
- Learner and individual profile.
- Vehicle and vehicle registration record.

B. One-to-many relationship

A **one-to-many relationship** occurs when one record in the first table can be associated with many records in the second table, while each record in the second table is associated with one record in the first table.

Example:

One class teacher may supervise many learners, while each learner is assigned to one class teacher for a particular class arrangement.



Other examples

- One customer can make many orders.
- One supplier can supply many products.
- One class can contain many learners.
- One department can have many employees.

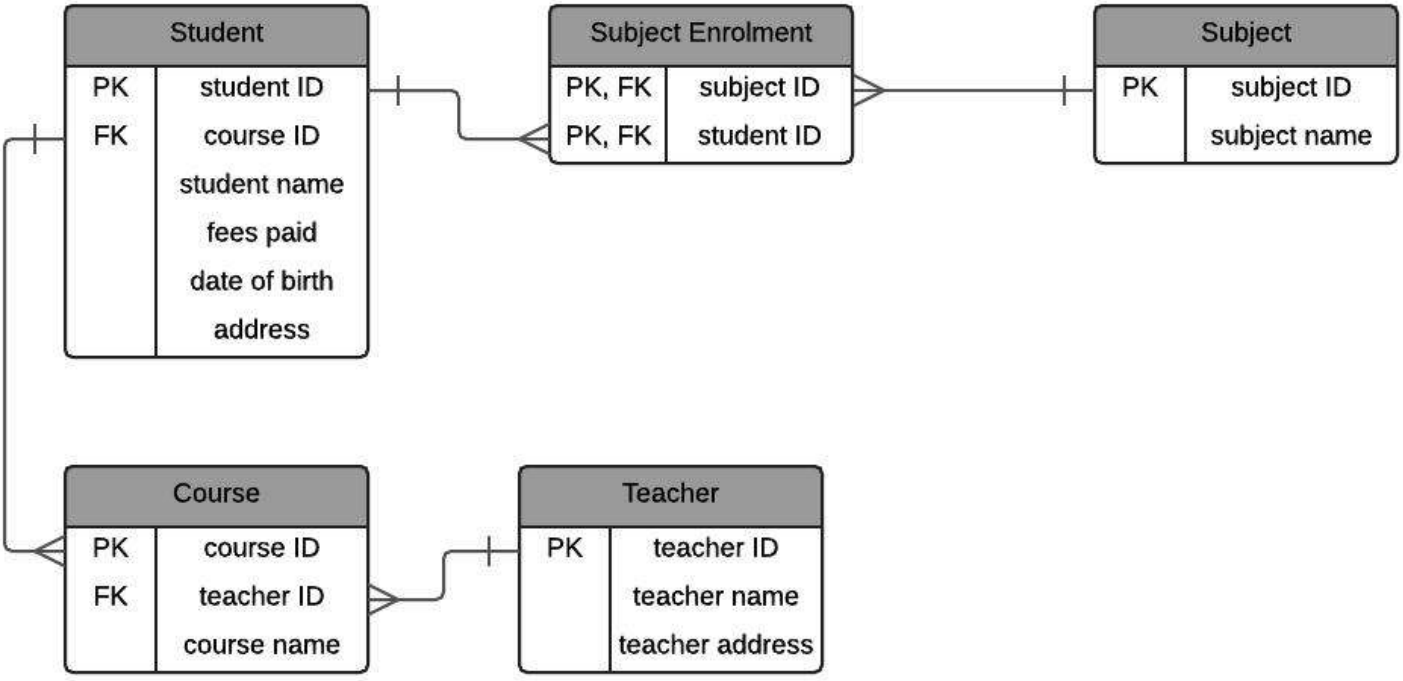
C. Many-to-many relationship

A **many-to-many relationship** occurs when many records in one table can be associated with many records in another table.

Example:

- One learner can study many subjects.
- One subject can be studied by many learners.

In a relational database, this relationship is normally implemented using a junction table, also called a linking or associative table.



Other examples

- Authors and books.
- Customers and products.
- Doctors and patients.
- Employees and projects.

6.10 Importance of relationships in a database

1. Connects related information stored in separate tables.
2. Reduces unnecessary repetition of data.
3. Improves data organisation.
4. Supports accurate queries.
5. Helps maintain referential integrity.
6. Makes it easier to update related information.
7. Supports the preparation of meaningful reports.
8. Makes databases easier to maintain.

6.11 Referential integrity

Referential integrity is a set of rules that ensures relationships between tables remain valid.

For example:

- An examination result should refer to an existing learner.
- A sales order should refer to an existing customer.
- A borrowing transaction should refer to an existing library book and borrower.

Importance of referential integrity

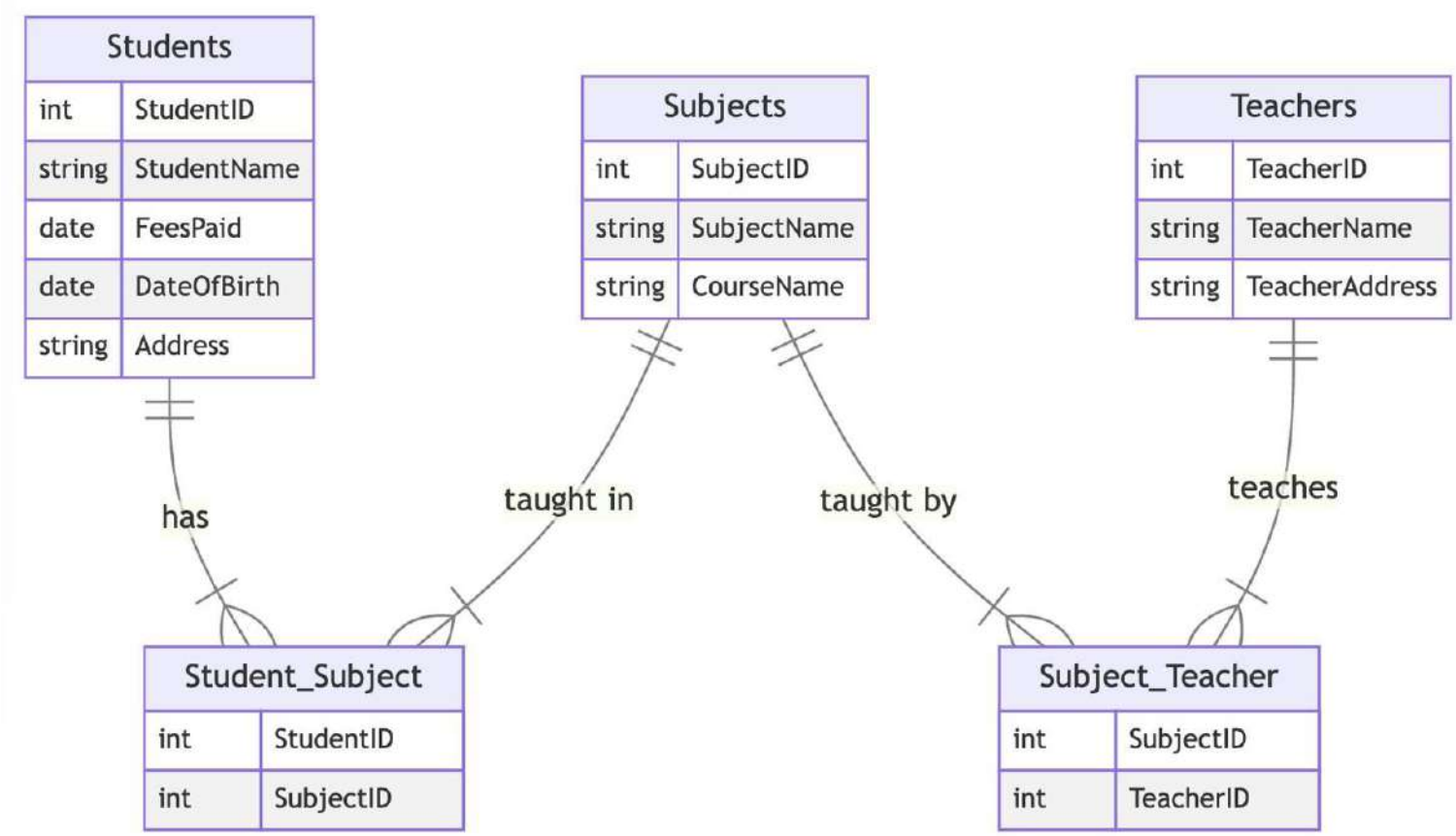
1. Prevents records from referring to non-existent related records.
2. Reduces inconsistent information.
3. Improves database reliability.
4. Helps maintain accurate relationships.
5. Supports trustworthy reporting.

7.0 Entity Relationship Diagrams (ERDs)

7.1 Meaning of an Entity Relationship Diagram

An **Entity Relationship Diagram (ERD)** is a visual representation of the entities in a database, their attributes and the relationships between them.

It is used during database planning and design to show how information will be organised.



7.2 Meaning of an entity

An **entity** is a person, place, object, event or concept about which data is stored in a database.

Examples in a school

1. Learner
2. Teacher
3. Subject
4. Class
5. Examination

6. Parent
7. Book
8. Fee transaction

Each entity normally becomes a table in a relational database.

7.3 Meaning of an attribute

An **attribute** is a property or characteristic that describes an entity.

Example:

The Learner entity may have the following attributes:

- AdmissionNumber
- FirstName
- Surname
- Gender
- DateOfBirth
- Grade
- Class

7.4 Meaning of cardinality

Cardinality describes the number of records of one entity that can be associated with records of another entity.

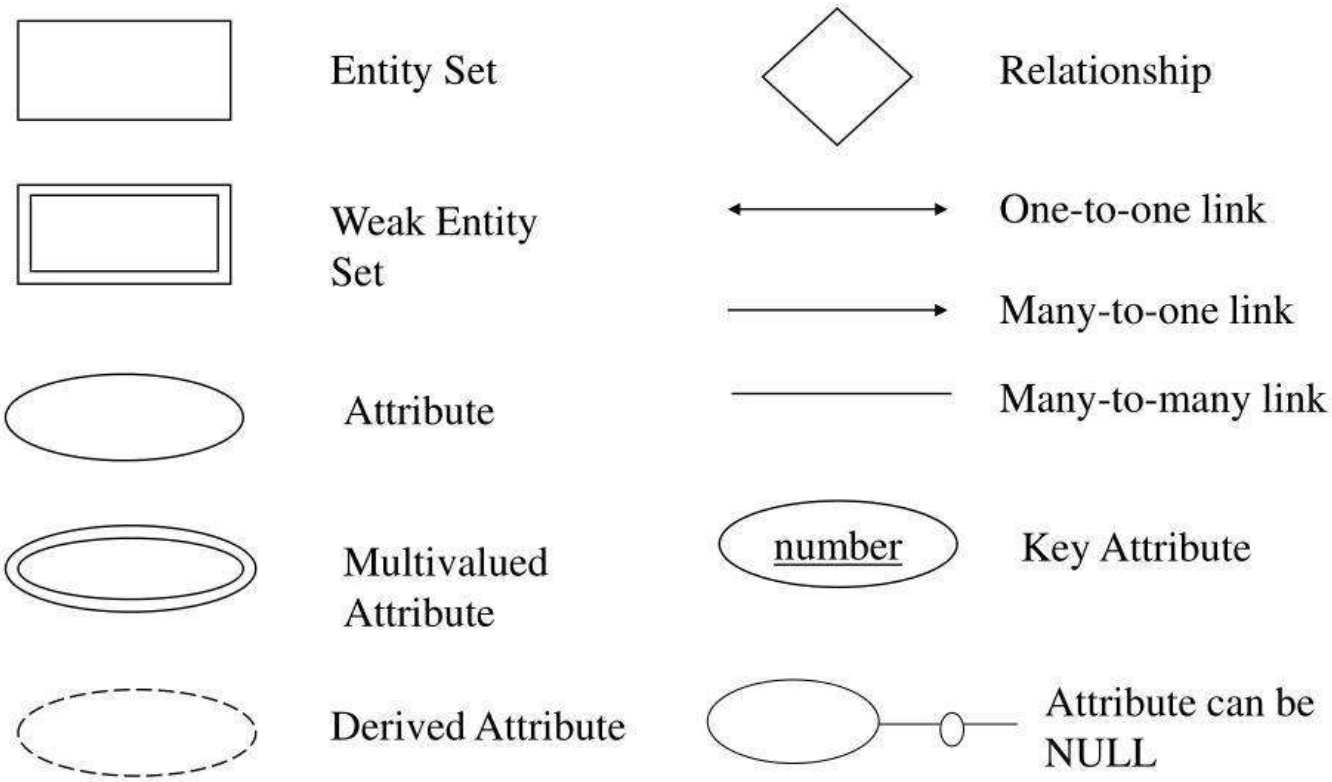
Common cardinalities include:

1. One-to-one (1:1).
2. One-to-many (1:M).
3. Many-to-many (M:N).

7.5 Common symbols used in ERDs

Different ERD drawing conventions exist. A common notation uses:

Symbol or representation	Meaning
Rectangle	Entity
Oval	Attribute
Diamond	Relationship in traditional Chen notation
Line	Connection between entities and relationships
1	One
M or N	Many
Underlined attribute	Primary key in some ERD notations



7.6 Example of a school ERD

A school wants to create a database to manage learners, subjects and examination results.

Entities

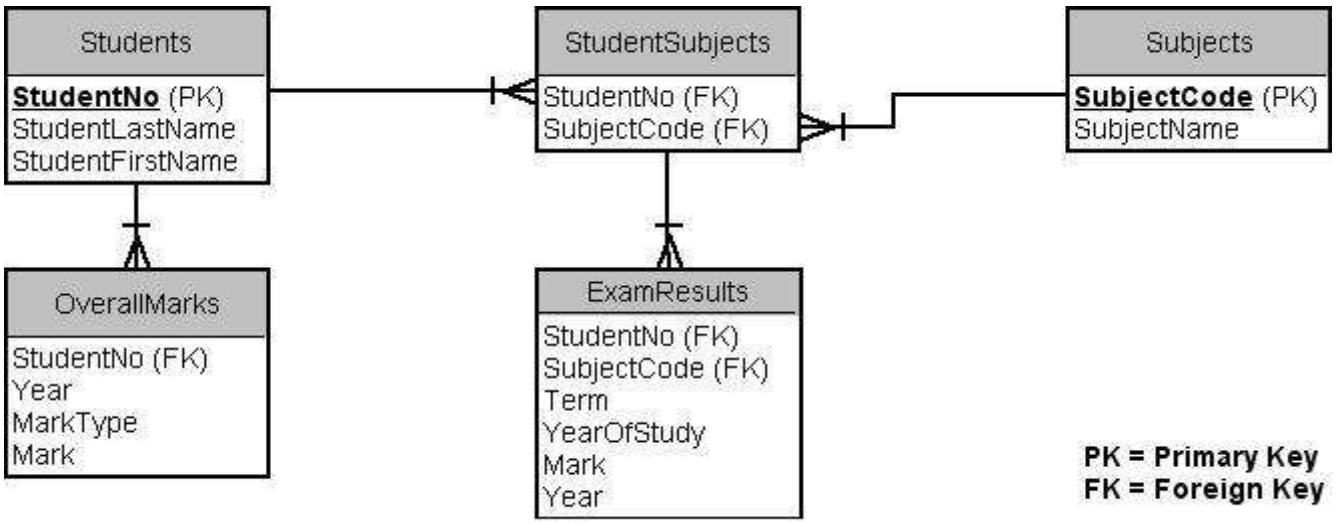
1. Learner
2. Subject
3. ExaminationResult

Attributes

- Learner: AdmissionNumber, FirstName, Surname, Grade.
- Subject: SubjectCode, SubjectName.
- ExaminationResult: ResultID, AdmissionNumber, SubjectCode, Marks, ExamDate.

Relationships

- One learner can have many examination results.
- One subject can appear in many examination results.
- Each examination result belongs to one learner and one subject.



7.7 Steps followed when designing an ERD

1. **Identify the purpose of the database**
   - Determine the problem the database should solve.
   - Example: Managing learner registration and examination results.
2. **Gather user requirements**
   - Consult the people who will use the database.
   - Identify the information they need to store and retrieve.
3. **Identify entities**
   - List the main subjects about which information will be stored.
   - Example: Learners, subjects and examination results.
4. **Identify attributes**
   - Determine the details required for each entity.
   - Example: Learner name, admission number and grade.
5. **Identify primary keys**
   - Select unique fields for identifying records.
   - Example: AdmissionNumber.
6. **Identify relationships**
   - Determine how entities are connected.
   - Example: One learner can have many examination results.
7. **Determine cardinality**
   - Specify whether the relationships are one-to-one, one-to-many or many-to-many.
8. **Draw the ERD**
   - Use appropriate symbols and relationship lines.
9. **Review the diagram**
   - Check for missing entities, attributes or relationships.

10. **Refine the design**

- Make corrections before creating the actual database tables.

7.8 Importance of ERDs

1. Help database designers understand the structure of a database.
2. Make relationships easier to identify.
3. Reduce design errors.
4. Help users communicate database requirements.
5. Support proper selection of primary and foreign keys.
6. Help identify unnecessary duplication.
7. Provide a guide when creating database tables.
8. Make database maintenance and future improvement easier.

8.0 Database Design and Normalisation

8.1 Meaning of database design

Database design is the process of planning how data will be stored, organised, related and managed in a database.

A good database design ensures that information is organised logically and can be retrieved efficiently.

8.2 Importance of good database design

1. Reduces unnecessary duplication.
2. Improves accuracy and consistency.
3. Makes updating records easier.
4. Improves retrieval of information.
5. Supports data integrity.
6. Makes the database easier to maintain.
7. Reduces the likelihood of data entry errors.

8.3 Meaning of database normalisation

Database normalisation is the process of organising data into related tables to reduce unnecessary duplication and improve data integrity.

Normalisation helps ensure that each type of information is stored in an appropriate place.

8.4 Problems caused by poor database design

1. **Data duplication**

- The same information is stored repeatedly.
- Example: A learner's name is repeated in every subject result record.

2. **Update anomaly**

- The same information must be changed in several places.
- If a learner changes their surname, some records may be updated while others remain unchanged.

3. **Insertion anomaly**

- It may be difficult to add one type of information without adding unrelated information.
- For example, a school may be unable to register a new subject until a learner is enrolled in it.

4. **Deletion anomaly**

- Removing one record may unintentionally remove other important information.
- For example, deleting the only learner registered for a subject may also remove the only stored details about that subject.

8.5 First Normal Form (1NF)

A table is in **First Normal Form (1NF)** when:

1. Each field contains a single value for each record.
2. Repeating groups are removed.
3. Each record can be uniquely identified.
4. Values in a field follow a consistent structure.

Example of a table that is not in 1NF

Admission No.	Learner	Subjects
001	Amina	ICT, Mathematics, English
002	Brian	Science, English

The Subjects field contains several values in one cell.

Improved structure

Admission No.	Learner	Subject
001	Amina	ICT
001	Amina	Mathematics
001	Amina	English
002	Brian	Science
002	Brian	English

8.6 Second Normal Form (2NF)

A table is in **Second Normal Form (2NF)** when:

1. It is already in 1NF.
2. Every non-key attribute depends on the whole candidate key, not just part of a composite key.

This is particularly important where a table has a composite key.

8.7 Third Normal Form (3NF)

A table is in **Third Normal Form (3NF)** when:

1. It is already in 2NF.
2. Non-key attributes do not depend transitively on the primary key.

In simple terms, information that belongs to another entity should be placed in its appropriate table.

Example:

Instead of repeating a subject name and teacher's details in every learner result record, the database can use separate Learners, Subjects, Teachers and Results tables connected by keys.

8.8 Benefits of normalisation

1. Reduces unnecessary duplication.
2. Minimises update anomalies.
3. Improves data consistency.
4. Makes records easier to maintain.
5. Improves the logical organisation of data.
6. Helps maintain reliable relationships.

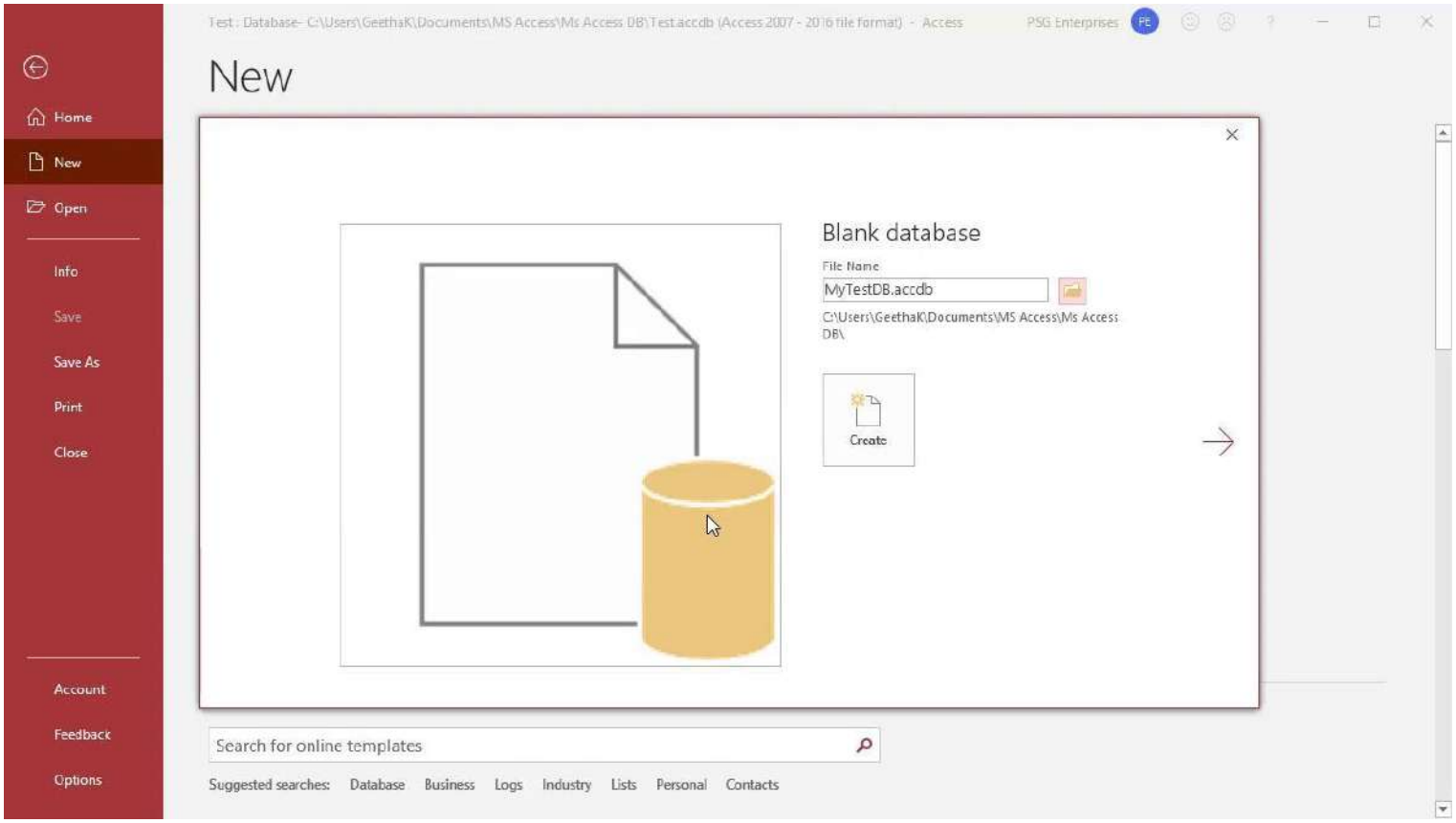
9.0 Creating, Formatting and Editing Database Files

9.1 Creating a database

Creating a database involves setting up a new database file and defining the structure that will be used to store information.

General steps when creating a database

1. Start the selected DBMS application.
2. Choose the option to create a new database.
3. Enter an appropriate database name.
4. Select the location where the database will be stored.
5. Create the required tables.
6. Define the fields for each table.
7. Assign suitable data types.
8. Identify primary keys.
9. Create relationships between related tables.
10. Save the database.



9.2 Creating a table

A table should be created to store one main category of related information.

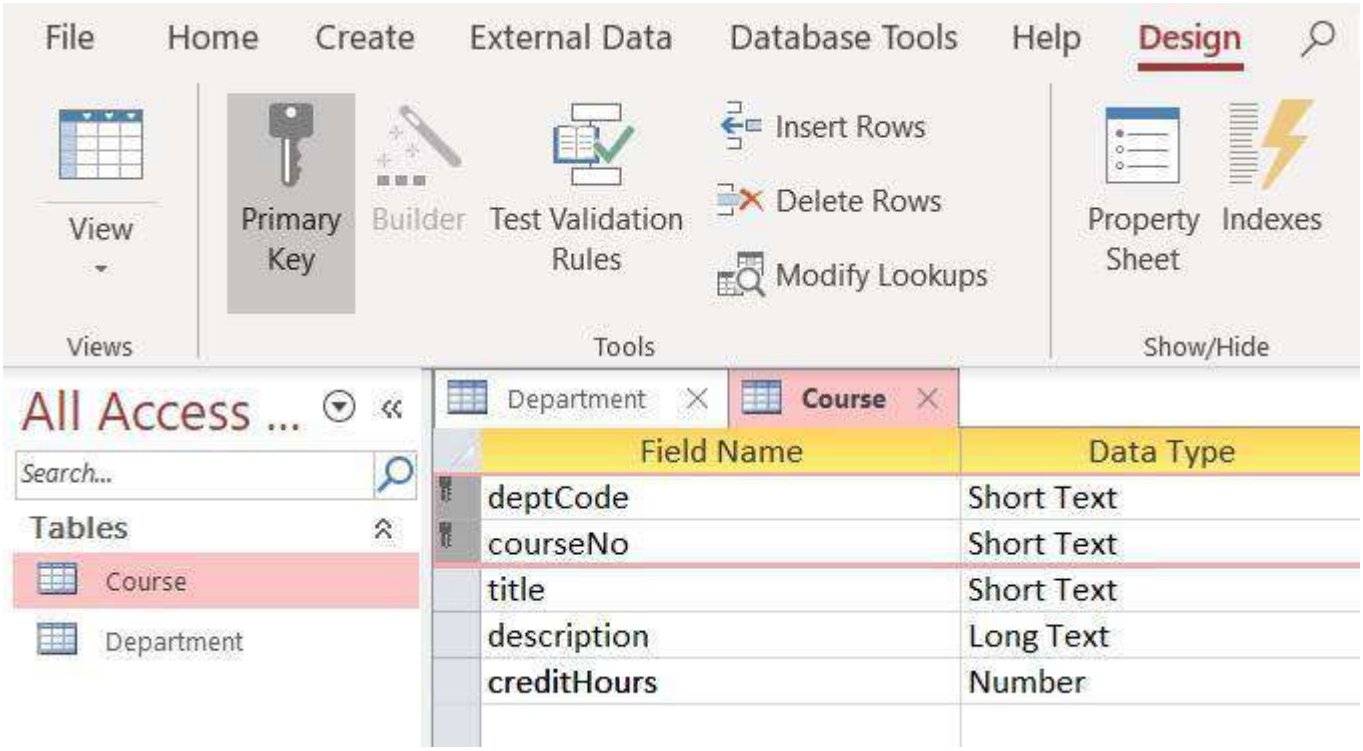
Example: Creating a Learners table

Field name	Data type	Description
AdmissionNumber	Short Text	Unique learner admission number
FirstName	Short Text	Learner's first name
Surname	Short Text	Learner's surname
Gender	Short Text	Learner's gender
DateOfBirth	Date/Time	Learner's date of birth
Grade	Number	Learner's grade
GuardianContact	Short Text	Guardian's telephone number

General steps in Microsoft Access

1. Open the database.
2. Select **Create**.

3. Choose **Table Design**.
4. Enter the field names.
5. Select suitable data types.
6. Set the primary key.
7. Save the table with an appropriate name.
8. Switch to Datasheet View.
9. Enter the required records.



9.3 Formatting a database table

Database formatting refers to adjusting the appearance and display of database objects to improve readability and presentation.

Formatting may involve:

1. Adjusting column widths.
2. Changing font type and size.
3. Applying suitable text alignment.
4. Formatting date fields.
5. Formatting currency fields.
6. Adjusting row heights.
7. Applying readable colours and styles.
8. Using meaningful field names.
9. Displaying appropriate headings.
10. Setting suitable page layouts for reports.

Importance of formatting

- Improves readability.
- Makes information easier to interpret.
- Gives reports a professional appearance.
- Helps users identify important information.
- Reduces confusion when viewing records.

9.4 Editing a database

Database editing refers to modifying the structure or contents of a database to correct errors, update information or improve its organisation.

Common editing activities include:

1. Adding new records.
2. Modifying existing records.
3. Deleting unnecessary records.
4. Adding new fields.
5. Renaming fields.
6. Changing data types where appropriate.
7. Changing field properties.
8. Updating relationships.
9. Correcting spelling errors.
10. Updating validation rules.

Example:

If a learner changes class from 11 East to 11 West, an authorised user updates the learner's class information in the appropriate table.

9.5 Importing data into a database

Data importing is the process of bringing data from an external file or application into a database.

Sources may include:

- Microsoft Excel workbooks.
- CSV files.
- Text files.
- Other databases.
- Supported online data sources.

Steps for importing data in a DBMS

1. Open the target database.
2. Select the import or external data option.
3. Choose the source file.

4. Select the relevant worksheet, table or data range.
5. Specify whether the first row contains field names.
6. Check the field names and data types.
7. Identify a primary key where appropriate.
8. Complete the import process.
9. Check the imported records for accuracy.

9.6 Exporting data from a database

Data exporting is the process of transferring database information to another file format or application.

Common export formats include:

- Excel workbook.
- CSV file.
- PDF document.
- Text file.
- HTML, where supported.

Steps for exporting data

1. Open the database.
2. Select the table, query or report to export.
3. Choose the export option.
4. Select the required file format.
5. Specify the destination folder.
6. Enter the output file name.
7. Confirm the export.
8. Open the exported file and check its contents.

Importance of importing and exporting

1. Supports data exchange between applications.
2. Makes reporting easier.
3. Reduces repeated manual data entry.
4. Supports data analysis in other applications.
5. Helps organisations share information in suitable formats.

10.0 Data Entry and Validation

10.1 Meaning of data entry

Data entry is the process of entering information into a database using a keyboard, form, import facility or another supported input method.

Examples

- Entering learner admission details.
- Recording examination marks.
- Entering customer contacts.
- Recording stock received by a shop.
- Entering hospital appointment details.

10.2 Methods of entering data into a database

1. **Direct table entry**
   - Data is typed directly into database table fields.
   - Suitable for entering small amounts of information.
2. **Form-based entry**
   - Data is entered using a designed form.
   - Useful where users need clear instructions and organised fields.
3. **Importing from files**
   - Data is brought from Excel, CSV or another supported file.
   - Useful when information already exists electronically.
4. **Online forms**
   - Information is collected through web-based forms and transferred to a database.
5. **Automated data capture**
   - Information is captured using supported devices such as barcode readers or scanners.

10.3 Meaning of data validation

Data validation is the process of checking whether data entered into a database meets specified rules before it is accepted or stored.

Validation helps prevent incorrect, incomplete or unsuitable entries.

10.4 Common data validation rules

1. **Required field**
   - Ensures that a field is not left blank.
   - Example: Every learner must have an admission number.
2. **Range check**
   - Ensures a value falls within a specified range.
   - Example: Examination marks must be between 0 and 100.

3. **Data type check**
   - Ensures that an entry is of the correct type.
   - Example: A date field should contain a valid date.
4. **Format check**
   - Ensures data follows a specified pattern.
   - Example: A telephone contact should follow the organisation's accepted format.
5. **Length check**
   - Restricts the number of characters entered.
   - Example: An admission number may be limited to a specified length.
6. **Uniqueness check**
   - Prevents duplicate values in fields that must be unique.
   - Example: Two learners should not share the same admission number.
7. **Lookup check**
   - Ensures that an entry matches an approved value in a related list.
   - Example: A learner's grade must be selected from the grades offered by the school.
8. **Consistency check**
   - Ensures that related entries do not contradict each other.
   - Example: The date of completion should not be earlier than the date of admission.

10.5 Difference between data validation and data verification

Data validation	Data verification
Checks whether data follows specified rules.	Checks whether entered data matches the original source.
Focuses on acceptable format, range and type.	Focuses on accuracy of copying or transferring information.
Example: Ensuring marks are between 0 and 100.	Example: Comparing a mark entered in the database with the learner's original script record.

10.6 Importance of data validation

1. Reduces incorrect data entry.
2. Improves database accuracy.
3. Maintains consistency.
4. Prevents unacceptable values.
5. Supports reliable calculations.
6. Improves the quality of reports.

7. Saves time spent correcting errors.
8. Supports data integrity.

11.0 Database Queries

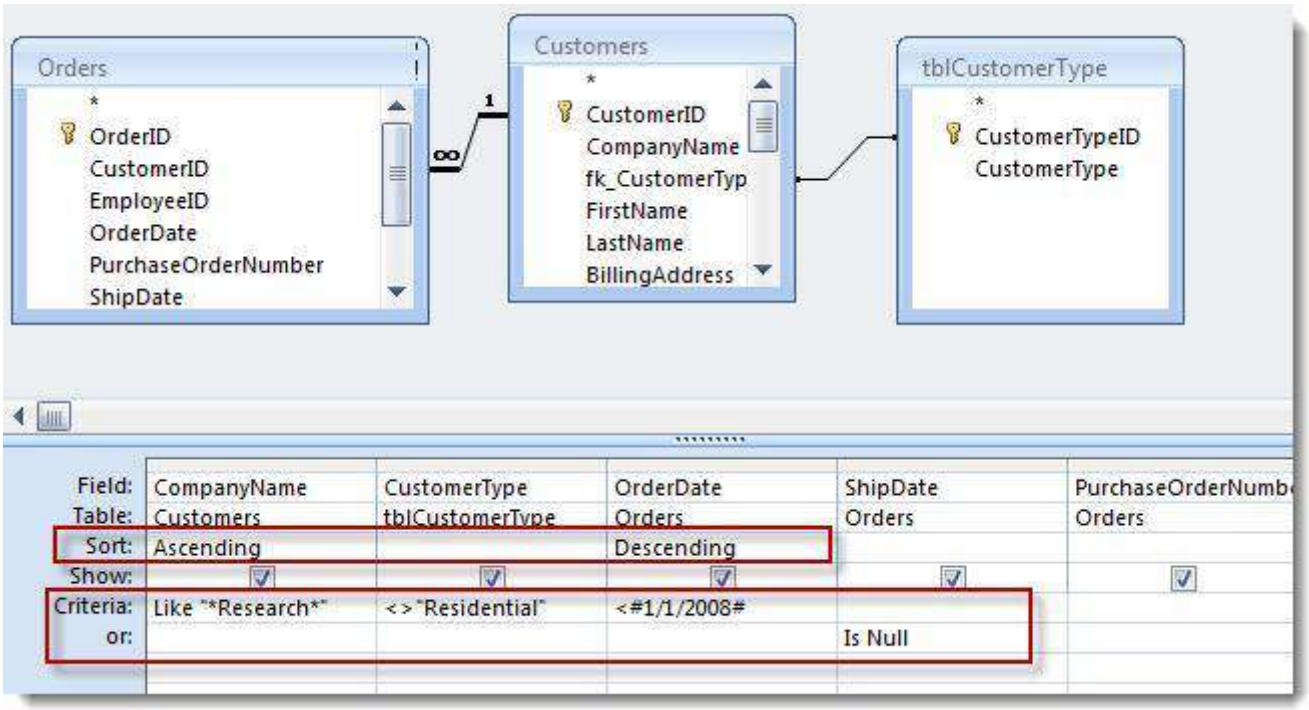
11.1 Meaning of a database query

A **database query** is a request made to a DBMS to retrieve, filter, calculate, combine or modify data according to specified conditions.

Queries help users obtain only the information they require from a database.

Example:

A teacher may query a learner database to display all Grade 11 learners who scored 70 marks and above in ICT.



11.2 Importance of database queries

1. Retrieve specific records quickly.
2. Filter information according to conditions.
3. Sort retrieved records.
4. Perform calculations.
5. Combine information from related tables.
6. Support decision-making.
7. Generate information for reports.
8. Reduce the need to examine every record manually.

11.3 Types of database queries

A. Select query

A **select query** retrieves records from one or more tables without changing the stored data.

Example:

Displaying all learners in Grade 11.

B. Parameter query

A **parameter query** prompts a user to enter a value or condition before displaying the results.

Example:

A teacher is prompted to enter a grade, after which the database displays learners in that grade.

C. Action query

An **action query** performs an operation that changes data or creates a new table.

Common action queries include:

1. **Update query**
    - Modifies existing records.
    - Example: Updating the class of selected learners.
2. **Delete query**
    - Removes selected records.
    - Example: Deleting duplicate test records after verification and authorisation.
3. **Append query**
    - Adds records from one table or query to another table.
    - Example: Adding new learner records to an existing registration table.
4. **Make-table query**
    - Creates a new table from the results of a query.
    - Example: Creating a table containing only Grade 11 learners.

D. Crosstab query

A **crosstab query** summarises data by displaying values in row headings and column headings.

Example:

Summarising the number of learners in each grade according to gender.

E. SQL query

An **SQL query** is a database request written using Structured Query Language.

Example:

This command retrieves the first name, surname and grade of learners whose grade is 11.

11.4 Common SQL commands

Structured Query Language (SQL) is a language used to communicate with relational databases.

SQL command	Purpose
SELECT	Retrieves data
INSERT	Adds new records
UPDATE	Modifies existing records
DELETE	Removes records
CREATE	Creates database objects
ALTER	Changes the structure of database objects
DROP	Removes database objects
WHERE	Specifies conditions
ORDER BY	Sorts query results
GROUP BY	Groups records for summaries
JOIN	Combines related information from tables

Examples of SQL statements

1. Retrieve all learners:

2. Retrieve learners in Grade 11:

3. Add a learner:

4. Update a learner's grade:

5. Sort learners by surname:

Important: UPDATE and DELETE commands should be used carefully. A condition such as WHERE helps restrict the operation to the intended records.

11.5 Query criteria and operators

Queries use criteria to specify which records should be selected.

Common operators include:

<table>
<tr><th>Operator</th><th>Meaning</th><th>Example</th></tr>
<tr><td>=</td><td>Equal to</td><td>Grade = 11</td></tr>
<tr><td>></td><td>Greater than</td><td>Marks > 70</td></tr>
<tr><td><</td><td>Less than</td><td>Marks < 40</td></tr>
<tr><td>>=</td><td>Greater than or equal to</td><td>Marks >= 50</td></tr>
<tr><td><=</td><td>Less than or equal to</td><td>Marks ` | Not equal to | Grade
10 |
<table>
<tr><td>AND</td><td>Both conditions must be true</td><td>Grade = 11 AND Marks > 70</td></tr>
<tr><td>NOT</td><td>Excludes a condition</td><td>NOT Gender = 'Male'</td></tr>
<tr><td>LIKE</td><td>Matches a text pattern</td><td>Name LIKE 'A%'</td></tr>
<tr><td>BETWEEN</td><td>Selects values within a range</td><td>Marks BETWEEN 50 AND 80</td></tr>
<tr><td>IN</td><td>Matches any value in a list</td><td>Grade IN (10, 11, 12)</td></tr>
</table>
11.6 Practical activity: Creating and running a query
A school has a database containing learner names, grades and ICT marks.
Task: Retrieve learners in Grade 11</td></tr>
</table>

SQL is used to communicate with relational databases.

Example 1: Retrieving all learners

```
SELECT * FROM Learners;
```

Example 2: Retrieving Grade 11 learners

```
SELECT * FROM Learners
WHERE Grade = 11;
```

Example 3: Retrieving learners in alphabetical order

```
SELECT * FROM Learners
ORDER BY FirstName ASC;
```

Example 4: Retrieving learners with marks above 70

```
SELECT * FROM ExaminationResults
WHERE Marks > 70;
```

Example 5: Adding a new learner

```
INSERT INTO Learners
(AdmissionNo, FirstName, Grade)
VALUES (1105, 'John', 11);
```

Example 6: Updating a learner's grade

```
UPDATE Learners
SET Grade = 11
WHERE AdmissionNo = 1105;
```

Example 7: Deleting a test record

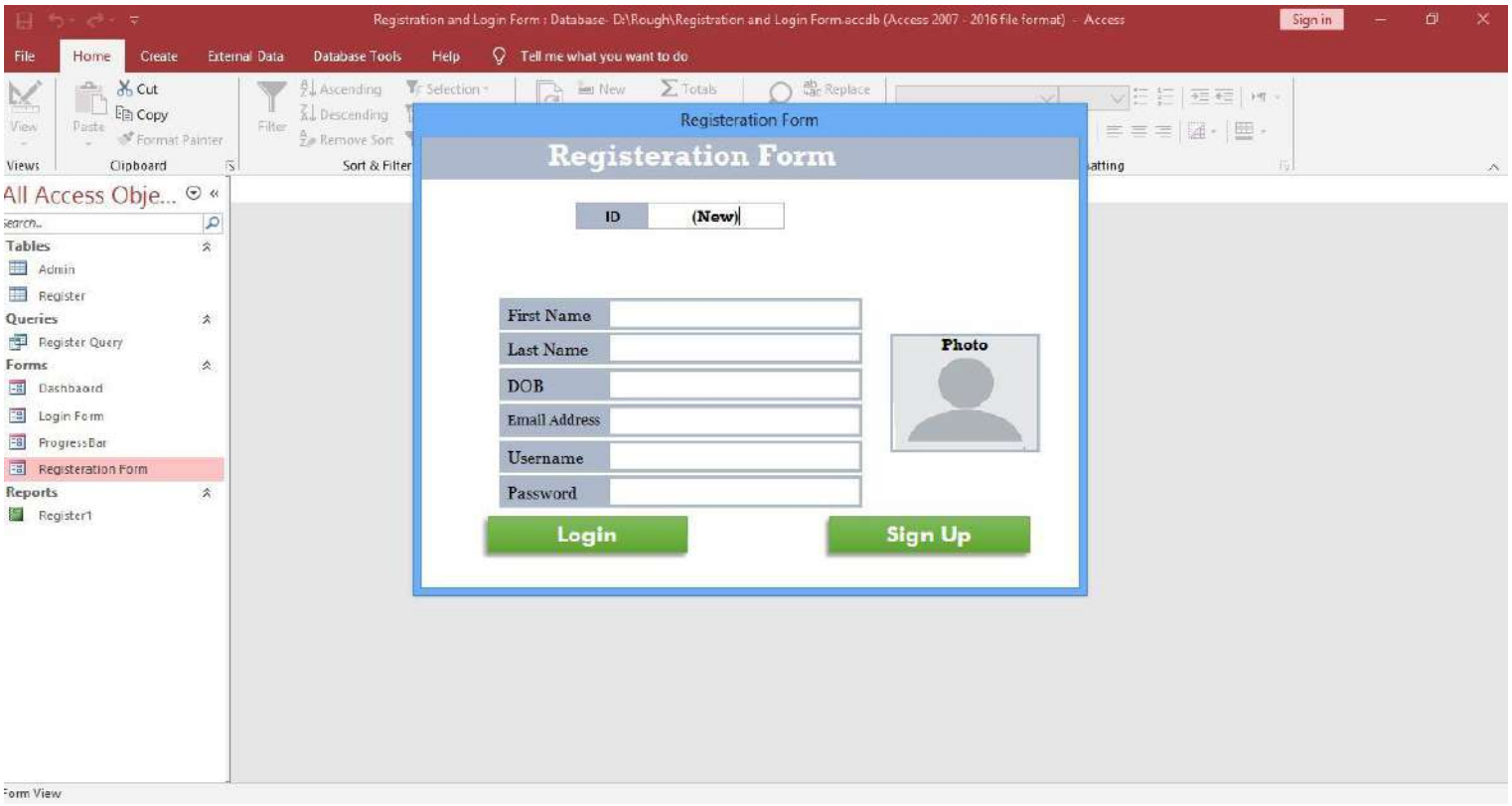
```
DELETE FROM Learners
WHERE AdmissionNo = 9999;
```

Note: SQL syntax may vary slightly across DBMS applications.

15.0 Forms and Reports in a Database

15.1 Forms

A form is a database object that provides a user-friendly interface for entering, viewing and editing records.



Uses of Forms

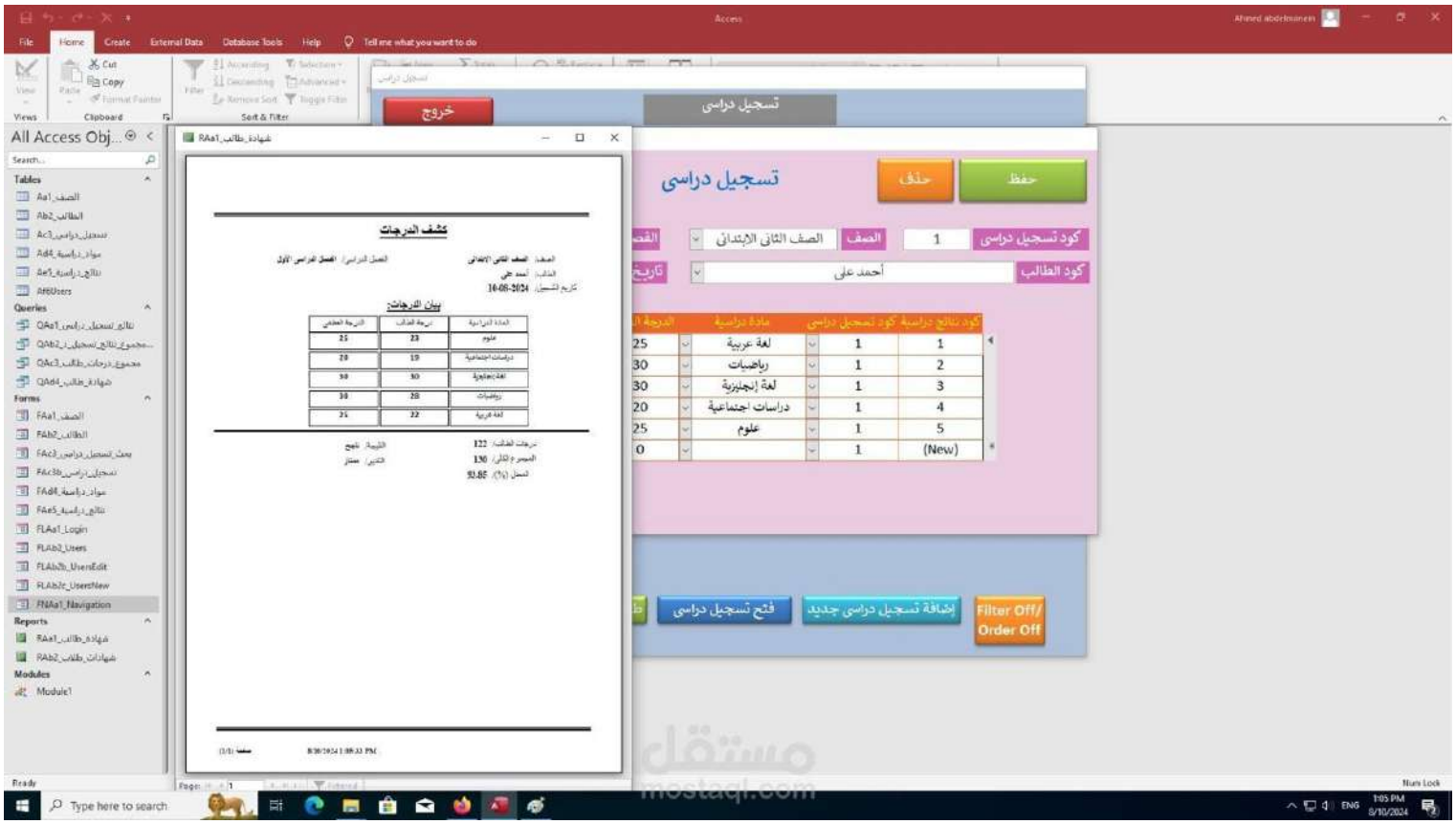
1. Entering new records.
2. Editing existing records.
3. Viewing individual records.
4. Reducing direct interaction with table structures.
5. Improving data entry organisation.
6. Supporting validation and controlled entry.

Examples of forms

- Learner registration form.
- Employee registration form.
- Customer information form.
- Library book entry form.
- Farmer registration form.

15.2 Reports

A report is a database object used to present information in an organised and readable format.



Uses of Reports

1. Presenting examination results.
2. Producing lists of registered learners.
3. Summarising business sales.
4. Preparing financial summaries.
5. Producing stock reports.
6. Presenting information for decision-making.
7. Printing organised records.

15.3 Difference Between Forms and Reports

Forms	Reports
Mainly used for data entry and editing.	Mainly used for presenting information.
Provide an interactive interface.	Provide an organised summary or presentation.
Used to add or modify records.	Used to view, print or share information.
Example: Learner registration form.	Example: Examination results report.

16.0 Data Validation and Data Integrity

16.1 Meaning of Data Validation

Data validation is the process of checking whether data entered into a database meets specified rules and requirements.

16.2 Examples of Data Validation

1. **Range check:** Ensures that a value falls within an acceptable range.
2. **Presence check:** Ensures that a required field is not left blank.
3. **Format check:** Ensures that data follows a specified format.
4. **Type check:** Ensures that the entered data matches the field's data type.
5. **Length check:** Ensures that the information has an acceptable number of characters.
6. **Uniqueness check:** Prevents duplicate values in fields that must be unique.
7. **Lookup validation:** Restricts entry to values from a predefined list.

16.3 Meaning of Data Integrity

Data integrity refers to the accuracy, consistency and reliability of data throughout its life cycle.

16.4 Importance of Data Integrity

- Prevents inaccurate records.
- Maintains consistency.
- Improves trust in stored information.
- Supports correct decision-making.
- Prevents invalid relationships between tables.
- Helps protect important organisational records.

16.5 Ways of Maintaining Data Integrity

1. Use primary keys.
2. Use foreign keys.
3. Apply validation rules.
4. Use appropriate data types.
5. Restrict unauthorised editing.
6. Conduct regular data checks.
7. Maintain accurate backup copies.
8. Train users on proper data entry.

17.0 Database Security and Privacy

17.1 Meaning of Database Security

Database security refers to the measures used to protect stored information from unauthorised access, modification, disclosure, destruction or loss.

17.2 Importance of Database Security

1. Protects confidential information.
2. Prevents unauthorised access.
3. Reduces the risk of data loss.
4. Protects organisational records.
5. Maintains customer and learner privacy.
6. Prevents unauthorised modification.
7. Supports trust in an organisation.

17.3 Database Security Measures

1. **Strong passwords:** Use passwords that are difficult to guess.
2. **User accounts:** Give each authorised user an individual account.
3. **Access permissions:** Allow users to access only the information needed for their duties.
4. **Encryption:** Protect information by converting it into a form that unauthorised users cannot easily understand.
5. **Antivirus protection:** Use appropriate security software to help detect malicious programs.
6. **Software updates:** Install security updates to address known vulnerabilities.
7. **Physical security:** Restrict access to computers and servers storing sensitive information.
8. **Audit logs:** Keep records of important database activities.
9. **Secure networks:** Use appropriate network protection.
10. **Backup:** Maintain secure copies of important records.

17.4 Meaning of Data Privacy

Data privacy refers to the proper handling and protection of personal information, including how it is collected, used, stored and shared.

17.5 Data Protection in Kenya

The Data Protection Act, 2019 provides a legal framework for the processing of personal data in Kenya.

Organisations handling personal information should observe relevant requirements, including:

- Collecting personal information for legitimate purposes.
- Using personal information fairly and lawfully.
- Keeping personal information accurate.
- Protecting personal information against unauthorised access.
- Avoiding unnecessary collection of personal information.

- Respecting applicable rights of data subjects.
- Sharing personal information only where legally permitted.

Examples of personal information that requires protection:

- Names.
- Telephone numbers.
- Home addresses.
- Identification details.
- Examination records.
- Medical information.
- Financial information.

17.6 Responsible Use of School Databases

Schools should:

1. Allow access only to authorised staff.
2. Protect learners' personal information.
3. Avoid sharing confidential records unnecessarily.
4. Use secure passwords.
5. Keep accurate records.
6. Back up important information.
7. Follow applicable data protection requirements.

18.0 Database Backup and Recovery

18.1 Meaning of Database Backup

A database backup is a copy of database information stored separately so that it can be restored if the original data is lost, damaged or corrupted.

18.2 Importance of Database Backup

1. Protects against accidental deletion.
2. Helps recover information after computer failure.
3. Protects against certain malware incidents.
4. Supports business continuity.
5. Preserves important organisational records.
6. Reduces the impact of unexpected data loss.

18.3 Types of Database Backup

1. **Full backup:** Copies the entire database.
2. **Incremental backup:** Copies changes made since the most recent backup.
3. **Differential backup:** Copies changes made since the last full backup.

4. **Cloud backup:** Stores backup copies using a secure cloud service.

18.4 Meaning of Database Recovery

Database recovery is the process of restoring a database to a usable state after data loss, corruption or system failure.

18.5 Good Backup Practices

- Back up information regularly.
- Keep copies in secure locations.
- Use more than one storage location where appropriate.
- Restrict access to backup copies.
- Test backups to confirm that they can be restored.
- Keep backup schedules.
- Protect backup media from damage.

19.0 Sharing and Collaboration in Database Management

19.1 Meaning of Database Sharing

Database sharing is the process of allowing authorised users to access common database information.

19.2 Importance of Database Sharing

1. Improves teamwork.
2. Reduces unnecessary duplication of records.
3. Enables timely access to information.
4. Improves communication.
5. Supports coordination between departments.
6. Helps users make informed decisions.

19.3 Examples of Database Sharing

- Teachers accessing authorised learner records.
- Hospital departments accessing authorised patient information.
- A cooperative's authorised staff accessing farmer delivery records.
- Business departments accessing shared inventory records.
- Library staff accessing common book records.

19.4 Challenges of Database Sharing

1. Unauthorised access.
2. Accidental modification of records.
3. Conflicting updates.
4. Network interruptions.
5. Privacy concerns.

6. Data duplication where systems are poorly integrated.

19.5 Ways of Improving Database Collaboration

- Assign user roles.
- Apply access permissions.
- Maintain audit logs.
- Use suitable multi-user database systems.
- Train users.
- Establish clear data-sharing procedures.
- Protect information during transmission.

20.0 Applications of DBMS in Real-Life Situations

Database management systems are used in many sectors.

20.1 Education

Schools and learning institutions use databases to manage:

- Learner registration.
- Examination results.
- Attendance records.
- Teacher information.
- Subject selection.
- Library records.
- Fee payment records.

Example: A school can use a database to identify learners who have not completed their registration details.

20.2 Healthcare

Hospitals and health facilities use databases to manage:

- Patient registration.
- Appointment records.
- Medical histories.
- Laboratory results.
- Pharmacy records.
- Billing information.

Example: An authorised healthcare worker can retrieve a patient's medical information to support appropriate care.

20.3 Banking and Finance

Banks use databases to manage:

- Customer records.

- Account details.
- Transactions.
- Loan applications.
- Payment records.
- Financial reports.

20.4 Agriculture

Farmers' organisations and agricultural institutions use databases to manage:

- Farmer registration.
- Farm sizes.
- Crop production.
- Livestock records.
- Agricultural inputs.
- Produce deliveries.
- Market prices.

Example: A farmers' cooperative can use a database to record the quantities of maize delivered by registered farmers.

20.5 Business and Retail

Businesses use databases to manage:

- Customer information.
- Stock records.
- Product prices.
- Sales transactions.
- Supplier details.
- Employee records.

20.6 Transport

Transport organisations use databases to manage:

- Vehicle registration details.
- Passenger records.
- Route information.
- Booking records.
- Vehicle maintenance.
- Delivery schedules.

20.7 Government Institutions

Government departments use databases to manage authorised records relating to:

- Public services.
- Revenue collection.
- Population records.
- Licences.
- Public employees.
- Service delivery.

20.8 Libraries

Libraries use databases to manage:

- Book titles.
- Authors.
- Book categories.
- Borrower details.
- Borrowing dates.
- Return dates.

20.9 Community Organisations

Community groups and non-governmental organisations use databases to manage:

- Membership records.
- Project information.
- Donations.
- Community activities.
- Beneficiary records.

21.0 Practical Activity: Designing a School Database

21.1 Activity Description

Learners are required to design a simple database for managing learner information and examination results in a school.

21.2 Objectives

By the end of the activity, learners should be able to:

1. Select a suitable DBMS.
2. Create a database file.
3. Create tables.
4. Define fields and data types.
5. Set primary keys.

6. Establish relationships.
7. Enter records.
8. Create queries.
9. Design forms.
10. Generate reports.

21.3 Selecting a Suitable DBMS

Possible tools include:

- Microsoft Access.
- Apache OpenOffice Base.
- MySQL.
- MariaDB.

For a basic desktop-based school database project, Microsoft Access or OpenOffice Base may be suitable.

21.4 Designing the Database Tables

Create a database named:

SchoolManagementDB

Create the following tables.

Table 1: Learners

Field Name	Data Type	Description
AdmissionNo	Short Text	Unique learner number
FirstName	Short Text	Learner's first name
LastName	Short Text	Learner's surname
Gender	Short Text	Learner's gender
Grade	Number	Current grade

Table 2: Subjects

Field Name	Data Type	Description
SubjectCode	Short Text	Unique subject code
SubjectName	Short Text	Name of subject
TeacherName	Short Text	Subject teacher

Table 3: ExaminationResults

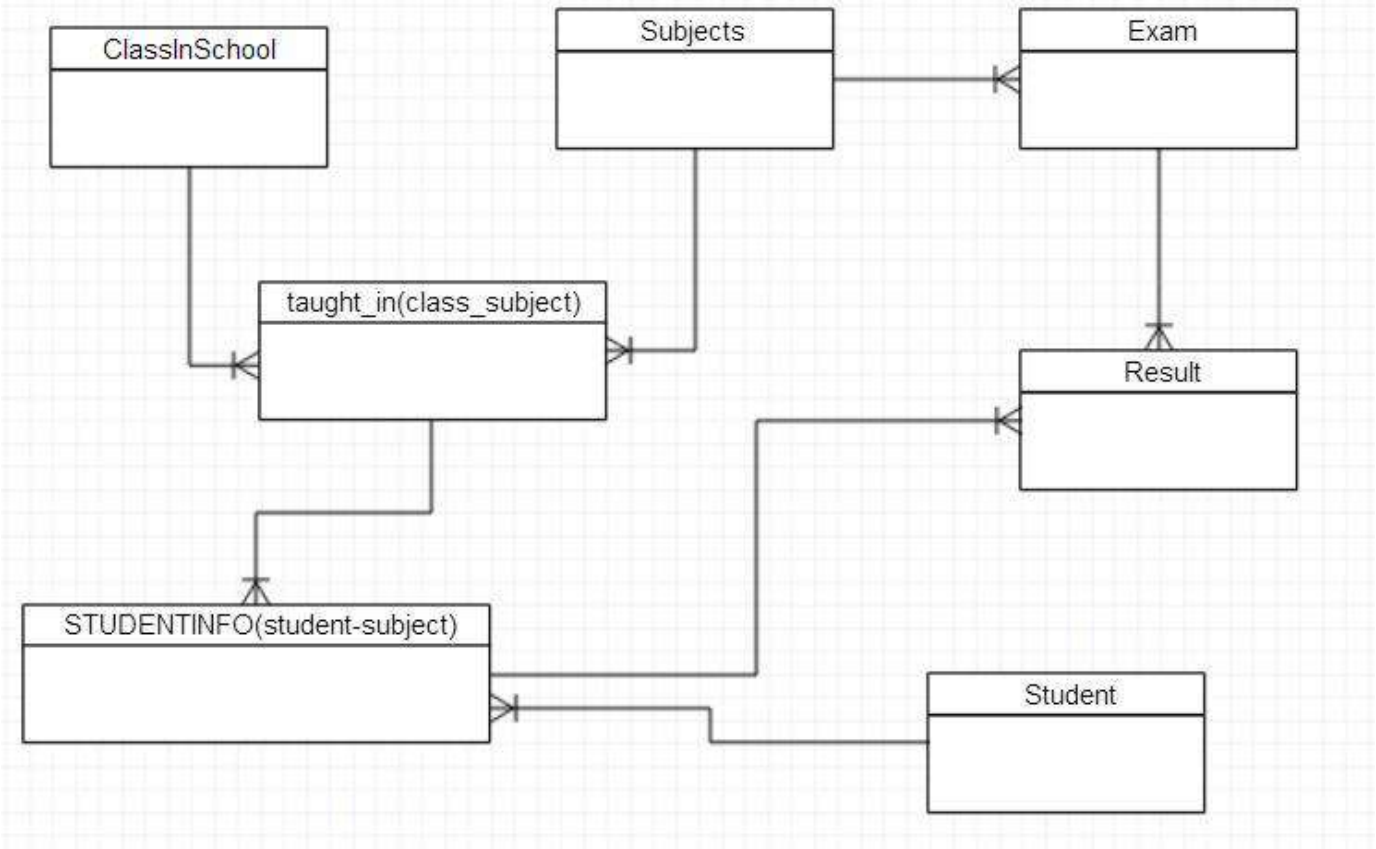
Field Name	Data Type	Description
ResultID	AutoNumber	Unique result identifier
AdmissionNo	Short Text	Learner reference
SubjectCode	Short Text	Subject reference
Marks	Number	Marks obtained
AssessmentDate	Date/Time	Date of assessment

21.5 Establishing Relationships

- AdmissionNo in Learners is the primary key.
- SubjectCode in Subjects is the primary key.
- ResultID in ExaminationResults is the primary key.
- AdmissionNo in ExaminationResults is a foreign key.
- SubjectCode in ExaminationResults is a foreign key.

The relationships are:

- One learner can have many examination results.
- One subject can appear in many examination results.



21.6 Practical Tasks

1. Open the selected DBMS.
2. Create a database named SchoolManagementDB.
3. Create the Learners table.
4. Create the Subjects table.
5. Create the ExaminationResults table.
6. Assign appropriate data types.
7. Set primary keys.
8. Establish relationships.
9. Enter sample records.
10. Create a query to display Grade 11 learners.
11. Create a form for registering learners.
12. Create a report showing examination results.
13. Save the database.
14. Back up the database file.

21.7 Sample SQL Query

To retrieve all Grade 11 learners:

```
SELECT *
FROM Learners
WHERE Grade = 11;
```

To retrieve learners who scored above 70 marks:

```
SELECT *
FROM ExaminationResults
WHERE Marks > 70;
```

21.8 Assessment Rubric

Assessment area	Marks
Creating the database	2
Creating appropriate tables	4
Selecting correct data types	3
Setting primary and foreign keys	3
Establishing relationships	3
Entering records	2
Creating a query	2

Designing a form	1
Generating a report	1
Saving and backing up the database	1
Total	22

22.0 Challenges Experienced When Using DBMS

1. **High initial cost:** Some database applications require expensive licences and infrastructure.
2. **Technical complexity:** Some DBMS tools require specialised knowledge.
3. **Data loss:** Hardware failure or accidental deletion may cause data loss.
4. **Security threats:** Databases may be exposed to unauthorised access.
5. **System failure:** Software or hardware problems may interrupt database operations.
6. **Training requirements:** Users may require training to operate the system correctly.
7. **Maintenance costs:** Databases may require regular updates and technical support.
8. **Data entry errors:** Incorrect information may affect the quality of reports.
9. **Compatibility problems:** Some systems may not work well with existing software.
10. **Network dependence:** Shared databases may become unavailable during network interruptions.

22.1 Possible Solutions

Challenge	Possible solution
High cost	Select affordable or suitable open-source tools.
Technical complexity	Provide user training.
Data loss	Maintain regular backups.
Security threats	Use strong access controls and security updates.
System failure	Provide maintenance and recovery procedures.
Data entry errors	Apply validation rules and verification.
Compatibility problems	Check system requirements before installation.
Network interruptions	Establish suitable recovery and continuity procedures.

23.0 Best Practices in Database Management

1. Plan the database before creating it.
2. Use meaningful table and field names.
3. Select appropriate data types.
4. Assign suitable primary keys.
5. Establish correct relationships.
6. Avoid unnecessary data duplication.
7. Apply data validation.
8. Protect confidential information.
9. Restrict access to authorised users.
10. Back up data regularly.
11. Test database operations.
12. Maintain accurate records.
13. Update database software where appropriate.
14. Train users.
15. Follow applicable data protection requirements.

24.0 Emerging Trends in Database Management

24.1 Cloud Databases

Cloud databases are databases hosted on cloud computing platforms and accessed through authorised network connections.

Benefits:

- Remote access.
- Flexible storage.
- Collaboration.
- Scalability.
- Reduced need for local server infrastructure in some settings.

24.2 Distributed Databases

A distributed database stores data across multiple connected locations or computers while allowing it to be managed as part of a coordinated system.

24.3 Big Data

Big data refers to extremely large and complex datasets that require specialised technologies for storage, processing and analysis.

24.4 Artificial Intelligence in Database Management

Artificial intelligence can support database-related activities such as:

- Identifying patterns.
- Supporting data analysis.
- Detecting unusual activities.
- Improving search and retrieval.
- Automating selected tasks.

24.5 Internet of Things (IoT)

IoT devices collect data from connected objects and may send it to databases for storage and analysis.

Example: Sensors on a farm can collect information about soil moisture and send the readings to a database.

24.6 Automated Database Management

Some database systems provide automated features for:

- Backup.
- Performance monitoring.
- Error detection.
- Maintenance.
- Resource management.

Key Terms and Definitions

Term	Meaning
Data	Raw facts and figures.
Information	Processed data that is meaningful.
Database	An organised collection of related data.
DBMS	Software used to manage databases.
Table	A database object containing rows and columns.
Field	A column in a database table.
Record	A row containing related information.
Data type	The kind of information a field can store.

Primary key	A field that uniquely identifies records.
Foreign key	A field used to link related tables.
Query	An instruction used to retrieve or manipulate data.
Form	A user-friendly interface for entering and viewing records.
Report	An organised presentation of database information.
ERD	A diagram showing entities and their relationships.
Entity	A person, place, object or concept about which data is stored.
Attribute	A property of an entity.
Normalisation	Organising tables to reduce duplication and improve integrity.
Validation	Checking whether entered data meets specified rules.
Data integrity	Accuracy and consistency of data.
Backup	A copy of data kept for restoration.
Recovery	Restoring data after loss or damage.
SQL	A language used to manage relational databases.
CRUD	Create, Read, Update and Delete.

REVISION QUESTIONS SET 1

SECTION A: SHORT-ANSWER QUESTIONS

1. Define the term database.
2. Explain the meaning of a Database Management System (DBMS).
3. Differentiate between a database and a DBMS.
4. State five examples of DBMS productivity tools.
5. Explain five importance of using DBMS productivity tools in managing data.
6. State four limitations of using database management systems.
7. Explain the meaning of SQL.
8. State four functions of SQL commands.
9. Differentiate between a field and a record.
10. Explain the meaning of a database file.
11. State five examples of fields that can be included in a school database.
12. Differentiate between primary keys and foreign keys.
13. State four types of databases.
14. Explain three types of database relationships.
15. Define an Entity Relationship Diagram (ERD).
16. State five benefits of using ERDs when designing databases.
17. Identify five common database objects.
18. State six examples of data types used in database management.
19. Explain the difference between sorting and filtering.
20. State five factors to consider when selecting a suitable DBMS.
21. Identify five real-life situations where databases are used.
22. State four methods of collecting data for use in a database.
23. Explain five ways of protecting information stored in a database.
24. Differentiate between data integrity and data security.
25. State five ethical practices that should be observed when managing personal information.

SECTION B: PRACTICAL AND STRUCTURED QUESTIONS

QUESTION 1: INTRODUCTION TO DBMS (10 MARKS)

a) Define the term Database Management System. (2 marks)

b) Explain four importance of DBMS in managing organisational information. (4 marks)

c) State four examples of DBMS productivity tools. (4 marks)

QUESTION 2: DATABASE ORGANISATION (10 MARKS)

A school has developed a database containing learners' personal information.

a) Explain the meaning of the following database components:

i) Field. (2 marks)

ii) Record. (2 marks)

b) State three examples of fields that can be included in the learners' table. (3 marks)

c) Identify one suitable field to use as the primary key in the learners' table. (1 mark)

d) Explain two reasons why the selected field is suitable as a primary key. (2 marks)

QUESTION 3: DATABASE TOOLS AND SQL (10 MARKS)

a) Differentiate between relational and NoSQL databases. (4 marks)

b) State the functions of the following SQL commands:

i) SELECT. (1 mark)

ii) INSERT. (1 mark)

iii) UPDATE. (1 mark)

iv) DELETE. (1 mark)

c) State two factors to consider when selecting a DBMS. (2 marks)

QUESTION 4: DATABASE DESIGN AND ERDs (10 MARKS)

a) Define an Entity Relationship Diagram. (2 marks)

b) Identify four components or symbols commonly used in an ERD. (4 marks)

c) Explain two benefits of using ERDs in database design. (2 marks)

d) Differentiate between one-to-one and one-to-many relationships. (2 marks)

QUESTION 5: PRACTICAL APPLICATION OF DATABASES (10 MARKS)

A secondary school wants to introduce a computerised database to manage learners' academic information.

a) State four types of information that should be stored in the database. (4 marks)

b) Explain three database operations that the school can perform using a DBMS. (3 marks)

c) State three security measures that should be implemented to protect the database. (3 marks)

GRADE 11 ICT SET 2

TOPICAL REVISION EXERCISES

STRAND 2.0: PRODUCTIVITY TOOLS

SUB-STRAND 2.2: DATABASE MANAGEMENT SYSTEM (DBMS)

TOTAL: 80 MARKS

SECTION A: MULTIPLE-CHOICE QUESTIONS (30 MARKS)

Instructions: Answer all questions by selecting the correct answer from the alternatives A, B, C or D.

1. What is a database?

A. A program used for drawing pictures.
B. An organised collection of related data.
C. A device used to store electricity.
D. A collection of computer games.

2. What is the main purpose of a Database Management System (DBMS)?

A. To create animations.
B. To manage, organise, store and retrieve data.
C. To browse the internet.
D. To protect computer hardware from damage.

3. Which of the following is an example of a DBMS productivity tool?

A. Microsoft PowerPoint
B. Microsoft Access
C. Microsoft Paint
D. Windows Media Player

4. Which of the following is an open-source database management system?

A. MariaDB
B. Microsoft PowerPoint
C. Adobe Photoshop
D. CorelDRAW

5. Which database tool is commonly used to create and manage relational databases?

A. Microsoft Access
B. Microsoft Word
C. Microsoft Publisher
D. Microsoft Paint

6. Which of the following is an example of a NoSQL database management system?

A. MongoDB
B. Microsoft Excel
C. Microsoft Word
D. Adobe Illustrator

7. What is a database table?

A. A physical piece of furniture.
B. An organised collection of related data arranged in rows and columns.
C. A computer's desktop background.
D. A folder containing pictures only.

8. In a database table, what is a field?

A. A complete database file.
B. A single attribute or category of information.
C. A collection of database tables.
D. A computer storage device.

9. Which of the following best describes a record in a database?

A. A single column in a table.
B. A complete set of related information about one item or entity.
C. A database software application.
D. A command used to delete a database.

10. What is a data value?

A. The actual information stored in a field.
B. The name of a database application.
C. A database security tool.
D. A type of computer network.

11. Which database component contains a collection of related tables and other database objects?

A. Database file
B. Field
C. Record
D. Data value

12. Which of the following is an example of a database application used in schools?

A. Managing learners' examination records.
B. Designing computer games.
C. Editing music files.
D. Creating animations.

13. What is the main advantage of using a DBMS instead of manually keeping records?

A. It increases duplication of information.
B. It improves data organisation and retrieval.
C. It makes data impossible to access.
D. It prevents all users from entering information.

14. Which of the following is a function of a DBMS?

A. Data sorting and searching.
B. Painting computer monitors.
C. Producing electricity.
D. Repairing computer keyboards.

15. Which database tool is developed as part of Apache OpenOffice?

A. OpenOffice Base
B. Microsoft Access
C. MongoDB
D. FileMaker Pro

16. Which of the following is a commercial database management tool?

A. FileMaker Pro
B. MariaDB
C. MongoDB Community Server
D. Apache OpenOffice Base

17. What does SQL stand for?

A. Structured Query Language
B. Standard Question List
C. System Quality Language
D. Sequential Query Link

18. What is the main purpose of SQL?

A. To create computer illustrations.
B. To communicate with and manipulate relational databases.
C. To edit video recordings.
D. To design presentation slides.

19. Which SQL command is used to retrieve data from a database?

A. DELETE
B. UPDATE
C. SELECT
D. DROP

20. Which SQL command is used to add new records to a database table?

A. INSERT
B. SELECT
C. DROP
D. ALTER

21. What is an Entity Relationship Diagram (ERD)?

A. A diagram used to represent the structure and relationships of database entities.
B. A diagram showing computer hardware components only.
C. A chart used for displaying weather conditions.
D. A tool used to calculate examination grades.

22. Which of the following is commonly represented by a rectangle in an ERD?

A. Attribute
B. Entity
C. Relationship
D. Data value

23. In database design, what does a primary key do?

A. It deletes duplicate tables automatically.
B. It uniquely identifies each record in a table.
C. It changes the colour of a database.
D. It stores all database files in one field.

24. What is a foreign key?

A. A key used to access another country's database.
B. A field that links one table to another by referring to a key in another table.
C. A password used to start a computer.
D. A key used to delete database records.

25. Which of the following is an important consideration when selecting a DBMS?

A. The colour of the computer monitor.
B. The size and nature of the data to be managed.
C. The type of computer wallpaper.
D. The number of desktop icons.

26. Which DBMS would be most suitable for a school managing learners' admission records, examination results and attendance?

A. A suitable relational database system.
B. A video editing application.
C. A graphics design application.
D. A music production application.

27. What is data redundancy?

A. Unnecessary repetition of the same data.
B. Complete removal of all data.
C. Protection of data from unauthorised access.
D. Arrangement of data in alphabetical order.

28. Why is data validation important in database management?

A. It ensures that entered data meets specified rules.
B. It increases the size of the computer screen.
C. It removes the need for data storage.
D. It prevents users from viewing records.

29. Which of the following is an example of a database application in a hospital?

A. Managing patients' medical records.
B. Editing promotional videos.
C. Designing posters.
D. Playing computer games.

30. Which practice helps protect information stored in a database?

A. Sharing passwords with everyone.
B. Deleting backup files.
C. Using access controls and regular backups.
D. Allowing unauthorised users to modify records.

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

Instructions: Answer all questions. Write your answers clearly and give relevant examples where necessary.

QUESTION 1: INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS (8 MARKS)

a) Define the term database. (2 marks)

b) Explain three reasons why organisations use Database Management Systems (DBMS) to manage data. (3 marks)

c) State three examples of organisations that use databases in their daily operations. (3 marks)

QUESTION 2: DATABASE STRUCTURE AND ORGANISATION (8 MARKS)

a) Differentiate between each of the following database components:

i) Field and record. (2 marks)

ii) Database file and table. (2 marks)

b) A school maintains a database containing learners' information with the following fields:

- Admission Number
- Learner's Name
- Gender
- Class
- Date of Birth

i) Identify the most suitable field to use as the primary key. (1 mark)

ii) Give three examples of records that could be stored in the table. (3 marks)

QUESTION 3: DATABASE MANAGEMENT TOOLS (8 MARKS)

a) State four examples of Database Management System productivity tools. (4 marks)

b) Explain any two factors to consider when selecting a suitable DBMS for an organisation. (4 marks)

QUESTION 4: DATABASE OPERATIONS AND SQL (8 MARKS)

a) Explain the meaning of SQL. (2 marks)

b) State the function of each of the following SQL commands:

i) SELECT (1 mark)

ii) INSERT (1 mark)

iii) UPDATE (1 mark)

iv) DELETE (1 mark)

c) Give two examples of database operations that can be performed using a DBMS. (2 marks)

QUESTION 5: DATABASE DESIGN AND ENTITY RELATIONSHIP DIAGRAMS (8 MARKS)

a) Define an Entity Relationship Diagram (ERD). (2 marks)

b) State three benefits of using ERDs when designing databases. (3 marks)

c) Differentiate between a primary key and a foreign key. (2 marks)

d) Name one symbol commonly used to represent an entity in an ERD. (1 mark)

QUESTION 6: PRACTICAL APPLICATION OF DBMS (10 MARKS)

A secondary school intends to develop a database to manage learners' academic information.

a) Identify four types of information that should be stored in the learners' database. (4 marks)

b) Explain three ways in which the school would benefit from using a DBMS instead of keeping manual records. (3 marks)

c) State three security measures that should be implemented to protect the learners' database. (3 marks)

MARKING SCHEME

SECTION A: MULTIPLE-CHOICE QUESTIONS (30 MARKS)

Award 1 mark for each correct answer.

Question	Answer	Question	Answer
1	B	16	A
2	B	17	A
3	B	18	B
4	A	19	C
5	A	20	A
6	A	21	A
7	B	22	B
8	B	23	B
9	B	24	B
10	A	25	B
11	A	26	A
12	A	27	A
13	B	28	A
14	A	29	A
15	A	30	C

Total: 30 marks

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

QUESTION 1: INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS (8 MARKS)

a) Define the term database. (2 marks)

- A database is an organised collection of related data stored electronically or in another organised format for easy access, management, retrieval and updating. (2 marks)

b) Explain three reasons why organisations use DBMS to manage data. (3 marks)

Award 1 mark for each well-explained point.

1. Easy data retrieval: Enables users to search and retrieve required information quickly.
2. Data organisation: Helps arrange information systematically in tables, records and fields.
3. Data security: Provides mechanisms for controlling access to stored information.
4. Reduced data redundancy: Minimises unnecessary duplication of information.
5. Data sharing: Allows authorised users to access and share information.
6. Data updating: Makes it easier to modify existing information.
7. Data integrity: Helps maintain accurate and consistent information.

8. Backup and recovery: Supports the protection and restoration of data.

Any three well-explained points. (3 × 1 = 3 marks)

c) State three examples of organisations that use databases. (3 marks)

1. Schools and educational institutions.
2. Hospitals and healthcare facilities.
3. Banks and financial institutions.
4. Government departments.
5. Supermarkets and retail businesses.
6. Insurance companies.
7. Hotels and travel agencies.

Any three. (3 × 1 = 3 marks)

QUESTION 2: DATABASE STRUCTURE AND ORGANISATION (8 MARKS)

a) Differentiate between the following:

i) Field and record. (2 marks)

- Field: A single category or attribute of information in a database table, represented by a column. (1 mark)
- Record: A complete collection of related fields describing one person, object or item, represented by a row. (1 mark)

ii) Database file and table. (2 marks)

- Database file: A file that contains an organised database and may include tables and other database objects. (1 mark)
- Table: A database object that stores related information in rows and columns. (1 mark)

b) School learners' database

i) Identify the most suitable field to use as the primary key. (1 mark)

- Admission Number. (1 mark)

ii) Give three examples of records that could be stored in the table. (3 marks)

Any three correctly constructed sample records.

Admission Number	Learner's Name	Gender	Class	Date of Birth
001	John Mwangi	Male	Grade 11	12/05/2009
002	Mary Wanjiku	Female	Grade 11	20/08/2009
003	Peter Kiptoo	Male	Grade 10	15/03/2010

Award 1 mark for each correctly constructed record, with relevant field values.

QUESTION 3: DATABASE MANAGEMENT TOOLS (8 MARKS)

a) State four examples of DBMS productivity tools. (4 marks)

1. Microsoft Access.

2. SQL (Structured Query Language).
3. Apache OpenOffice Base.
4. FileMaker Pro.
5. MariaDB.
6. Grist.
7. Knack.
8. MongoDB.

Any four. (4 × 1 = 4 marks)

b) Explain any two factors to consider when selecting a suitable DBMS. (4 marks)

Award 2 marks for each well-explained factor.

1. Cost: The organisation should consider the purchase, licensing, installation and maintenance costs of the DBMS.

2. Ease of use: The selected tool should be easy for users to learn, operate and manage.

3. Data storage capacity: It should support the amount of data the organisation intends to store.

4. Security features: It should provide adequate protection against unauthorised access and data loss.

5. Compatibility: It should work well with the organisation's existing hardware, software and operating systems.

6. Scalability: It should accommodate future growth in the volume of data and number of users.

7. Technical support: Availability of documentation, updates and technical assistance should be considered.

8. Performance: It should process queries and retrieve information efficiently.

Any two well-explained factors. (2 × 2 = 4 marks)

QUESTION 4: DATABASE OPERATIONS AND SQL (8 MARKS)

a) Explain the meaning of SQL. (2 marks)

- SQL stands for Structured Query Language. (1 mark)
- It is a language used to create, retrieve, manipulate and manage data in relational databases. (1 mark)

b) State the function of each SQL command.

i) SELECT (1 mark)

- Used to retrieve or display information from a database table.

ii) INSERT (1 mark)

- Used to add new records into a database table.

iii) UPDATE (1 mark)

- Used to modify or change existing records in a database table.

iv) DELETE (1 mark)

- Used to remove existing records from a database table.

c) Give two examples of database operations that can be performed using a DBMS. (2 marks)

1. Sorting records.
2. Searching for specific information.
3. Filtering records.
4. Adding new records.
5. Editing existing records.
6. Deleting unwanted records.
7. Generating reports.
8. Creating tables.

Any two. (2 × 1 = 2 marks)

QUESTION 5: DATABASE DESIGN AND ENTITY RELATIONSHIP DIAGRAMS (8 MARKS)

a) Define an Entity Relationship Diagram (ERD). (2 marks)

- An ERD is a visual representation of the structure of a database. (1 mark)
- It shows entities, their attributes and the relationships between them. (1 mark)

b) State three benefits of using ERDs when designing databases. (3 marks)

1. They help visualise the structure of a database.
2. They show relationships between different entities.
3. They help identify the attributes required for each entity.
4. They help identify primary and foreign keys.
5. They reduce errors during database design.
6. They make database structures easier to understand and communicate.

Any three. (3 × 1 = 3 marks)

c) Differentiate between a primary key and a foreign key. (2 marks)

- Primary key: A field that uniquely identifies each record in a table. (1 mark)
- Foreign key: A field in one table that refers to a primary key in another table to establish a relationship between the tables. (1 mark)

d) Name one symbol commonly used to represent an entity in an ERD. (1 mark)

- Rectangle. (1 mark)

QUESTION 6: PRACTICAL APPLICATION OF DBMS (10 MARKS)

a) Identify four types of information that should be stored in the learners' database. (4 marks)

1. Admission number.
2. Learner's full name.
3. Gender.
4. Date of birth.
5. Class or grade.

6. Parent or guardian contact details.
7. Examination results.
8. Attendance records.
9. Address.
10. Enrolment date.

Any four. (4 × 1 = 4 marks)

b) Explain three ways in which the school would benefit from using a DBMS instead of keeping manual records. (3 marks)

Award 1 mark for each well-explained point.

1. Faster retrieval: Teachers can quickly search for learners' details and examination results.
2. Easy updating: Learners' information can be modified without rewriting entire records.
3. Improved accuracy: Validation features help reduce data-entry errors.
4. Better storage: Large amounts of information can be stored systematically.
5. Easy report generation: The school can generate examination and attendance reports quickly.
6. Data security: Access permissions help prevent unauthorised users from accessing information.
7. Reduced paperwork: Less physical storage space and paper are required.

Any three. (3 × 1 = 3 marks)

c) State three security measures that should be implemented to protect the learners' database. (3 marks)

1. Use strong passwords.
2. Restrict access to authorised users.
3. Perform regular database backups.
4. Install and update antivirus software.
5. Use encryption to protect sensitive information.
6. Install firewalls.
7. Keep database software updated.
8. Use user authentication mechanisms.
9. Maintain secure storage of backup copies.

Any three. (3 × 1 = 3 marks)

STRAND: INTERNET AND WEB TECHNOLOGIES

SUBSTRAND: WEB AUTHORING

1.0 INTRODUCTION TO WEB AUTHORING

1.1 Meaning of web authoring

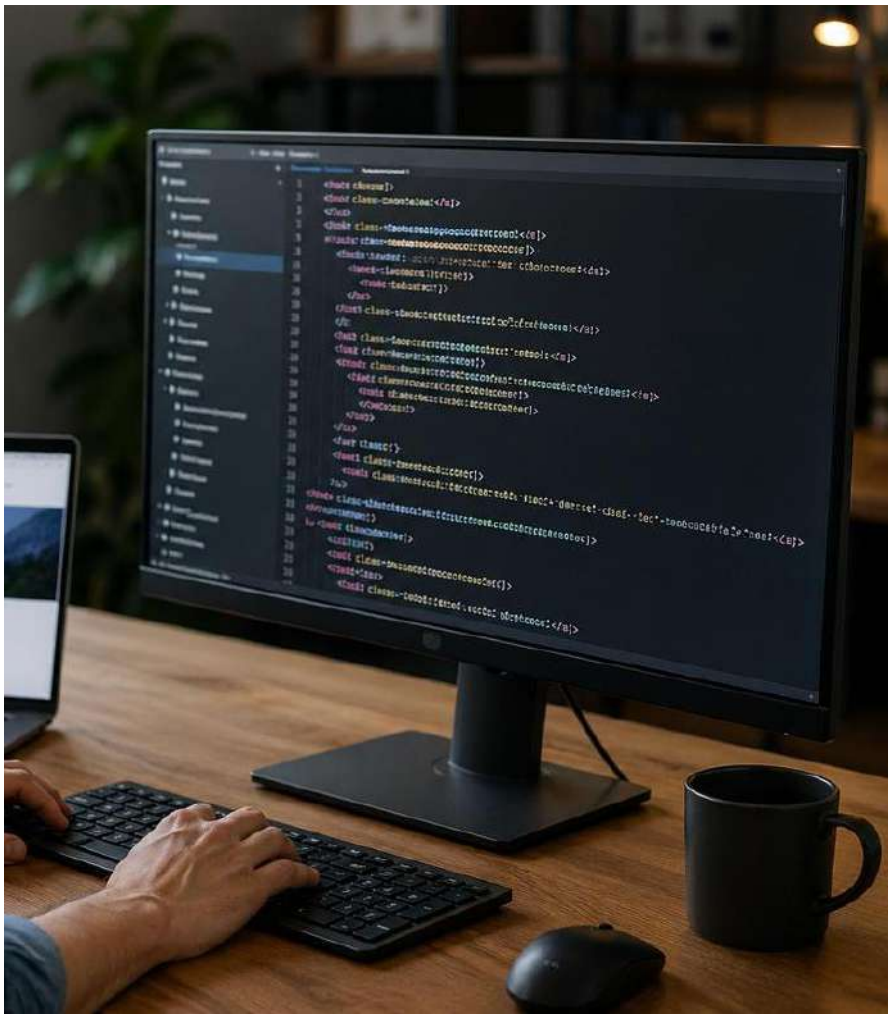
Web authoring is the process of creating, designing, editing and maintaining webpages and websites using web technologies and specialised software.

It involves developing webpages that contain text, images, videos, hyperlinks, tables, forms, animations and other interactive features.

Web authoring enables individuals and organisations to communicate information through the World Wide Web.

Examples of activities involved in web authoring:

1. Creating a school website.
2. Designing an online shopping website.
3. Developing an educational webpage.
4. Creating a personal portfolio.
5. Designing a news and information website.
6. Developing an online registration system.



1.2 Objectives of web authoring

Web authoring is carried out to:

1. Create webpages for displaying information.
2. Develop websites for businesses and institutions.
3. Improve communication through online platforms.
4. Provide educational materials and learning resources.
5. Advertise and promote products and services.
6. Facilitate online shopping and electronic transactions.
7. Create interactive platforms for users.
8. Share multimedia content such as pictures, videos and audio.
9. Provide access to information from different geographical locations.
10. Support online collaboration and information exchange.

1.3 Importance of web authoring

Web authoring is important because it:

- Enables organisations to establish an online presence.
- Makes information available to many people.
- Supports online learning and teaching.
- Promotes businesses and commercial activities.
- Improves communication between organisations and customers.
- Enables users to access services at any time.
- Supports creativity and innovation.
- Provides employment opportunities in web development.
- Allows information to be updated whenever necessary.

2.0 BASIC ELEMENTS OF WEB TECHNOLOGY

Web technology refers to the tools, languages, applications, protocols and systems used to create, access and manage information on the World Wide Web.

The main elements include webpages, websites, web browsers, web authoring software and web servers.

2.1 Webpage

A webpage is a single electronic document available on the World Wide Web that can be accessed using a web browser.

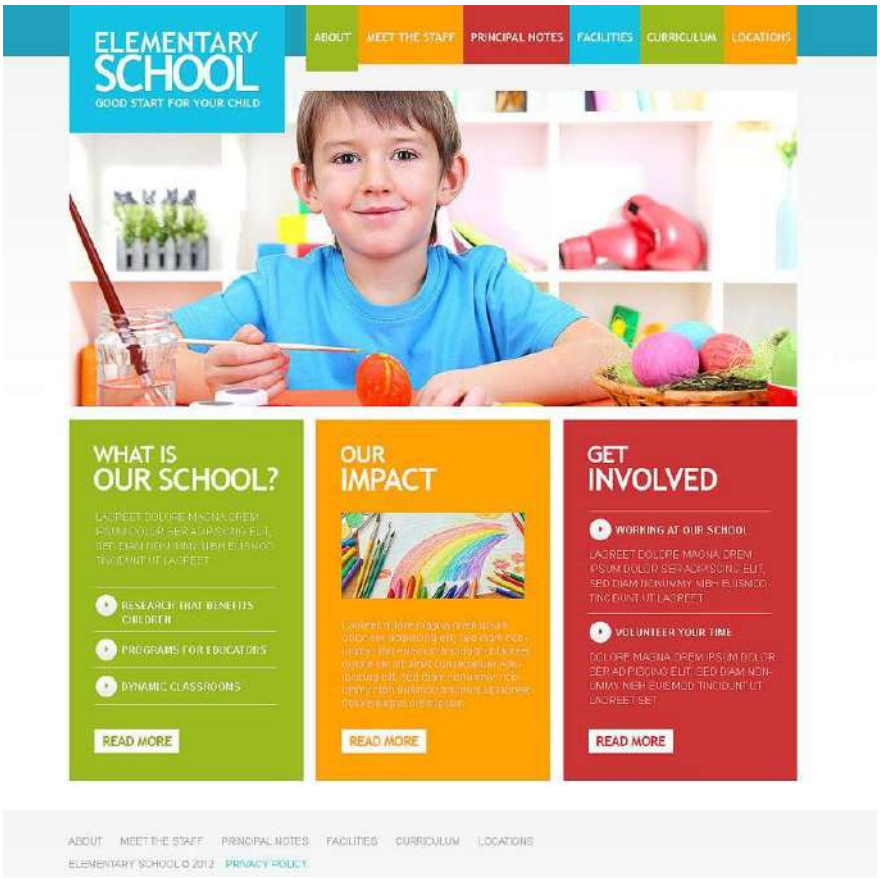
A webpage may contain text, images, hyperlinks, audio, videos, tables and other multimedia elements.

Webpages are commonly created using HTML and styled using CSS.

Examples of webpages:

- Home page of a school website.
- Contact page of a business website.

- About Us page of an organisation.
- Online registration page.
- News article page.



Characteristics of a webpage

1. Has a unique web address called a URL.
2. Can contain text and multimedia information.
3. Can contain hyperlinks to other webpages.
4. Can be accessed using a web browser.
5. Is usually created using HTML.
6. Can be styled using CSS.
7. May contain interactive features.
8. Can be stored on a web server.

2.2 Website

A website is a collection of related webpages that are linked together and usually share a common domain name.

A website is stored on a web server and accessed through the internet using a web browser.

Examples of websites:

- Google – search engine website.
- Wikipedia – online encyclopaedia.

- YouTube – video-sharing website.
- Kenya National Examinations Council (KNEC) – educational examinations information.
- School websites – provide information about schools.

Common pages found in a website

Webpage	Purpose
Home page	Introduces the website.
About Us	Provides background information.
Contact Us	Provides contact details.
Services	Describes services offered.
Gallery	Displays photographs and videos.
News	Provides current information.
Registration	Allows users to register.

Characteristics of a website

1. Contains two or more related webpages, although a simple website may have only one.
2. Has a common domain name.
3. Provides navigation links between webpages.
4. Is hosted on a web server.
5. Can contain multimedia information.
6. Can be accessed through a web browser.

2.3 Difference between a webpage and a website

Webpage	Website
A single document on the web.	A collection of related webpages.
Contains specific information.	Contains information organised into different pages.
Has its own URL.	Has a domain name and multiple page URLs.
Forms part of a website in most cases.	Consists of one or more webpages.
Example: Contact Us page.	Example: A school's entire website.

2.4 Web browser

A web browser is application software used to access, retrieve, interpret and display information from websites on the internet.

It enables users to view webpages containing text, images, videos, animations and hyperlinks.

Examples of web browsers



Google Chrome



Mozilla Firefox



Microsoft Edge



Safari



Opera

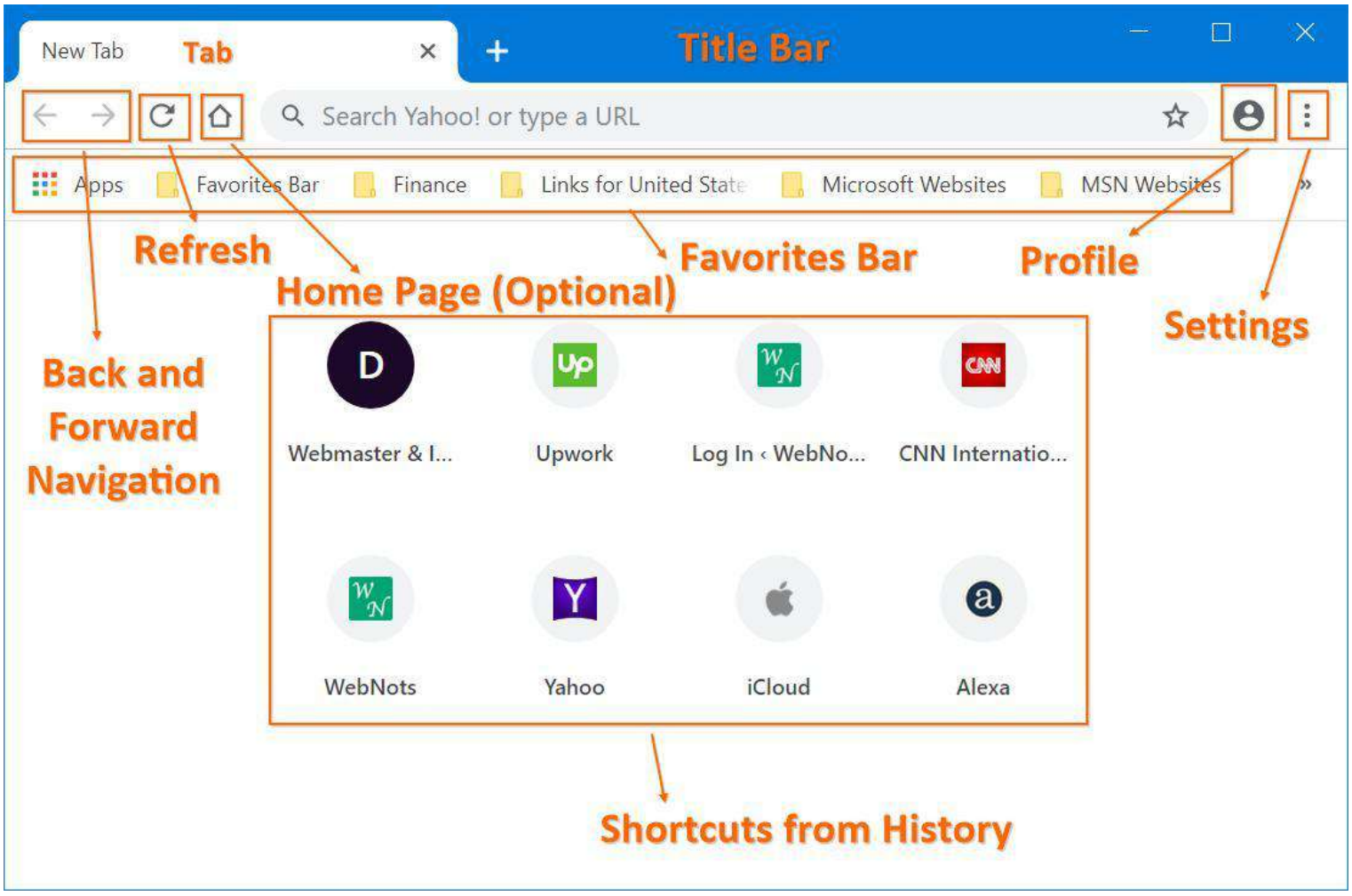


Brave

Functions of a web browser

1. Opens and displays webpages.
2. Retrieves information from web servers.
3. Interprets HTML, CSS and JavaScript.
4. Allows users to navigate between webpages.
5. Supports downloading and uploading of files.
6. Stores bookmarks for frequently visited websites.
7. Maintains browsing history.
8. Supports multiple open tabs.
9. Provides security features such as warnings about unsafe websites.
10. Stores temporary internet files in a cache to improve loading speed.

Main components of a web browser interface



1. **Title bar:** Displays the title of the browser window or active page.
2. **Tab bar:** Displays open webpages in separate tabs.
3. **Address bar:** Displays the URL of the current webpage and accepts website addresses.
4. **Back button:** Returns to the previously visited webpage.
5. **Forward button:** Moves to the next page in browsing history.

6. **Refresh button:** Reloads the current webpage.
7. **Home button:** Opens the browser's configured homepage.
8. **Bookmarks bar:** Provides quick access to saved websites.
9. **Webpage display area:** Shows the contents of the webpage.
10. **Scroll bar:** Allows users to move up and down or across a webpage.

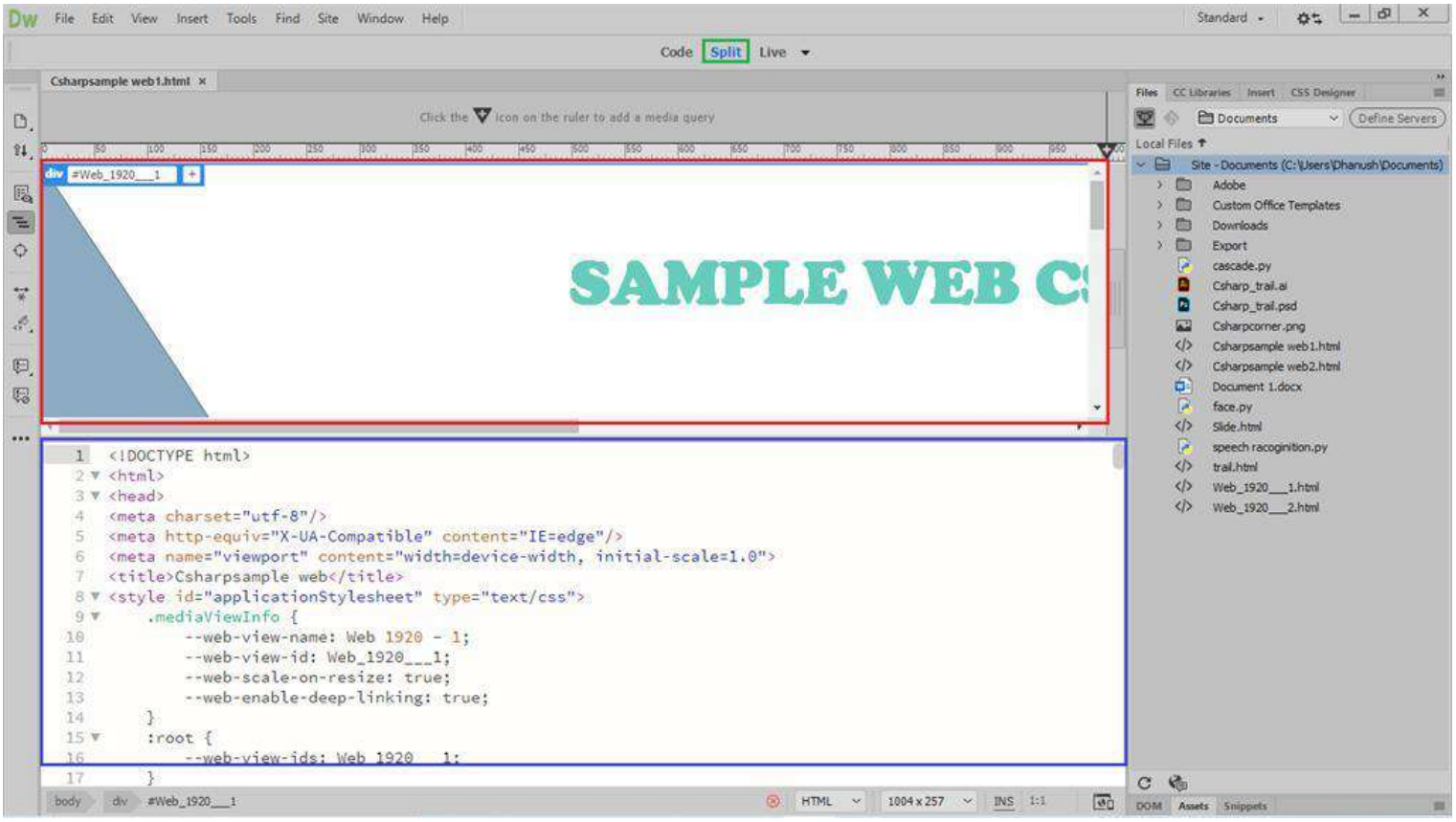
2.5 Web authoring software

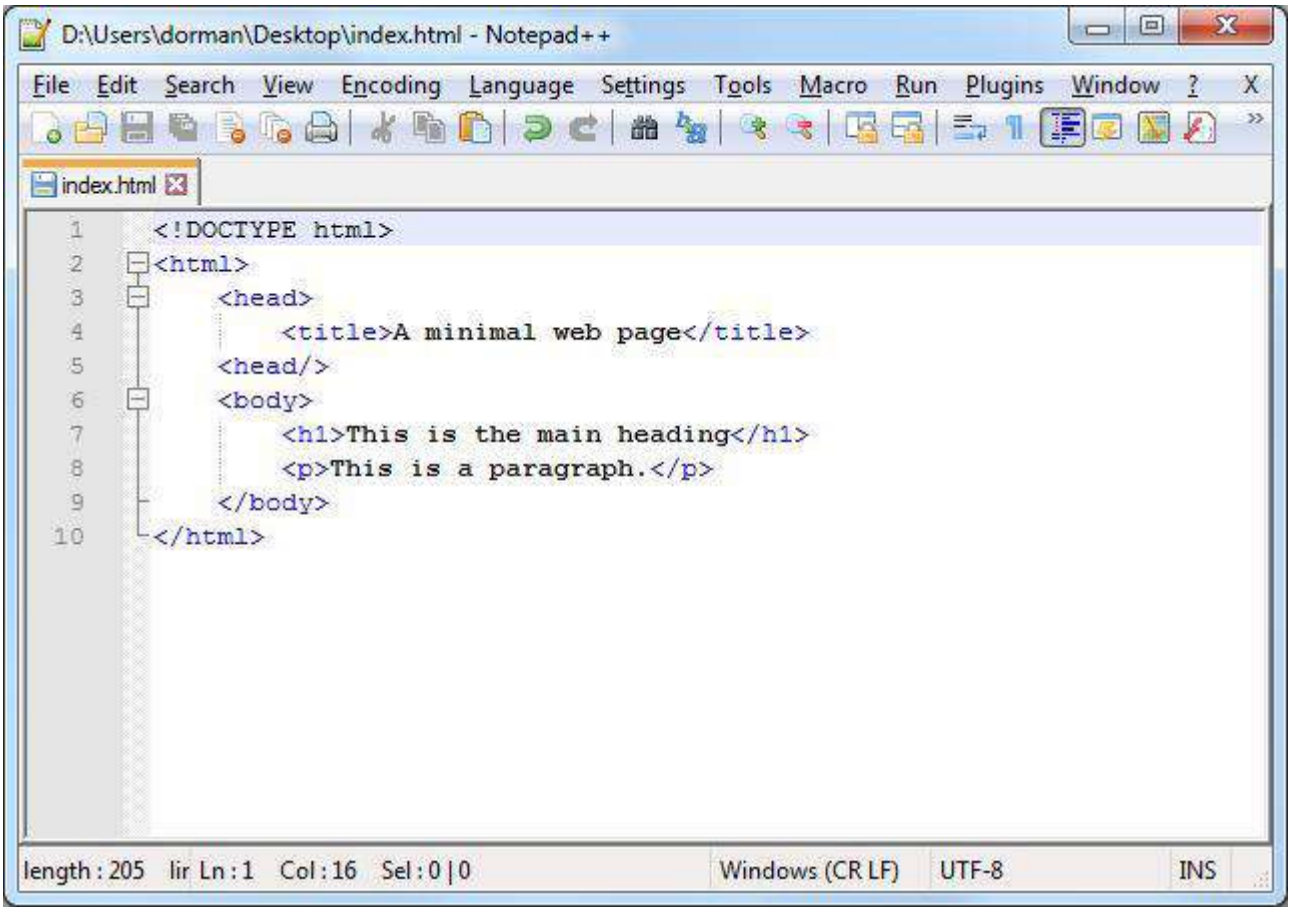
Web authoring software refers to computer applications used to create, design, edit, test and maintain webpages and websites.

The software helps web developers write HTML code, apply CSS styling and add interactive features.

Examples of web authoring software







1. **Visual Studio Code:** A source code editor used to write and edit HTML, CSS and JavaScript.
2. **Adobe Dreamweaver:** A web authoring application that supports visual webpage design and code editing.
3. **Notepad++:** A lightweight text editor that can be used to write HTML and CSS code.
4. **BlueGriffon:** A visual web authoring application.

5. **Sublime Text:** A text editor used for writing and editing website source code.

Functions of web authoring software

- Writing and editing HTML code.
- Applying CSS styles to webpages.
- Creating website layouts.
- Inserting pictures and multimedia content.
- Creating hyperlinks.
- Developing interactive webpages.
- Checking and correcting errors in code.
- Previewing webpages before publishing.
- Organising website files and folders.

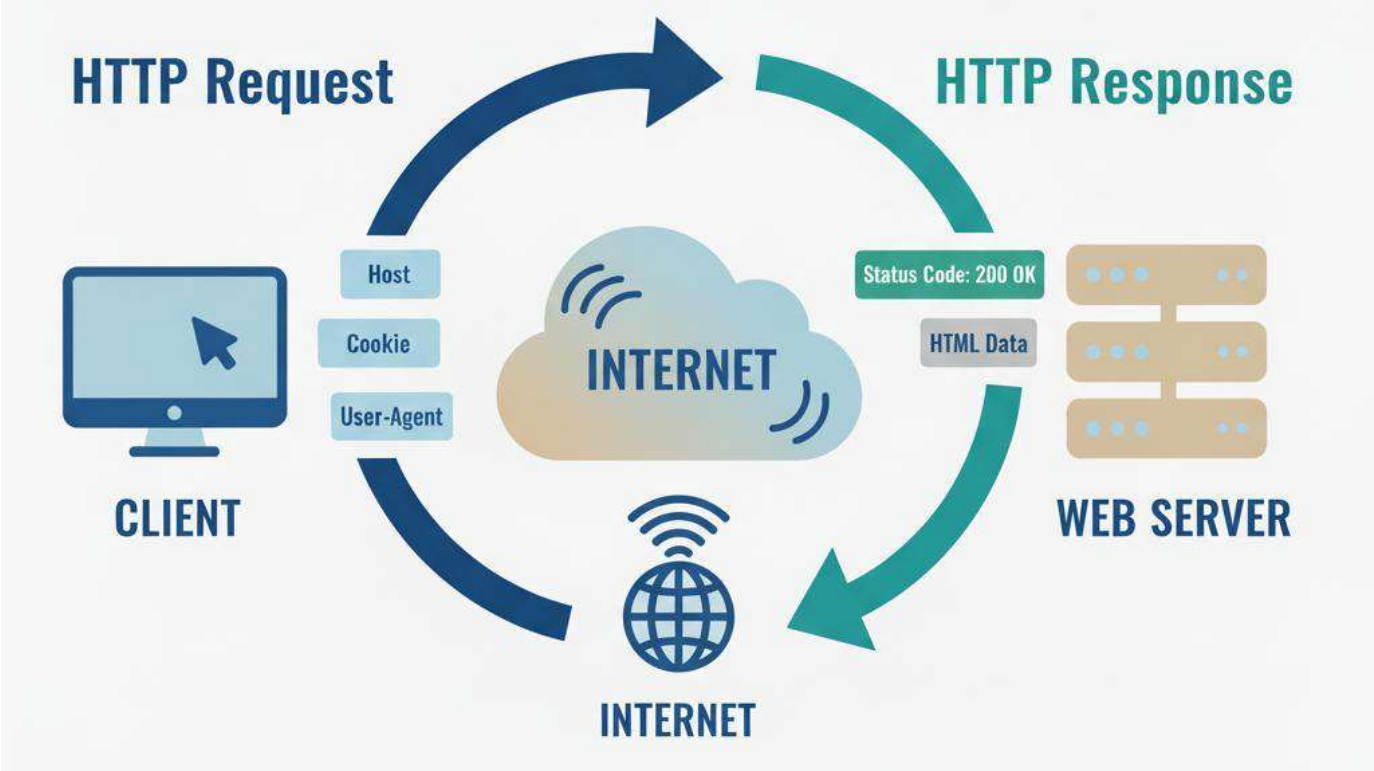
2.6 Web server

A web server is a computer system or software application that stores, processes and delivers webpages and other web resources to users through the internet or an intranet.

When a user requests a webpage through a browser, the web server receives the request and sends the required resources to the browser.

Examples of web server software

1. Apache HTTP Server.
2. Nginx.
3. Microsoft Internet Information Services (IIS).
4. LiteSpeed Web Server.



Functions of a web server

1. Stores website files such as HTML, CSS, JavaScript and images.
2. Receives requests from web browsers.
3. Sends requested webpages to users.
4. Processes certain server-side requests.
5. Manages access to website resources.
6. Supports secure communication through HTTPS.
7. Records website access information in log files.
8. Helps websites remain accessible to internet users.

How a web server works

Step 1: A user enters a website address into a web browser.

Step 2: The browser identifies the server associated with the website address.

Step 3: The browser sends a request to the web server using HTTP or HTTPS.

Step 4: The web server receives and processes the request.

Step 5: The web server sends the requested webpage files to the browser.

Step 6: The browser interprets the files and displays the webpage.

Difference between a web browser and a web server

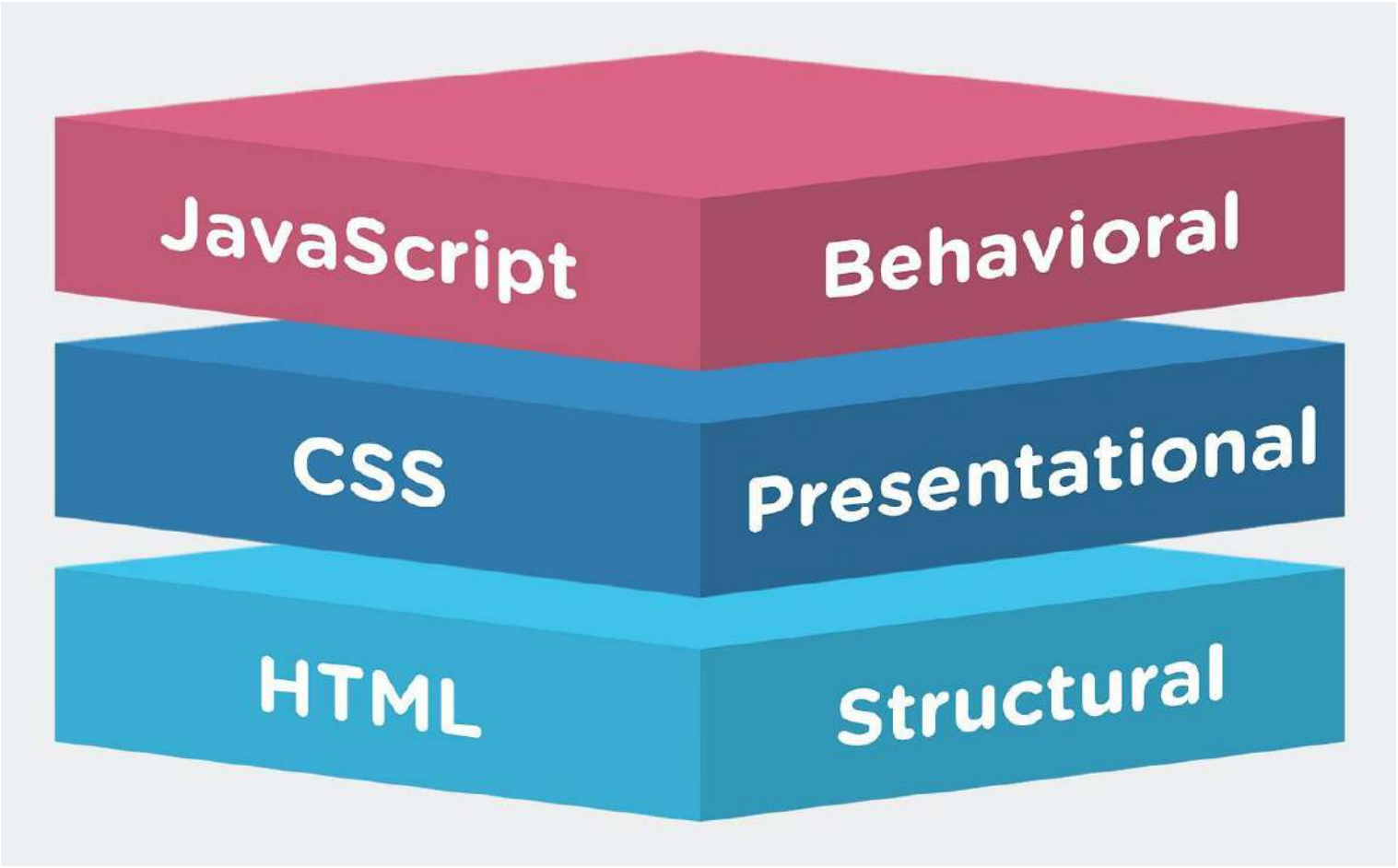
Web browser	Web server
Used to access websites.	Used to host and deliver website resources.
Installed on a user's device.	Runs on a server computer or hosting environment.
Requests webpages.	Responds to webpage requests.
Displays website content.	Stores or retrieves website content.
Examples: Chrome and Firefox.	Examples: Apache and Nginx.

3.0 LAYERS OF A WEBPAGE

A webpage can be organised into three main layers:

1. Content layer.
2. Presentation layer.
3. Behaviour layer.

Each layer performs a different function, but they work together to produce a complete and functional webpage.



3.1 Content layer

The content layer contains the actual information displayed on a webpage.

It is mainly created using HTML (HyperText Markup Language).

HTML provides the structure and meaning of webpage elements.

Examples of content layer elements

- Headings.
- Paragraphs.
- Images.
- Tables.
- Lists.
- Hyperlinks.
- Forms.
- Audio and video.

Example of HTML code

</> HTML

```
<!DOCTYPE html>
<html>
<head>
    <title>My School</title>
</head>

<body>
    <h1>Welcome to My School</h1>

    <p>Our school provides quality education.</p>
</body>
</html>
```

Explanation of the code

- <!DOCTYPE html> declares that the document uses HTML5.
- <html> identifies the beginning of the HTML document.
- <head> contains information about the webpage.
- <title> specifies the title shown on the browser tab.
- <body> contains the visible webpage content.
- <h1> creates the main heading.
- creates a paragraph.
- Closing tags such as mark the end of an element.

3.2 Presentation layer

The presentation layer determines how the webpage looks to users.

It controls the appearance and layout of webpage elements using CSS (Cascading Style Sheets).

CSS enables web developers to modify colours, fonts, sizes, spacing, borders, backgrounds and positioning.

Examples of presentation features

1. Text colour.
2. Background colour.
3. Font size.
4. Font family.
5. Text alignment.
6. Border styles.
7. Page layout.
8. Element spacing.
9. Image dimensions.
10. Responsive design.

Example of CSS code

```
h1 {
    color: blue;
    font-size: 30px;
    text-align: center;
}

p {
    color: black;
    font-family: Arial;
}
```

Explanation

- h1 selects all first-level headings.
- color determines the text colour.
- font-size determines the size of the text.
- text-align determines the horizontal alignment.
- font-family specifies the typeface.

3.3 Behaviour layer

The behaviour layer determines how a webpage responds to user actions.

It is mainly developed using JavaScript.

JavaScript enables webpages to perform actions when users click buttons, enter information, select options or interact with other elements.

Examples of behaviour layer activities

1. Displaying messages when buttons are clicked.
2. Validating information entered in forms.
3. Creating interactive menus.
4. Calculating values automatically.
5. Displaying and hiding webpage content.
6. Creating image slideshows.
7. Updating webpage information without reloading the entire page.
8. Responding to mouse and keyboard events.

Example of JavaScript code

```
<button onclick="showMessage()">
    Click Me
</button>

<script>
function showMessage() {
    alert("Welcome to our school!");
}
</script>
```

Explanation

- <button> creates a clickable button.
- onclick specifies an action when the button is clicked.
- function defines a JavaScript function.
- alert() displays a message in a dialogue box.

3.4 Summary of the three webpage layers

Layer	Technology	Main purpose
Content	HTML	Determines what appears on a webpage.
Presentation	CSS	Determines how the webpage looks.
Behaviour	JavaScript	Determines how the webpage responds to users.

Practical illustration

Consider a school website displaying the heading *WELCOME TO MEMA SCHOOL*.

- HTML creates the heading.
- CSS makes the heading blue, bold and centred.
- JavaScript can make a button display a welcome message when clicked.

The three layers work together to produce an attractive, informative and interactive webpage.

4.0 CREATING A WEBPAGE USING HTML

4.1 Meaning of HTML

HTML stands for **HyperText Markup Language**.

It is the standard markup language used to create and structure content on webpages.

HTML uses special instructions called tags or elements to tell a web browser how to organise and display information.

HTML is not a programming language because it mainly describes the structure and meaning of webpage content rather than providing general-purpose programming instructions.

4.2 Uses of HTML in web authoring

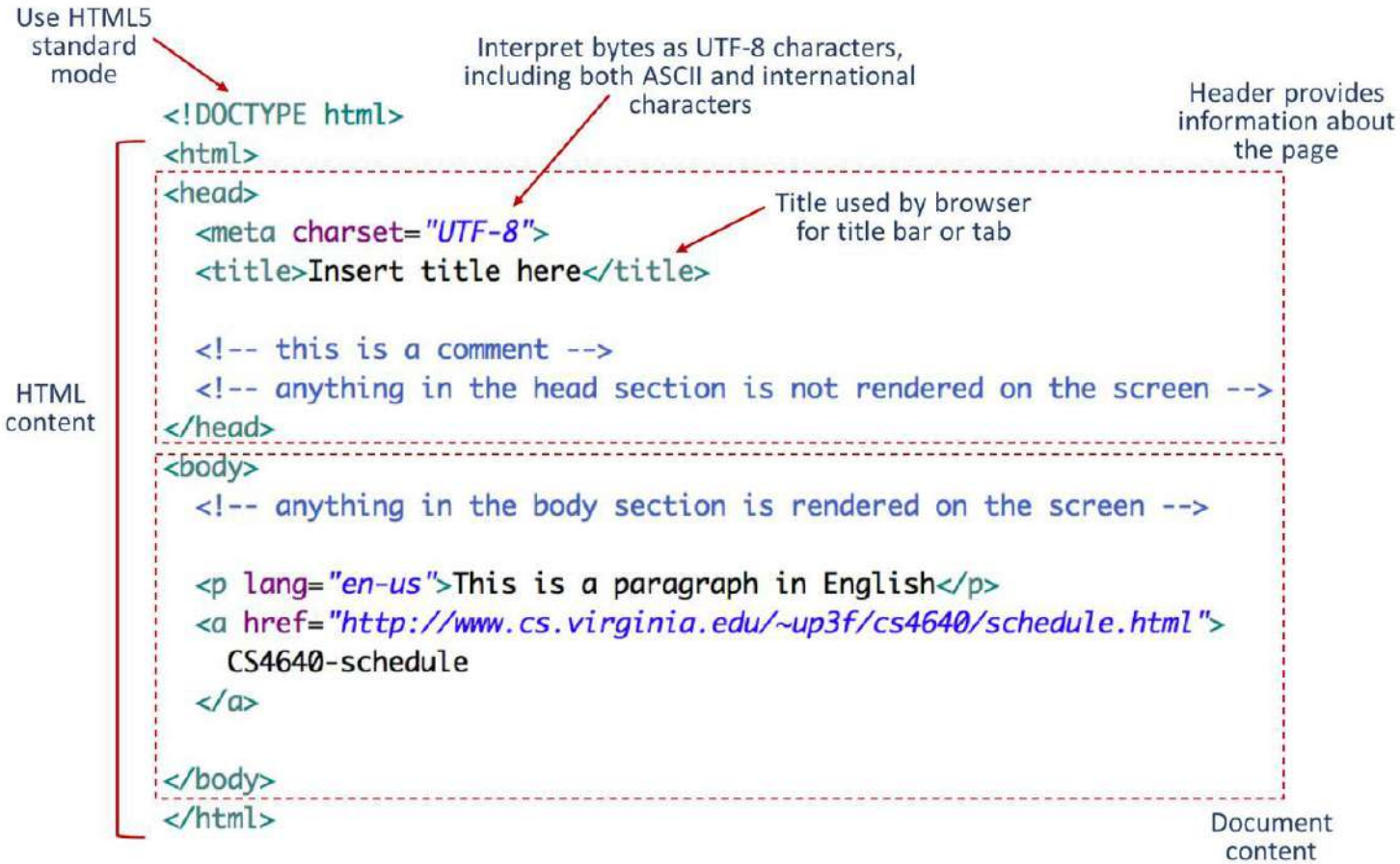
HTML is used to:

1. Create headings and paragraphs.
2. Insert images into webpages.
3. Create hyperlinks to other webpages.
4. Organise information using lists.
5. Create tables for displaying data.
6. Create forms for collecting user information.
7. Embed audio and video.
8. Structure webpage sections.
9. Organise navigation menus.
10. Provide a foundation for applying CSS and JavaScript.

4.3 Basic HTML document structure

An HTML document follows a specific structure consisting of different elements.

Illustration of a basic HTML structure



The basic structure is:

```
<!DOCTYPE html>
<html>

<head>
   <title>My First Webpage</title>
</head>

<body>

   <h1>Welcome to ICT</h1>

   <p>This is my first webpage.</p>

</body>
</html>
```

Explanation of the main HTML elements

HTML element	Function
<!DOCTYPE html>	Declares an HTML5 document.
<html>	Defines the root of an HTML document.
<head>	Contains metadata and other document information.
<title>	Specifies the browser tab title.
<body>	Contains the visible webpage content.
<h1>	Creates the main heading.
<p>	Creates a paragraph.

4.4 HTML tags and elements

An HTML tag is a keyword enclosed in angle brackets used to define an HTML element.

For example:

Welcome to our website.

In this example:

- is the opening tag.
- Welcome to our website. is the content.
- is the closing tag.
- The complete structure is called an HTML element.

Types of HTML tags

A. Paired tags

These are tags that have both an opening tag and a closing tag.

Examples:

```
<h1>My School</h1>

<p>Welcome to our school.</p>

<b>Important information</b>
```

B. Void elements

These are HTML elements that do not require closing tags.

Examples:

```
<br>

<hr>

<img src="school.jpg" alt="School building">

<input type="text">
```

4.5 Common HTML tags and their uses

Tag	Function
<html>	Defines an HTML document.
<head>	Contains document information.
<title>	Defines the webpage title.
<body>	Contains visible webpage content.

<h1> to <h6>	Create headings of different levels.
<p>	Creates a paragraph.
 	Inserts a line break.
<hr>	Inserts a horizontal line.
<b>	Makes text bold.
<i>	Makes text italic.
<u>	Underlines text.
	Indicates important text.
	Emphasises text.
<img>	Inserts an image.
<a>	Creates a hyperlink.
	Creates an unordered list.
	Creates an ordered list.
	Defines a list item.
<table>	Creates a table.
<tr>	Creates a table row.
<th>	Creates a table heading cell.
<td>	Creates a table data cell.
<form>	Creates a form.
<input>	Creates an input field.
<button>	Creates a clickable button.
<video>	Embeds video content.

<audio>	Embeds audio content.
	Groups webpage content into a block.
	Groups inline content.
<nav>	Defines navigation links.
<footer>	Defines the footer section.

4.6 HTML attributes

An HTML attribute provides additional information about an HTML element.

Attributes are normally written inside the opening tag.

Example:

```
<img src="school.jpg"
    alt="Our school"
    width="400">
```

In this example:

- src specifies the image location.
- alt provides alternative text describing the image.
- width specifies the image width.

Common HTML attributes

Attribute	Purpose
id	Gives an element a unique identifier.
class	Groups elements for styling.
src	Specifies the location of an image or media file.
href	Specifies a hyperlink destination.
alt	Provides alternative text for an image.
width	Specifies the width of an element.
height	Specifies the height of an element.
style	Applies inline CSS styling.
title	Provides additional information about an element.
target	Specifies where a linked document opens.

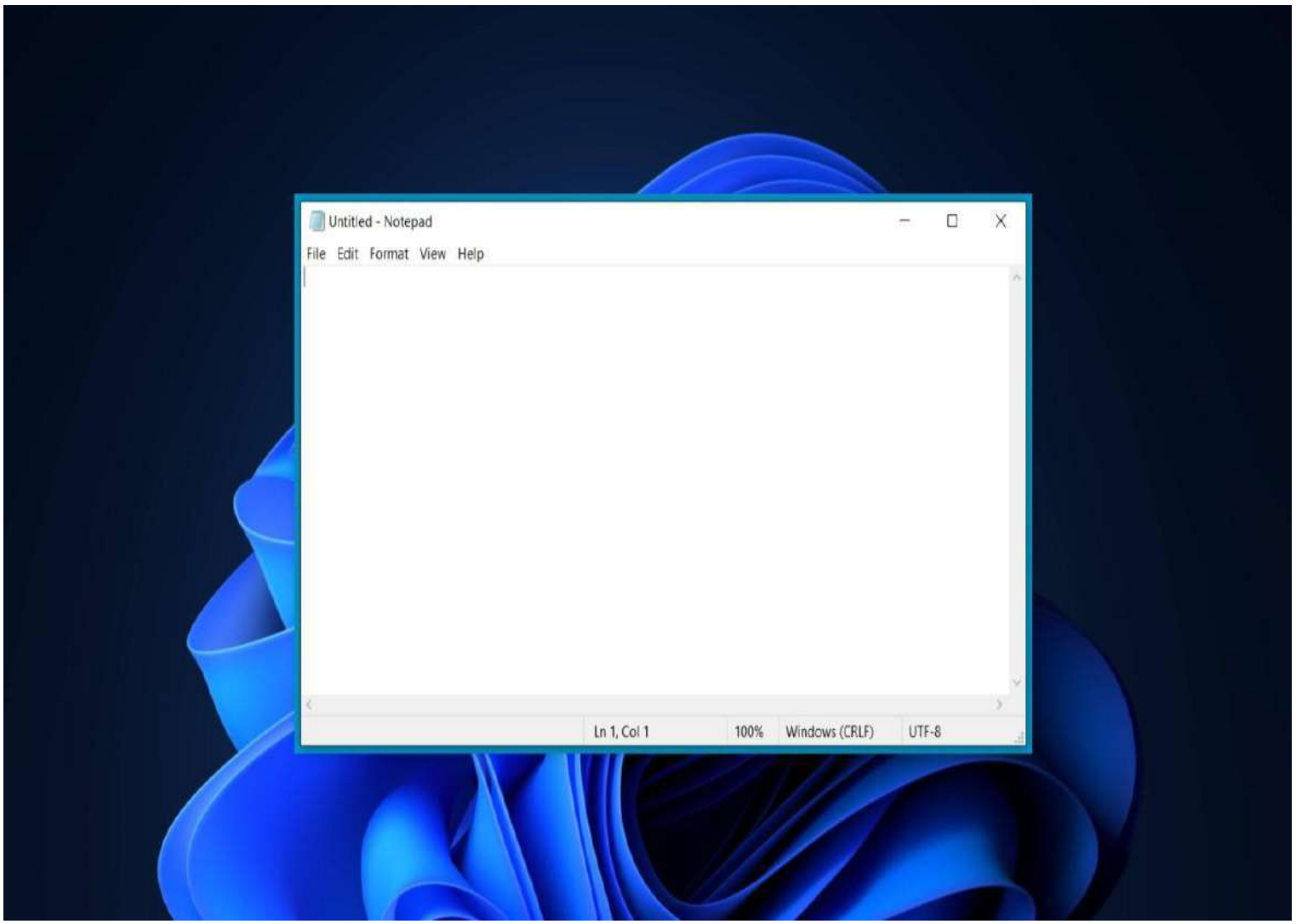
4.7 Step-by-step procedure for creating a webpage using HTML

Requirements

- A computer.
- A text editor such as Notepad or Visual Studio Code.
- A web browser such as Chrome or Firefox.
- Basic knowledge of HTML tags.

Step 1: Open a text editor

Open Notepad, Notepad++ or Visual Studio Code.



Step 2: Type the HTML structure

Enter the following code:

```
<!DOCTYPE html>
<html>

<head>
   <title>My First Website</title>
</head>

<body>

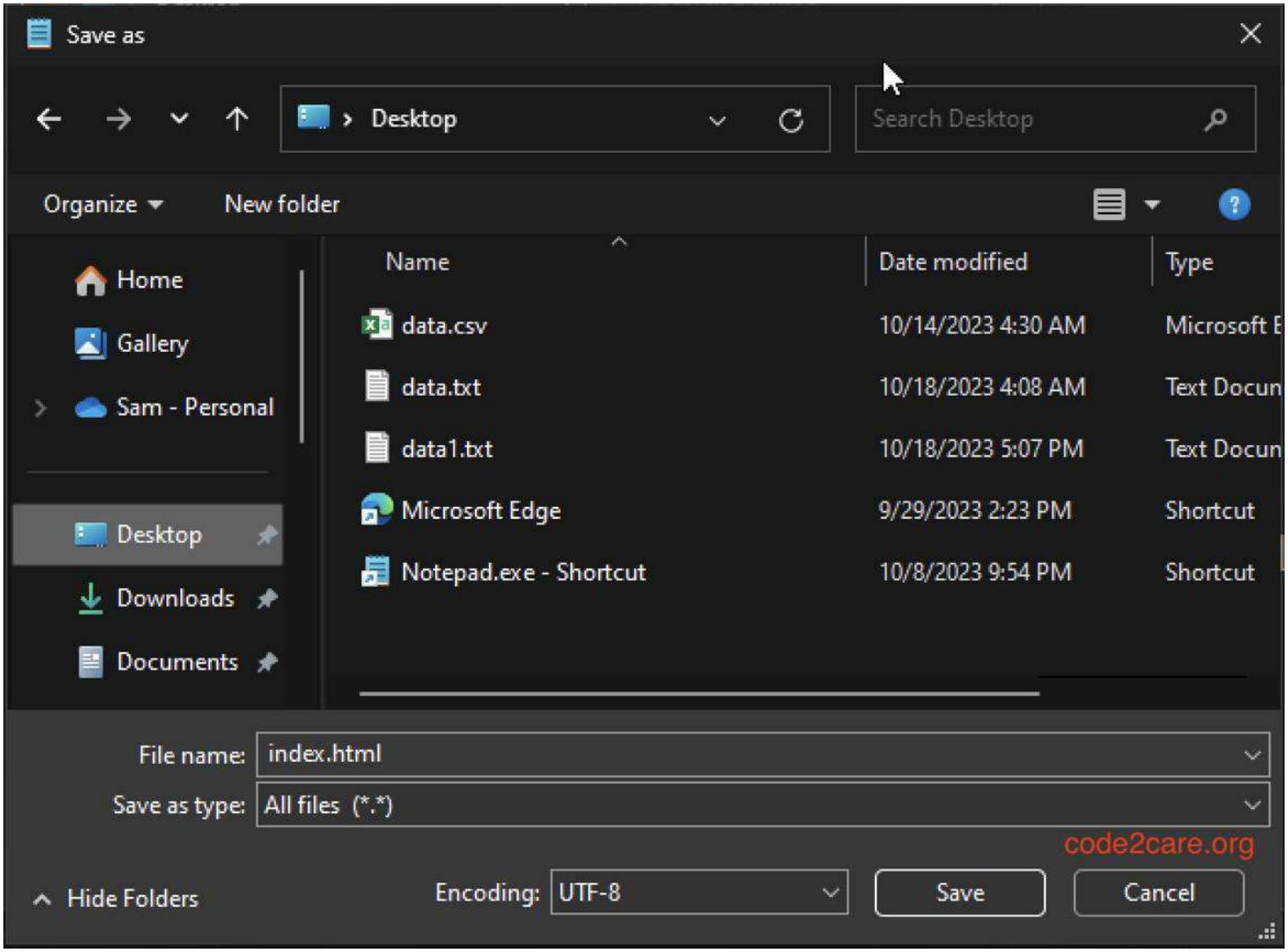
   <h1>WELCOME TO MY WEBSITE</h1>

   <p>
      This is my first webpage
      created using HTML.
   </p>

</body>
</html>
```

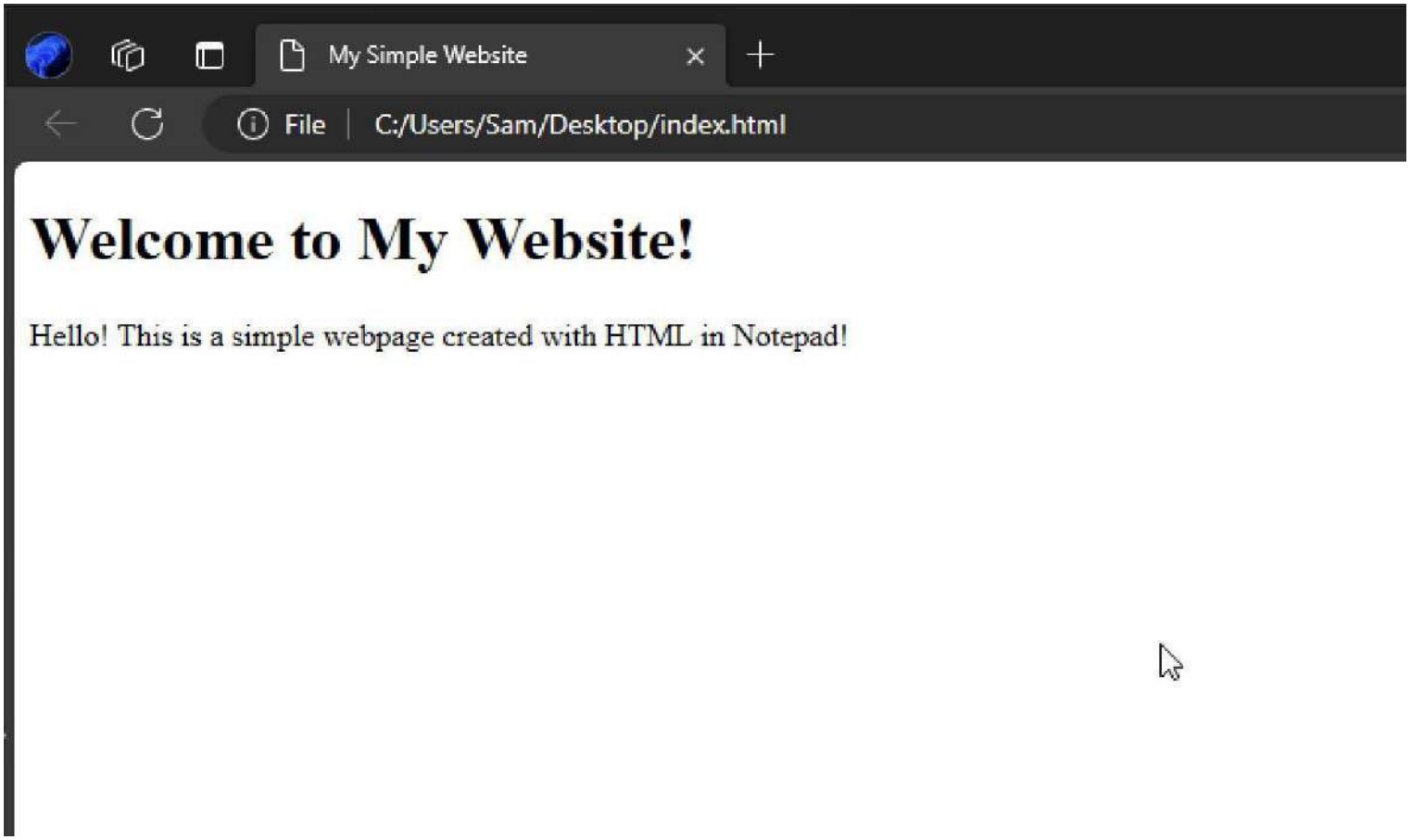
Step 3: Save the HTML file

1. Click File.
2. Select Save As.
3. Enter the filename index.html.
4. Select a folder where you want to save the file.
5. Ensure that the file extension is .html.
6. Save the file.



Step 4: Open the webpage in a browser

1. Locate the saved index.html file.
2. Double-click the file.
3. The webpage will open in the default web browser.
4. Observe how the browser displays the heading and paragraph.



Step 5: Modify the webpage

Return to the text editor and change the content.

For example, replace:

<h1>WELCOME TO MY WEBSITE</h1>

with:

<h1>MAONO SCHOOL</h1>

Save the changes.

Step 6: Refresh the browser

Return to the browser and click the Refresh button.

The browser will display the updated webpage.

Expected result

The learner should be able to create, save, open, view and modify a basic webpage using HTML.

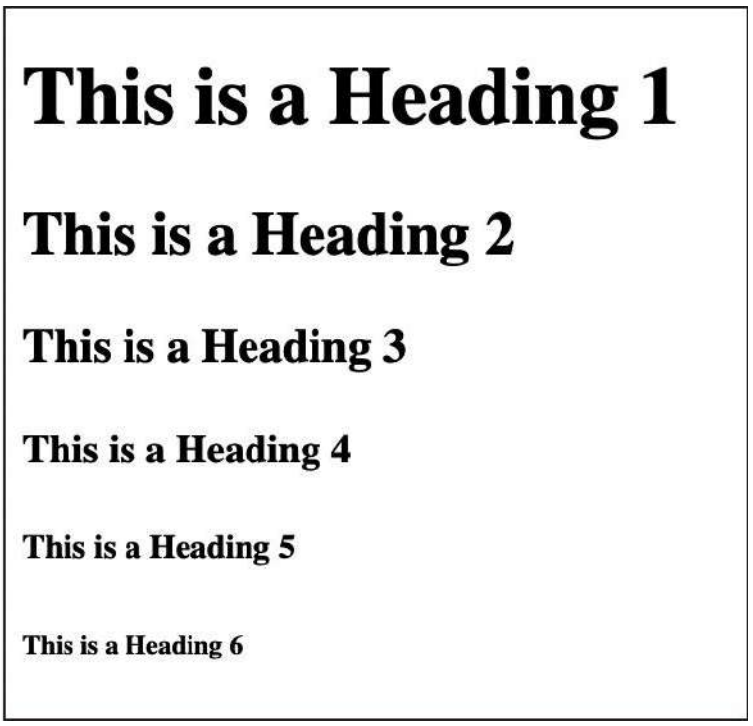
4.8 Creating different webpage elements using HTML

A. Creating headings

HTML provides six levels of headings, from <h1> to <h6>.

```
<h1>Main Heading</h1>
<h2>Second Heading</h2>
<h3>Third Heading</h3>
<h4>Fourth Heading</h4>
<h5>Fifth Heading</h5>
<h6>Sixth Heading</h6>
```





B. Creating paragraphs

The <p> tag is used to create paragraphs.

```
<p>
ICT enables learners to develop
digital skills and creativity.
</p>
```

C. Creating ordered lists

An ordered list displays items in a numbered sequence.

```
<ol>
   <li>Mathematics</li>
   <li>English</li>
   <li>ICT</li>
</ol>
```

D. Creating unordered lists

An unordered list displays items using bullets.

```
<ul>
   <li>Computer</li>
   <li>Printer</li>
   <li>Scanner</li>
</ul>
```

E. Inserting images

The <img> tag is used to display an image on a webpage.

```
<img src="school.jpg"
    alt="Our school"
    width="400">
```

Explanation:

- img identifies the image element.
- src specifies the image file location.
- alt describes the image.
- width specifies the image width.

F. Creating hyperlinks

A hyperlink connects one webpage to another webpage or resource.

The <a> tag is used to create hyperlinks.

```
<a href="https://www.google.com">
   Visit Google
</a>
```

When a user clicks the words *Visit Google*, the browser opens the linked website.

G. Creating tables

HTML tables are used to organise information into rows and columns.

```
<table border="1">

<tr>
   <th>Subject</th>
   <th>Marks</th>
</tr>

<tr>
```

```
    <td>ICT</td>
    <td>85</td>
</tr>

<tr>
    <td>Mathematics</td>
    <td>90</td>
</tr>

</table>
```



Student report

Name	Subject	Marks
Alex	Maths	96
Alex	Scinece	80

H. Creating forms

Forms are used to collect information from website visitors.

```
<form>

<label>Full Name:</label>

<input type="text"
      name="fullname">

<br><br>

<label>Email:</label>
```

```
<input type="email"
       name="email">

<br><br>

<button type="submit">
   Register
</button>

</form>
```



4.9 Complete practical example: Creating a school webpage

The following activity combines several HTML elements to create a simple school webpage.

Step 1: Open your text editor.

Step 2: Enter the following HTML code.

```
<!DOCTYPE html>
<html>

<head>
   <title>Mema School</title>
</head>

<body>
```

```
<h1>MEMA SCHOOL</h1>

<h2>Welcome to Our School</h2>

<p>
   Our school provides quality education
   and promotes creativity, discipline
   and academic excellence.
</p>

<h2>Our Subjects</h2>

<ul>
   <li>Mathematics</li>
   <li>English</li>
   <li>Integrated Science</li>
   <li>ICT</li>
</ul>

<h2>Contact Information</h2>

<p>Email: info@ourschool.example</p>

<a href="https://www.google.com">
   Visit Google
</a>

</body>
</html>
```

Step 3: Save the file as school.html.

Step 4: Open it using a web browser.

Step 5: Observe the displayed webpage.

Step 6: Modify the heading, paragraph and list to suit another school.



5.0 STYLING OF WEBPAGES USING CSS

5.1 Meaning of CSS

CSS stands for **Cascading Style Sheets**.

It is a stylesheet language used to control the appearance, formatting and layout of webpages.

CSS works together with HTML to make webpages attractive, organised, readable and user-friendly.

While HTML provides the structure and content, CSS controls how the content is presented.

5.2 Importance of CSS in web authoring

CSS is important because it:

1. Improves the appearance of webpages.
2. Makes website content easier to read.
3. Controls text colours and background colours.
4. Controls font sizes and font styles.
5. Provides consistent formatting across webpages.
6. Makes website layouts attractive and organised.
7. Supports responsive design for different screen sizes.
8. Reduces repeated formatting instructions.
9. Makes it easier to update website designs.
10. Separates content from presentation.
11. Improves the user experience.
12. Helps establish a professional website identity.



5.3 Basic CSS syntax

CSS rules are written using a specific structure.

```
selector {
    property: value;
}
```

Example:

```
h1 {
    color: blue;
    font-size: 30px;
}
```

Explanation

- h1 is the selector.
- color is the property.
- blue is the value.
- font-size is another property.
- 30px is its value.

A CSS declaration consists of a property and its assigned value.

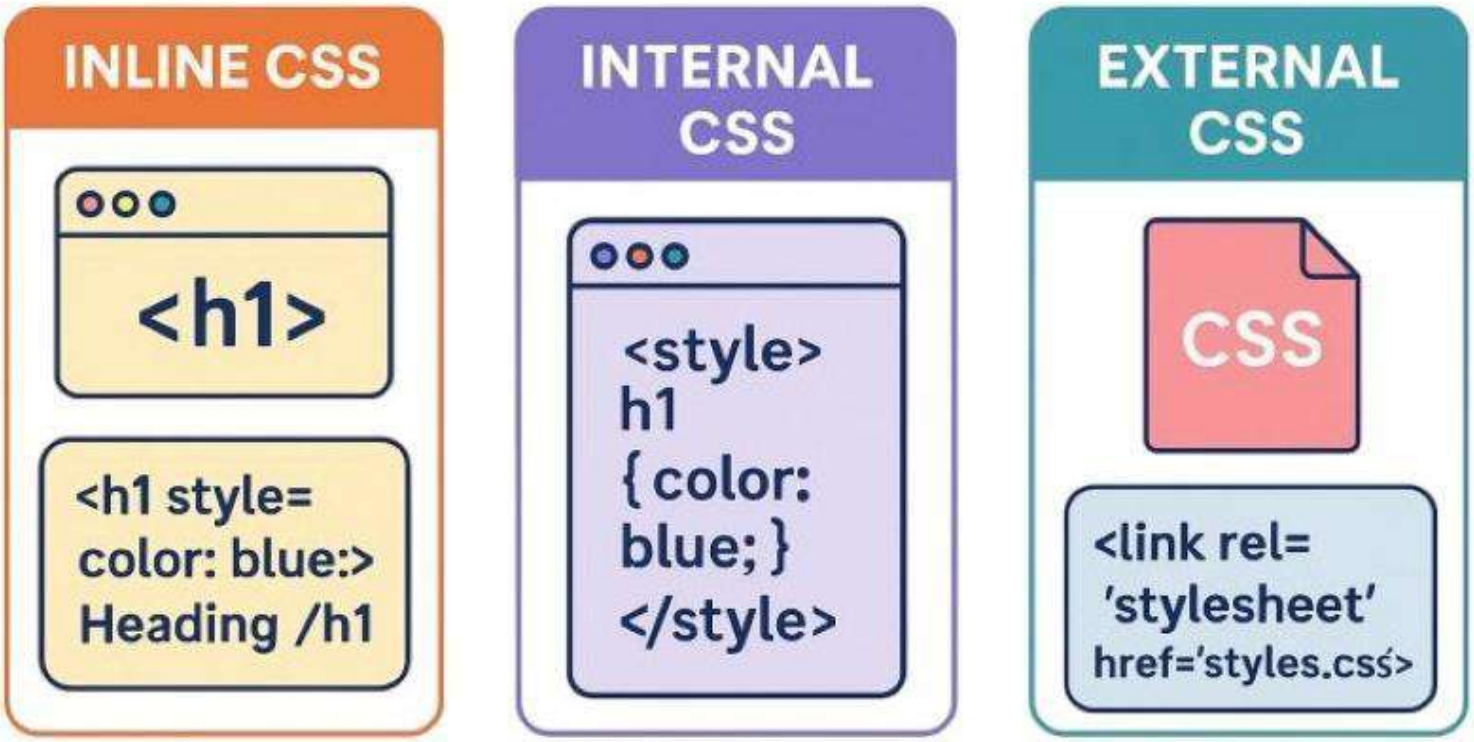
5.4 Common CSS properties

CSS property	Function
color	Changes text colour.
background-color	Changes background colour.
font-size	Changes text size.
font-family	Changes the typeface.
font-weight	Controls text thickness.
text-align	Aligns text.
text-decoration	Adds or removes text decoration.
margin	Controls space outside an element.
padding	Controls space inside an element.
border	Adds a border around an element.
width	Sets the width of an element.
height	Sets the height of an element.
border-radius	Rounds the corners of an element.
display	Controls how an element is displayed.

5.5 Types of CSS styling

There are three main ways of applying CSS to HTML webpages:

1. Inline CSS.
2. Internal CSS.
3. External CSS.



6.0 INLINE CSS STYLING

6.1 Meaning of inline CSS

Inline CSS is a method of applying styles directly to an individual HTML element using the style attribute.

The styling instructions are written inside the opening HTML tag.

Inline CSS affects only the element to which the style attribute is applied.

6.2 Structure of inline CSS

```
<tag style="property: value;">
   Content
</tag>
```

6.3 Examples of inline CSS

Example 1: Changing text colour

```
<h1 style="color: blue;">
   Welcome to ICT
</h1>
```

This changes the heading colour to blue.

Example 2: Changing background colour

```
<p style="background-color: yellow;">
   ICT is an important subject.
</p>
```

This gives the paragraph a yellow background.

Example 3: Changing font size

```
<h2 style="font-size: 30px;">
   Web Authoring
</h2>
```

This increases the heading size to 30 pixels.

Example 4: Aligning text

```
<p style="text-align: center;">
   Welcome to our school.
</p>
```

This centres the paragraph text.

Example 5: Changing font family

```
<p style="font-family: Arial;">
   Learning ICT is interesting.
</p>
```

This changes the text font to Arial.

6.4 Step-by-step procedure for applying inline CSS

Step 1: Open an existing HTML document.

Step 2: Identify the element that needs styling.

Step 3: Add the style attribute inside its opening tag.

Step 4: Specify the CSS property.

Step 5: Assign the desired value to the property.

Step 6: Save the document.

Step 7: Open or refresh the webpage in the browser to observe the changes.

Practical activity

Use the following code:

```
<!DOCTYPE html>
<html>

<head>
   <title>Inline CSS</title>
</head>

<body>
```

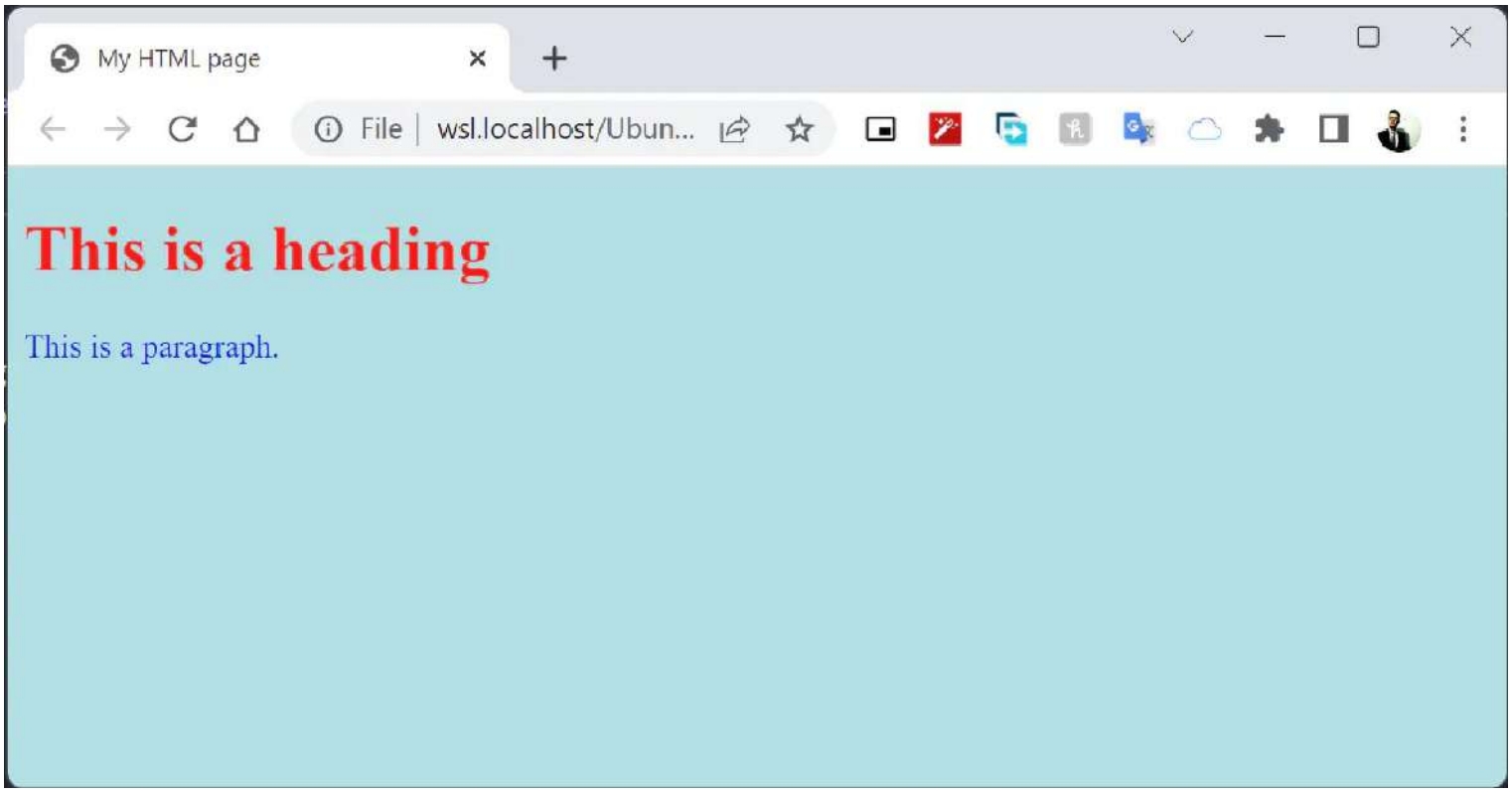
```
<h1 style="color: blue;">
   MY SCHOOL
</h1>

<p style="font-size: 20px;">
   Welcome to our school website.
</p>

<p style="background-color: yellow;">
   Education is the key to success.
</p>

</body>
</html>
```

Expected output



6.5 Advantages of inline CSS

1. Easy to apply to individual HTML elements.
2. Useful for making quick styling changes.
3. Does not require a separate CSS file.

4. Useful for testing specific styles.
5. Suitable for styling a small number of elements.

6.6 Disadvantages of inline CSS

1. Makes HTML code longer.
2. Difficult to maintain when styling many elements.
3. Cannot easily apply one style to many pages.
4. Makes it harder to separate content from presentation.
5. Repeating styles increases the size of the HTML code.

7.0 INTERNAL CSS STYLING

7.1 Meaning of internal CSS

Internal CSS is a method of applying styles to a webpage by writing CSS instructions inside the <style> element in the <head> section of an HTML document.

The styles apply to the elements specified by the CSS selectors within that particular webpage.

Internal CSS is also known as an embedded stylesheet.

7.2 Structure of internal CSS

```
<!DOCTYPE html>
<html>

<head>

<style>

selector {
   property: value;
}

</style>

</head>

<body>

</body>
</html>
```

7.3 Example of internal CSS

```
<!DOCTYPE html>
<html>

<head>

<title>Internal CSS Example</title>

<style>

h1 {
    color: blue;
    text-align: center;
}

p {
    color: black;
    font-size: 18px;
}

body {
    background-color: lightblue;
}

</style>

</head>

<body>

<h1>WELCOME TO ICT</h1>

<p>
ICT enables learners to acquire
```

important digital skills.

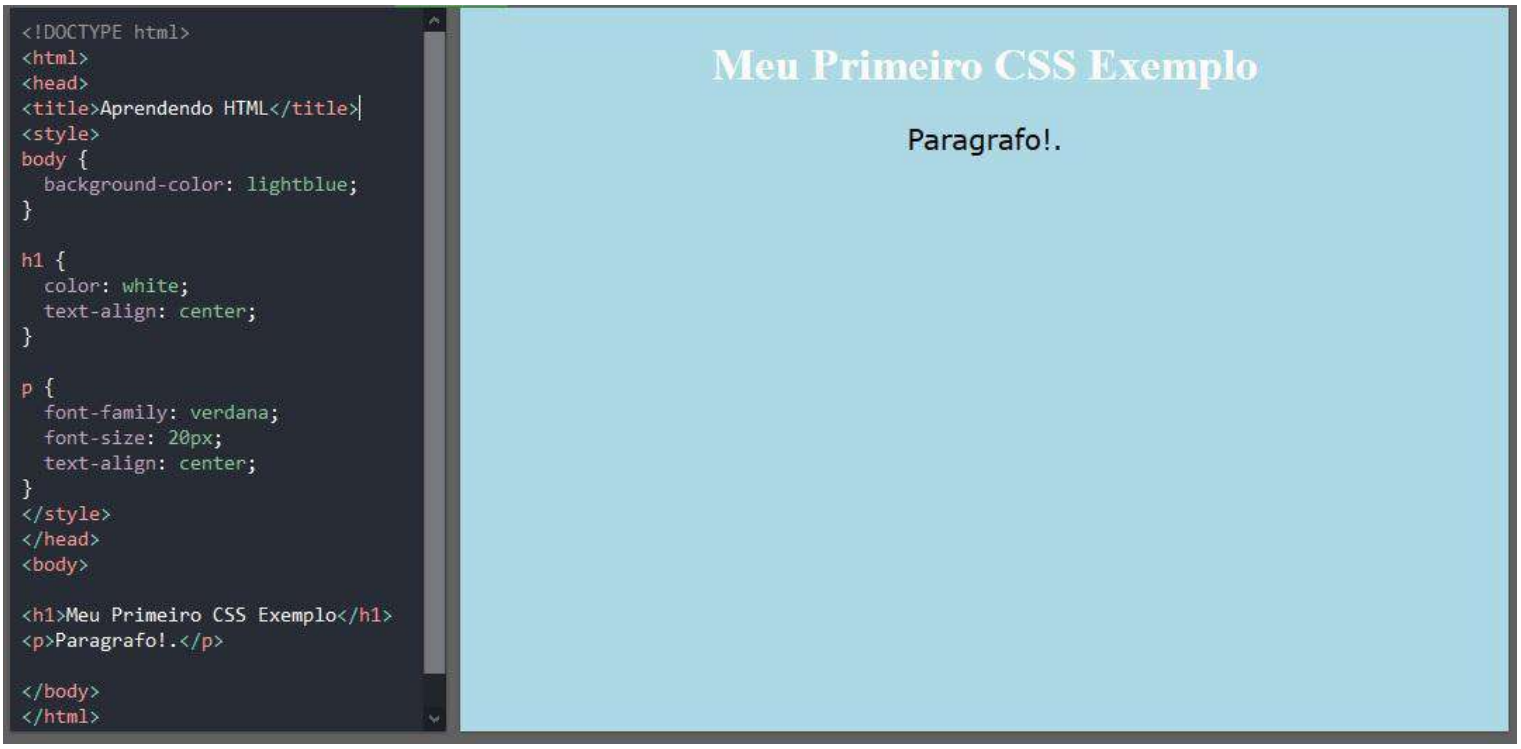
</p>

</body>

</html>

Explanation of the code

- <style> introduces the internal CSS rules.
- h1 selects all first-level headings.
- color: blue makes the headings blue.
- text-align: center centres the headings.
- p selects all paragraphs.
- font-size: 18px makes paragraph text 18 pixels.
- body selects the entire webpage body.
- background-color: lightblue changes the background colour.



7.4 Step-by-step procedure for applying internal CSS

Step 1: Open the HTML file using a text editor.

Step 2: Locate the <head> section.

Step 3: Insert the <style> opening tag.

Step 4: Write the CSS selectors and declarations.

Step 5: Close the stylesheet using </style>.

Step 6: Save the HTML file.

Step 7: Open or refresh the webpage in a browser.

Step 8: Observe the changes in the webpage presentation.

7.5 Advantages of internal CSS

1. Allows several elements on one webpage to share the same styles.
2. Keeps the styling instructions in one section of the HTML document.
3. Does not require a separate stylesheet file.
4. Easier to manage than repeated inline styling.
5. Useful when creating a webpage that has its own unique design.

7.6 Disadvantages of internal CSS

1. Styles apply only to the webpage containing the stylesheet.
2. Repeating styles across many webpages increases code duplication.
3. Makes the HTML document longer.
4. Updating the appearance of many pages becomes difficult.
5. Mixing content and presentation reduces maintainability.

8.0 EXTERNAL CSS STYLING

8.1 Meaning of external CSS

External CSS is a method of styling webpages by writing CSS instructions in a separate file with the .css extension.

The external stylesheet is then linked to the HTML document using the <link> element.

This method allows several webpages to use the same stylesheet.

Example of an external CSS file

style.css

```
body {
    background-color: lightblue;
}

h1 {
    color: navy;
    text-align: center;
    font-size: 30px;
}

p {
    color: black;
```

```
    font-family: Arial;
    font-size: 18px;
}
```

8.2 Linking an external CSS file to HTML

The <link> element is placed inside the <head> section of an HTML document.

Example:

```
<!DOCTYPE html>
<html>

<head>

<title>External CSS Example</title>

<link rel="stylesheet"
      href="style.css">

</head>

<body>

<h1>WELCOME TO OUR SCHOOL</h1>

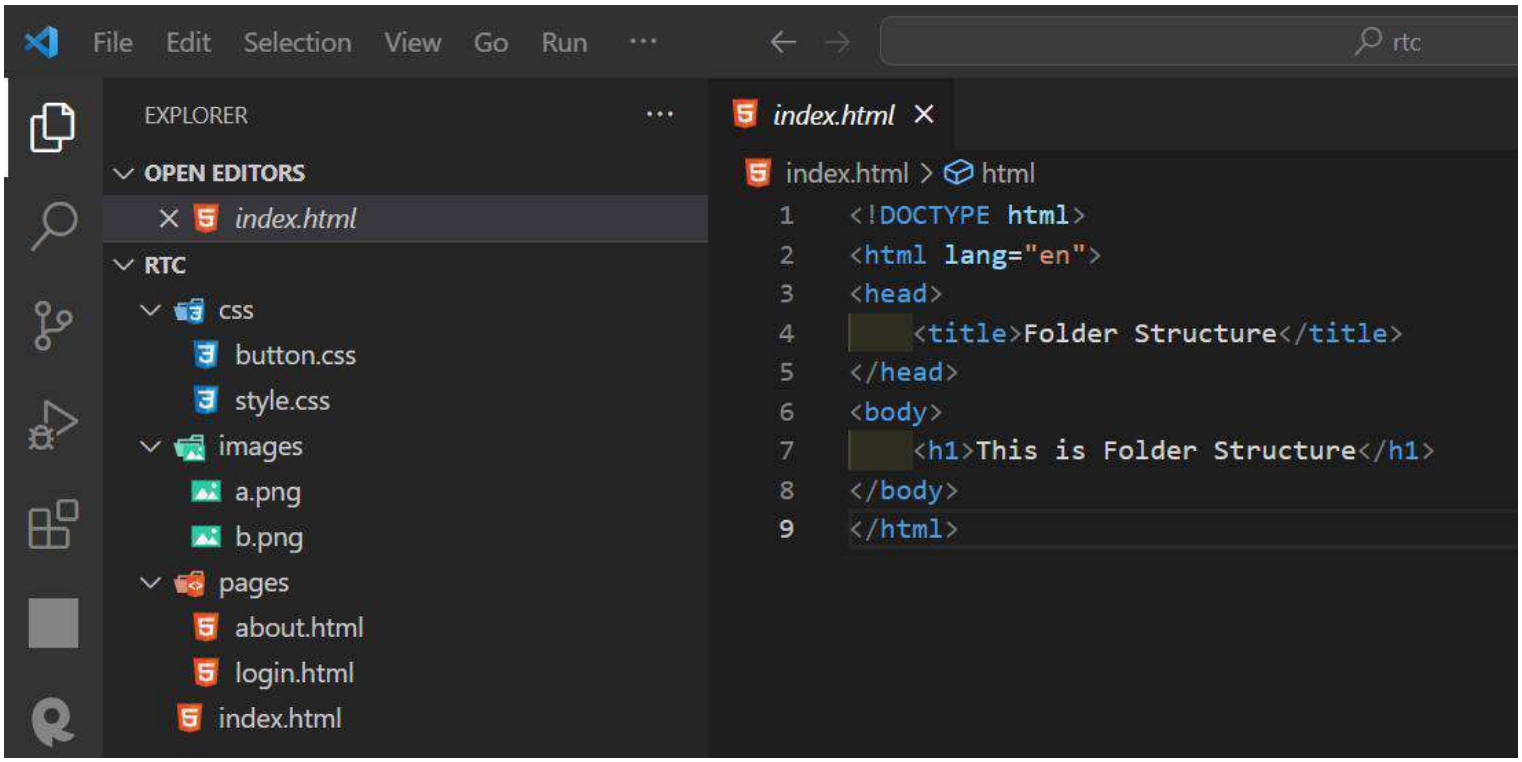
<p>
Our school promotes quality education.
</p>

</body>
</html>
```

Explanation

- <link> connects the HTML document to an external resource.
- rel="stylesheet" identifies the linked resource as a stylesheet.
- href="style.css" specifies the name and location of the CSS file.

8.3 Step-by-step procedure for creating external CSS



Step 1: Create a project folder

Create a folder on your computer and name it:

MyWebsite

Step 2: Create an HTML file

Open your text editor and create a new file.

Save it as:

index.html

Step 3: Create a CSS file

Create another new file and save it as:

style.css

Step 4: Write the CSS instructions

Open style.css and type:

```
body {
    background-color: lightyellow;
}

h1 {
    color: green;
    text-align: center;
```

```
}

p {
    font-size: 20px;
    color: black;
}
```

Step 5: Link the CSS file to HTML

Open index.html and enter:

```
<!DOCTYPE html>
<html>

<head>

<title>My Website</title>

<link rel="stylesheet"
      href="style.css">

</head>

<body>

<h1>WELCOME TO MY WEBSITE</h1>

<p>
This website uses external CSS.
</p>

</body>
</html>
```

Step 6: Save both files

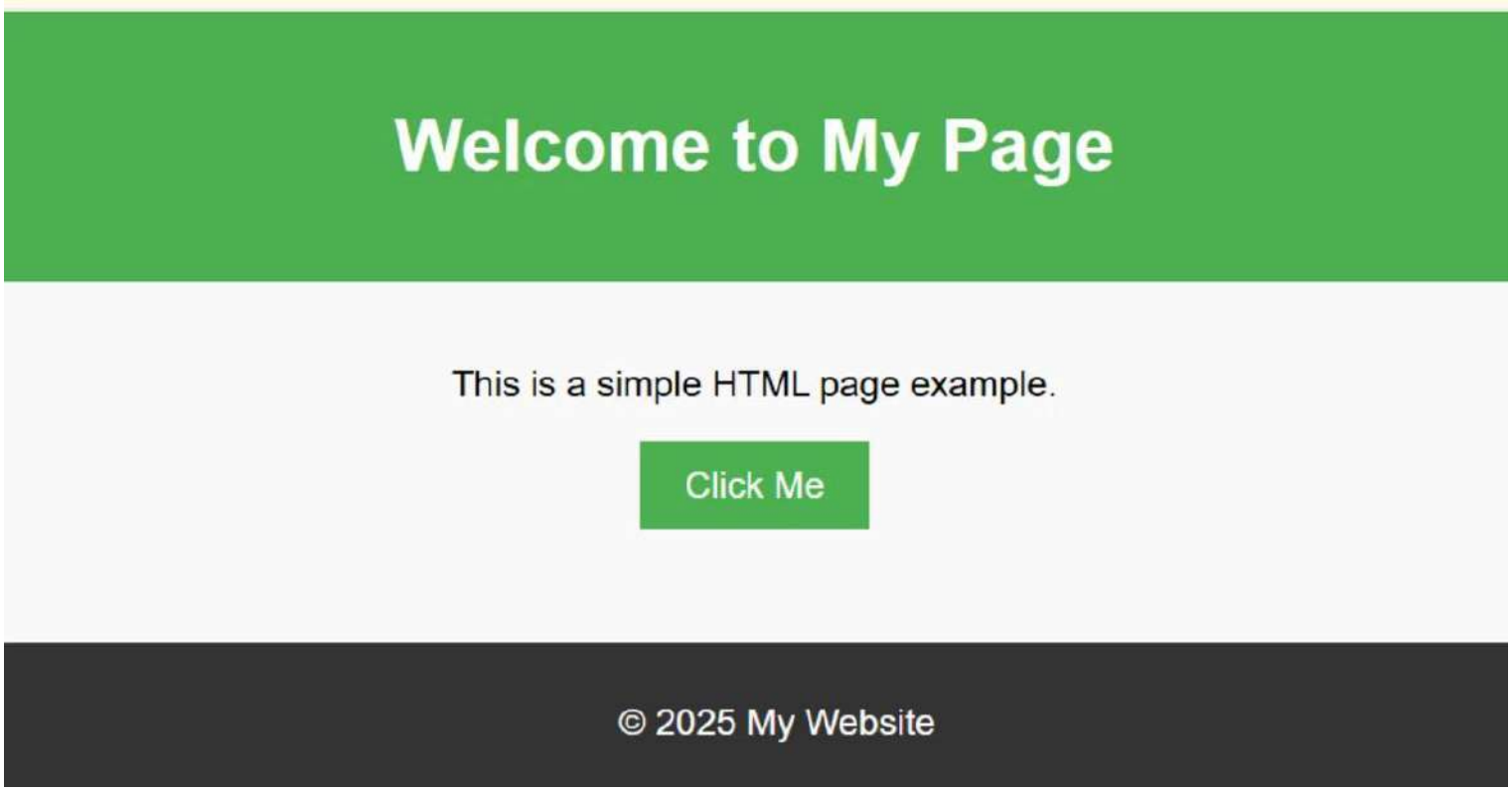
Ensure that both files are saved in the same project folder.

Step 7: Open the HTML file

Double-click index.html to open it in a web browser.

Step 8: Observe the results

The browser should display a light yellow background, green centred heading and black paragraph text.



8.4 Advantages of external CSS

1. Allows one stylesheet to control several webpages.
2. Makes website maintenance easier.
3. Reduces repeated CSS instructions.
4. Separates webpage content from presentation.
5. Makes HTML documents shorter and easier to read.
6. Provides consistency in website design.
7. Makes it easier to change the appearance of an entire website.
8. Browsers can cache external CSS files, improving loading efficiency on subsequent visits.

8.5 Disadvantages of external CSS

1. Requires an additional stylesheet file.
2. The webpage may appear unstyled if the stylesheet is missing or incorrectly linked.
3. Requires correct file paths.
4. A change to a shared stylesheet may affect several webpages.
5. An additional resource may need to be downloaded by the browser.

9.0 COMPARISON OF INLINE, INTERNAL AND EXTERNAL CSS

Feature	Inline CSS	Internal CSS	External CSS
Location	Inside an HTML element.	Inside the <style> element.	In a separate .css file.
Scope	Individual element.	One webpage.	Multiple webpages can share it.
File required	HTML file only.	HTML file only.	HTML and CSS files.
Reusability	Low.	Limited to the page.	High.
Maintenance	Difficult for many elements.	Moderate.	Easier for large websites.
Best use	Quick individual changes.	Single-page styling.	Multi-page website design.

9.1 Understanding the CSS cascade

The word *cascading* in Cascading Style Sheets refers to how the browser determines which CSS rules should apply when more than one rule affects the same element.

The browser considers factors such as:

1. Importance of the declaration.
2. Specificity of the selector.
3. Order in which rules appear.
4. Whether the declaration is inline or in a stylesheet.

Example:

```
<!DOCTYPE html>
<html>

<head>

<style>
p {
   color: blue;
}
</style>
```

```
</head>

<body>

<p style="color: red;">
   Welcome to ICT.
</p>

</body>
</html>
```

In this example, the paragraph normally appears red because the inline declaration has higher specificity than the ordinary internal CSS rule.

Important: CSS does not always follow a simple rule that inline styling is always strongest. Important declarations, selector specificity and cascade layers can affect the final result.

9.2 Difference between class and ID selectors

CSS uses selectors to identify the HTML elements that should be styled.

A. Class selector

A class selector is used to apply the same style to several HTML elements.

It is identified by a full stop (.) in CSS.

Example:

```
<style>

.highlight {
   color: blue;
   font-weight: bold;
}

</style>

<p class="highlight">
   Welcome to ICT.
</p>

<h2 class="highlight">
```

```
    Web Authoring
</h2>
```

Both elements receive the same styling.

B. ID selector

An ID selector is used to identify a specific element on a webpage.

It is identified by a hash symbol (#) in CSS.

Example:

```
<style>

#main-heading {
    color: green;
    text-align: center;
}

</style>

<h1 id="main-heading">
    MY SCHOOL WEBSITE
</h1>
```

The heading with the specified ID receives the styling.

Comparison

Class selector	ID selector
Begins with a dot (.) in CSS.	Begins with a hash (#) in CSS.
Can be used by many elements.	Should identify one unique element in a page.
Useful for grouping elements.	Useful for identifying a particular element.
Example: .heading	Example: #heading

10.0 MODIFYING WEBPAGE PRESENTATION USING CSS

Modifying webpage presentation involves changing the visual appearance, formatting and arrangement of webpage elements using CSS.

A web developer can modify existing HTML content without changing the actual information contained in the webpage.

10.1 Changing text colour

The color property is used to change the colour of text.

Example:

```
h1 {
    color: red;
}
```

Other colour values include:

```
p {
    color: blue;
}

h2 {
    color: green;
}

h3 {
    color: #ff0000;
}
```

10.2 Changing background colour

The background-color property is used to change the background colour of an element.

Example:

```
body {
    background-color: lightblue;
}
```

10.3 Changing font size

The font-size property controls the size of text.

Example:

```
h1 {
    font-size: 32px;
}

p {
    font-size: 18px;
}
```

Common units include:

- px – pixels.
- em – relative to the font size of the parent element.
- rem – relative to the root font size.
- % – percentage-based sizing.

10.4 Changing font family

The font-family property specifies the typeface used to display text.

Example:

```
body {
    font-family: Arial, sans-serif;
}
```

Other font families include:

- Times New Roman.
- Georgia.
- Verdana.
- Tahoma.
- Courier New.

10.5 Changing text alignment

The text-align property controls the horizontal alignment of text.

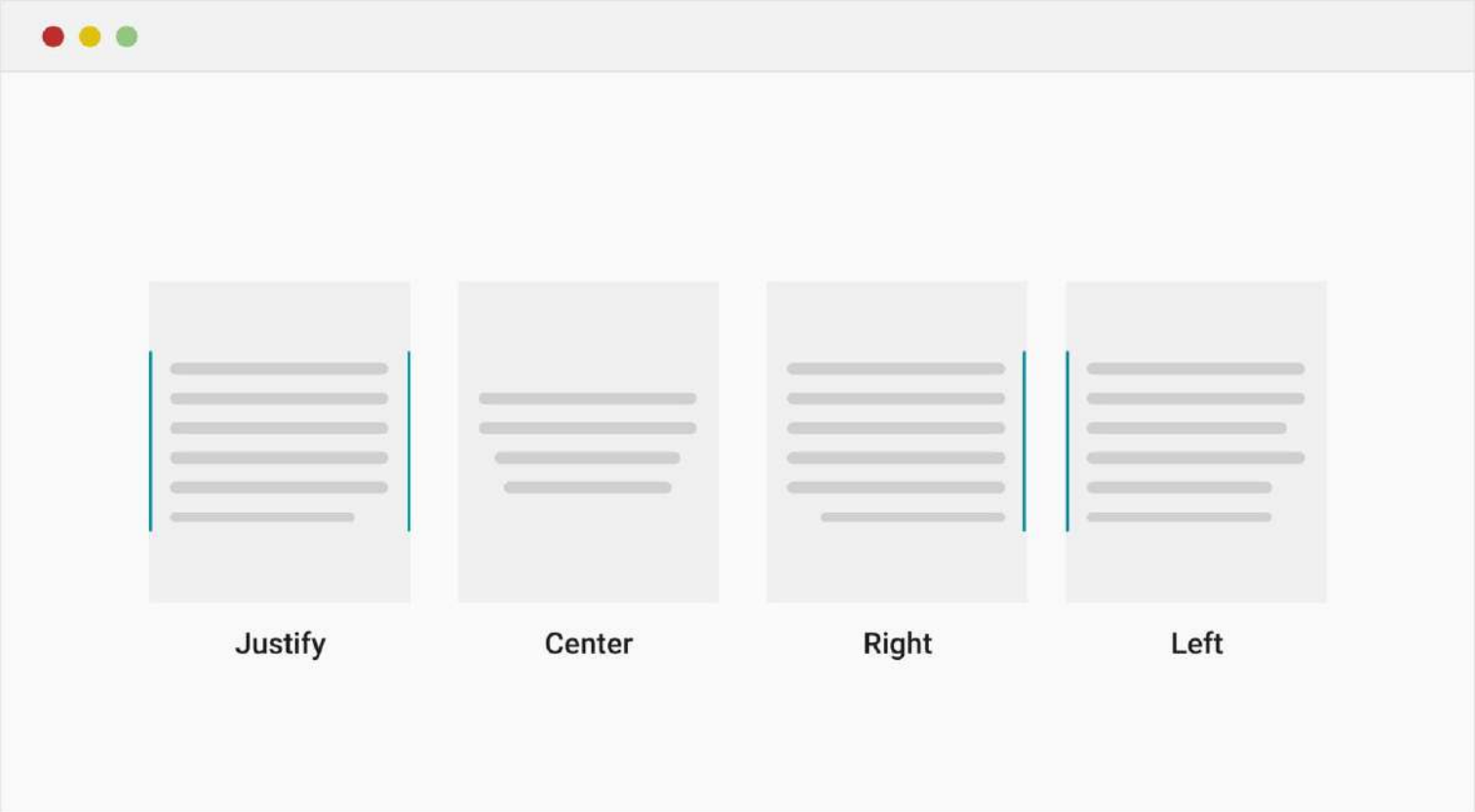
Example:

```
h1 {
    text-align: center;
}

p {
    text-align: justify;
}
```

Common alignment values include:

- left
- right
- center
- justify



10.6 Applying borders

The border property adds a visible boundary around an element.

Example:

```
p {
   border: 2px solid blue;
}
```

The property can specify:

- Border width.
- Border style.
- Border colour.

Common border styles include:

- solid
- dashed
- dotted
- double

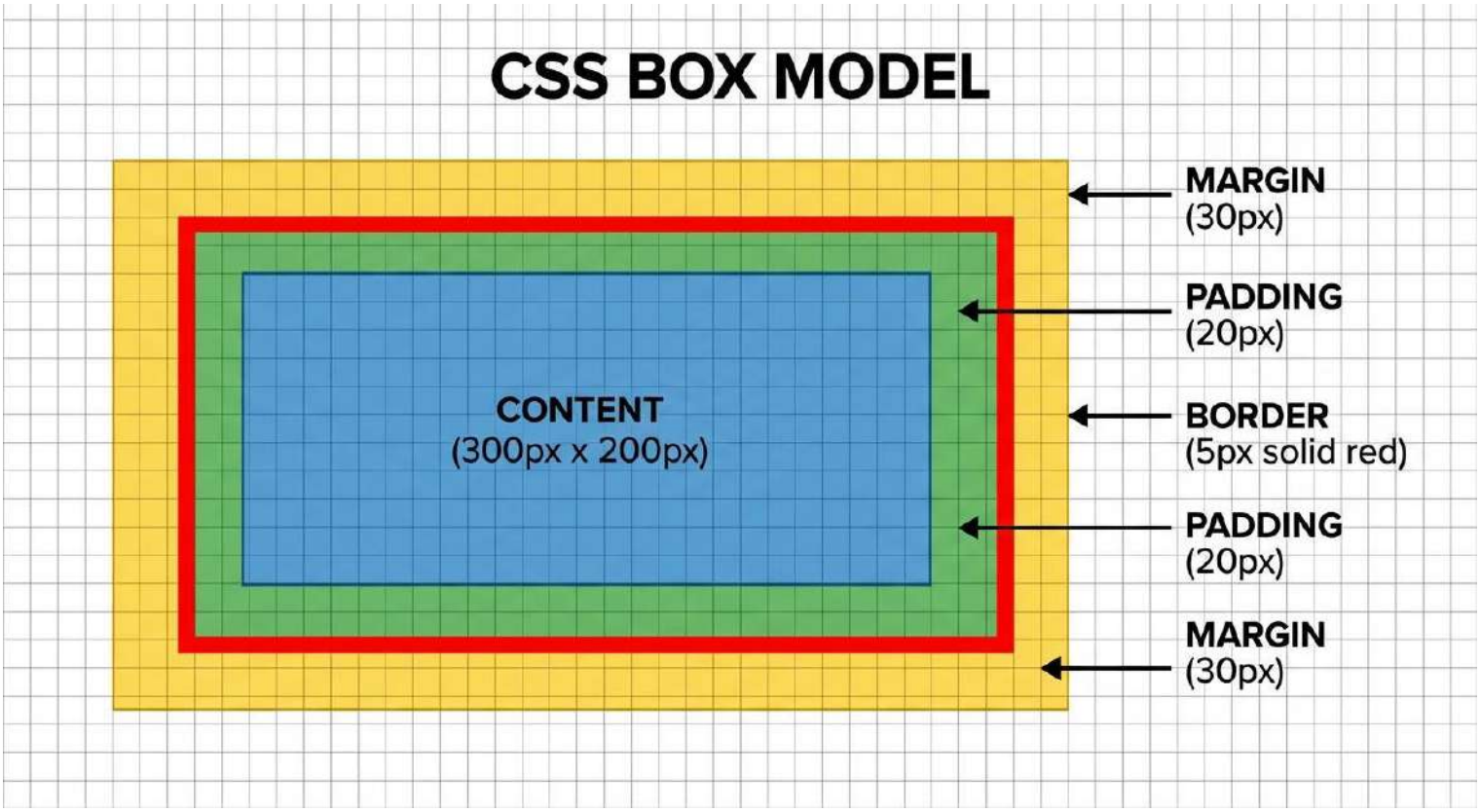
10.7 Adding margins and padding

Margin

Margin is the space outside an element's border.

Padding

Padding is the space between an element's content and its border.



Example:

```
div {
    margin: 20px;
    padding: 15px;
    border: 2px solid black;
}
```

Explanation

- margin: 20px creates space outside the element.
- padding: 15px creates space inside the element.
- border: 2px solid black creates a black border.

10.8 Modifying webpage dimensions

The width and height properties control the dimensions of webpage elements.

Example:

```
img {
    width: 300px;
    height: 200px;
}
```

This sets an image width of 300 pixels and a height of 200 pixels.

10.9 Adding rounded corners

The border-radius property is used to make the corners of an element rounded.

Example:

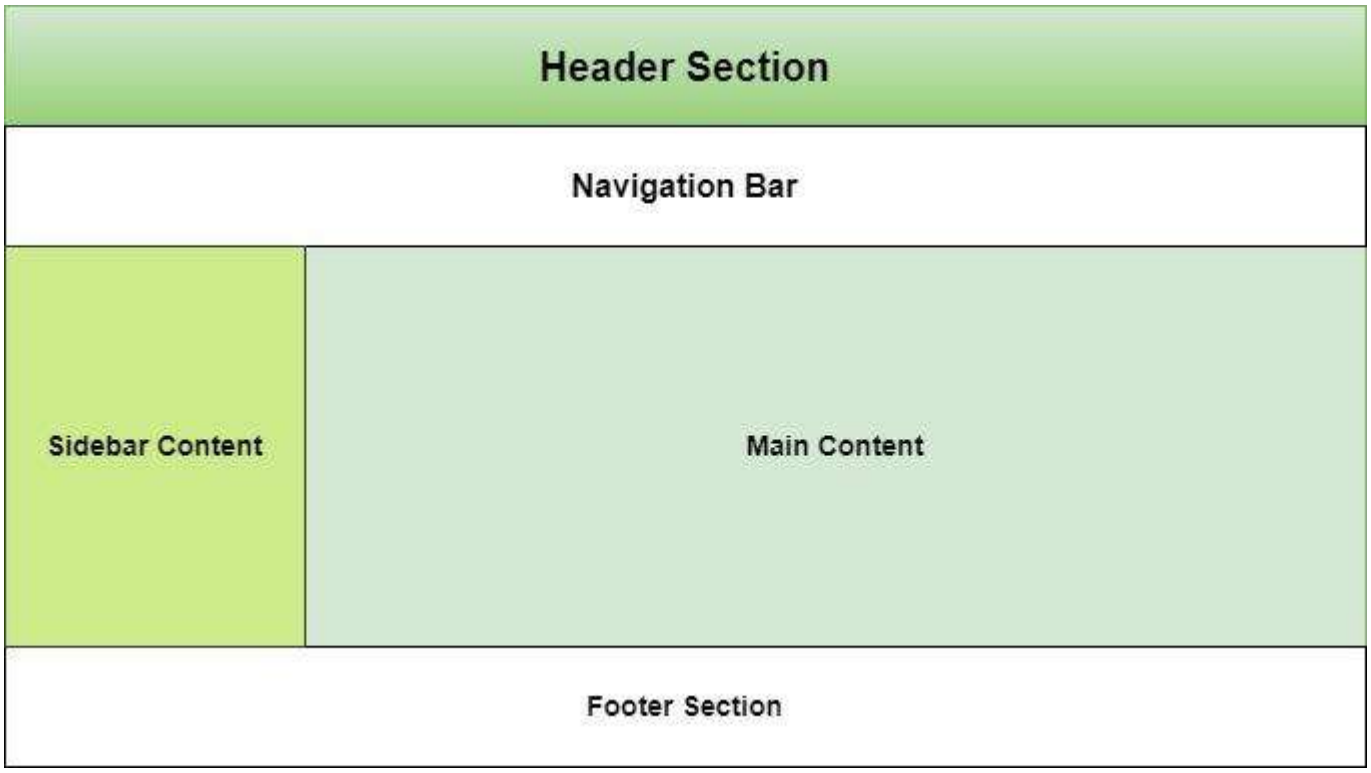
```
button {
    background-color: green;
    color: white;
    border-radius: 10px;
}
```

10.10 Creating webpage layouts

CSS can arrange webpage content into different sections.

Common sections include:

1. Header.
2. Navigation bar.
3. Main content area.
4. Sidebar.
5. Footer.



Example:

```
<header>
    <h1>MY SCHOOL</h1>
</header>
```

```
<nav>
  Home | About | Contact
</nav>

<main>
  <h2>Welcome</h2>
  <p>Welcome to our school website.</p>
</main>

<footer>
  Copyright 2026
</footer>
```

A corresponding CSS layout could be:

```
header {
  background-color: navy;
  color: white;
  padding: 20px;
  text-align: center;
}

nav {
  background-color: lightblue;
  padding: 12px;
}

main {
  padding: 20px;
}

footer {
  background-color: navy;
  color: white;
  text-align: center;
  padding: 10px;
```

}

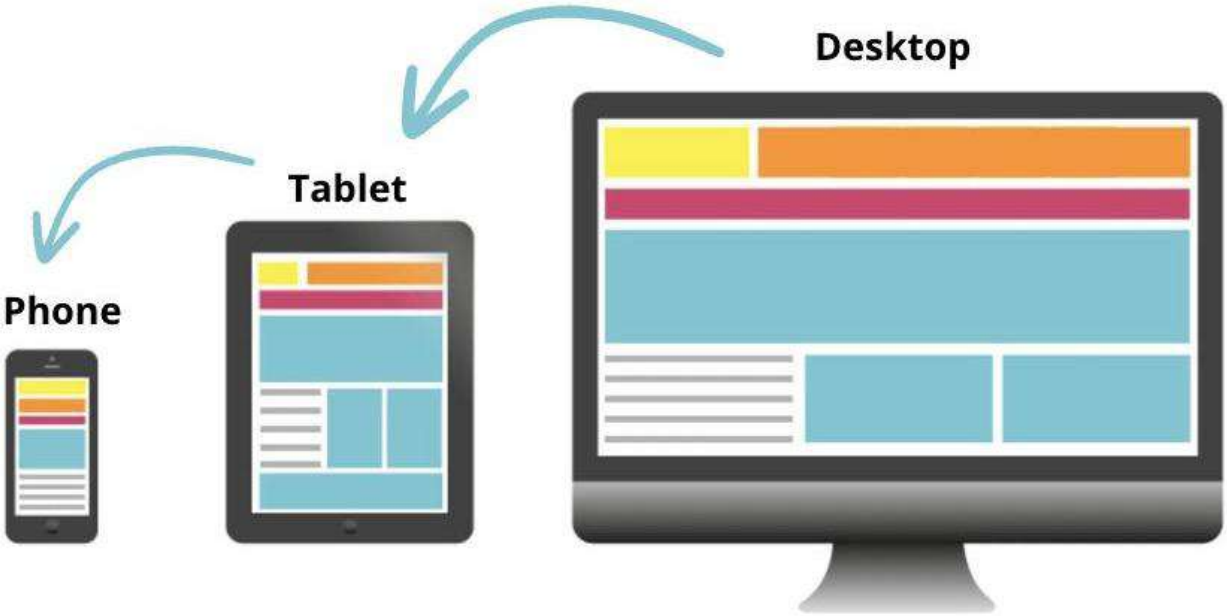
11.0 RESPONSIVE WEB DESIGN

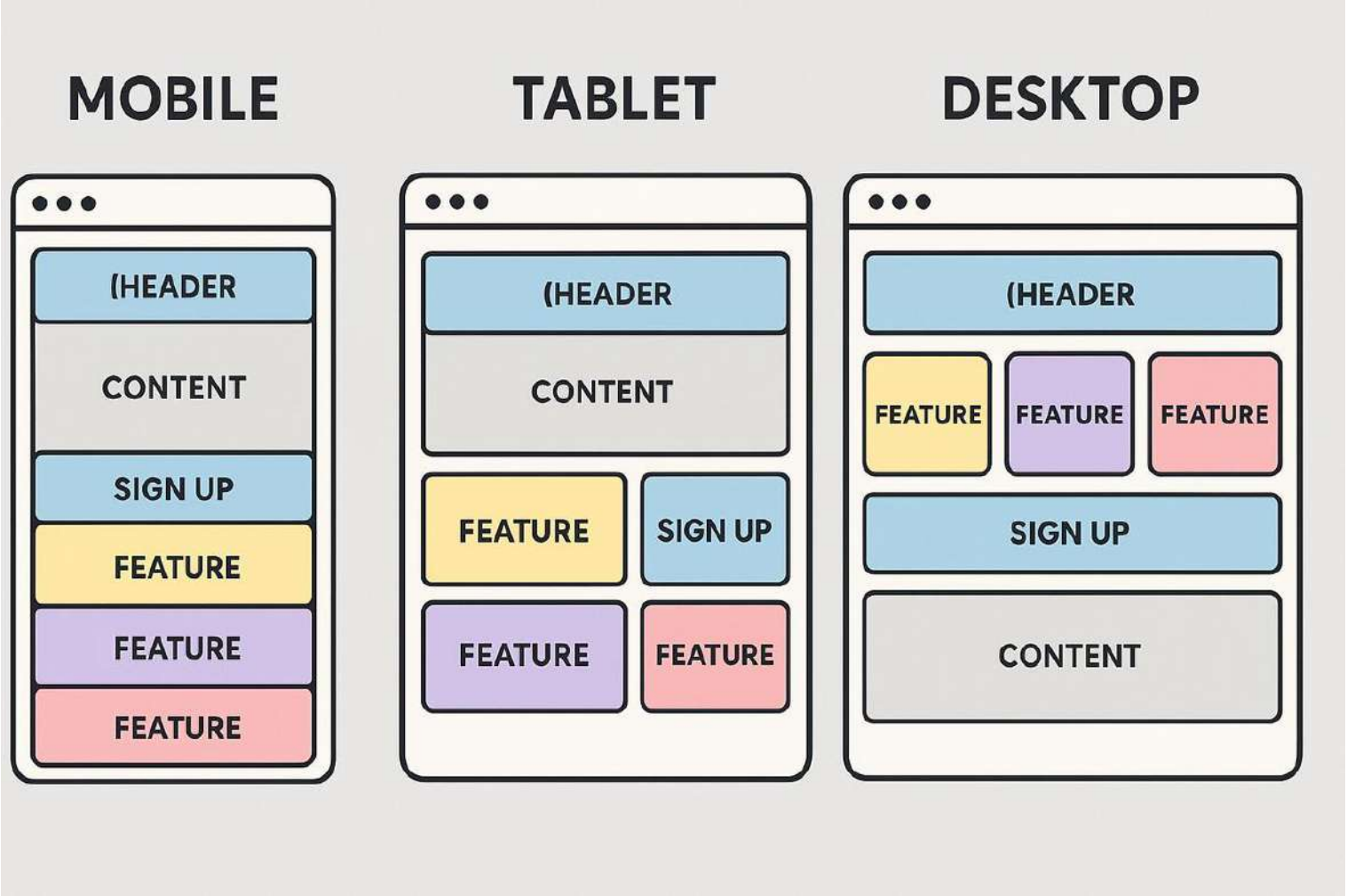
11.1 Meaning of responsive web design

Responsive web design is an approach to website development in which webpages automatically adjust their layout and appearance to fit different screen sizes and devices.

It ensures that website content can be accessed conveniently using computers, tablets and smartphones.







11.2 Importance of responsive web design

1. Improves accessibility on different devices.
2. Makes webpages easier to read on small screens.
3. Reduces unnecessary horizontal scrolling.
4. Improves the user experience.
5. Supports mobile internet users.
6. Helps websites maintain a consistent appearance.
7. Makes navigation easier on smartphones and tablets.

11.3 Methods of creating responsive webpages

A. Using the viewport meta tag

The viewport meta tag helps browsers display webpages at appropriate sizes on mobile devices.

```
<meta name="viewport"
    content="width=device-width, initial-scale=1.0">
```

B. Using flexible widths

```
img {
    max-width: 100%;
    height: auto;
}
```

This allows images to fit within their available containers.

C. Using media queries

Media queries apply different CSS rules depending on the characteristics of the device or viewport.

Example:

```
body {
    font-size: 18px;
}

@media (max-width: 600px) {
    body {
        font-size: 14px;
    }
}
```

The smaller font size is applied when the screen width is 600 pixels or less.

12.0 CREATING WEBPAGES FOR TARGET AUDIENCES

12.1 Meaning of a target audience

A target audience refers to a specific group of people for whom a webpage or website is designed.

Web developers must understand the needs, interests, abilities and expectations of the intended users before designing a website.

A webpage should be designed to communicate effectively with the people who are expected to use it.

Examples of target audiences

1. Learners.
2. Teachers.
3. Parents and guardians.
4. Business customers.
5. Tourists.
6. Researchers.
7. Government employees.
8. Health professionals.

9. Farmers.
10. General internet users.







12.2 Importance of identifying a target audience

Identifying the target audience is important because it:

1. Helps developers select appropriate website content.
2. Determines the language and vocabulary to use.
3. Helps select suitable colours and fonts.
4. Determines the type of images and videos to include.
5. Helps organise website navigation.
6. Improves communication between the website and its users.
7. Makes the website relevant to users' needs.
8. Improves accessibility and usability.
9. Helps developers select suitable website features.
10. Increases user satisfaction.

12.3 Factors to consider when creating webpages for target audiences

A. Age of the users

The age of the intended users influences the language, design and presentation of a webpage.

For example:

- Websites for young children should use simple language, colourful illustrations and large buttons.
- Websites for teenagers may include educational resources, multimedia and interactive activities.
- Websites for adults may contain detailed information and professional layouts.

B. Educational level

Developers should consider the users' level of education.

For example:

- Websites for primary school learners should use simple language.
- Websites for secondary school learners may include educational explanations and practical activities.
- Websites for researchers may provide technical information and references.

C. Language

The website should use a language that the intended audience understands.

For example, a Kenyan school website may provide information in English and Kiswahili.

D. Cultural background

Website content, images, colours and symbols should be appropriate for the intended users' cultural backgrounds.

E. Accessibility needs

Webpages should be designed to accommodate users with different abilities.

Examples include:

- Providing alternative text for images.
- Using readable font sizes.
- Providing captions for videos.
- Ensuring sufficient colour contrast.
- Supporting keyboard navigation.
- Avoiding designs that depend only on colour to communicate information.

F. Type of device

Developers should consider whether users will access the website through computers, tablets or smartphones.

G. Internet connectivity

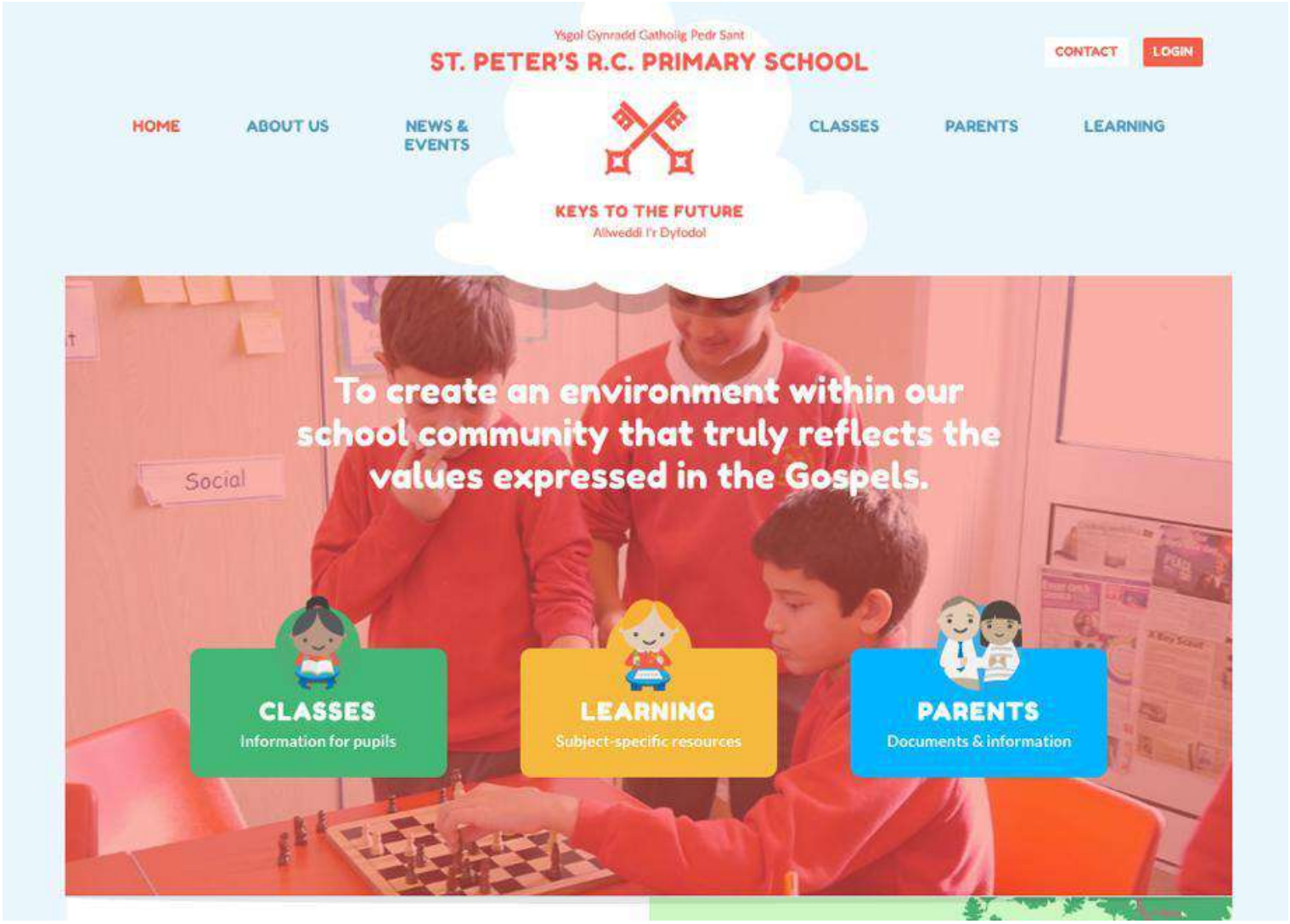
Websites intended for users with limited internet connectivity should avoid unnecessarily large files and heavy multimedia content.

H. Purpose of the website

The purpose of the website determines the type of content and features to include.

For example, an educational website may need notes, quizzes, learning videos and downloadable resources.

12.4 Examples of webpages designed for different target audiences



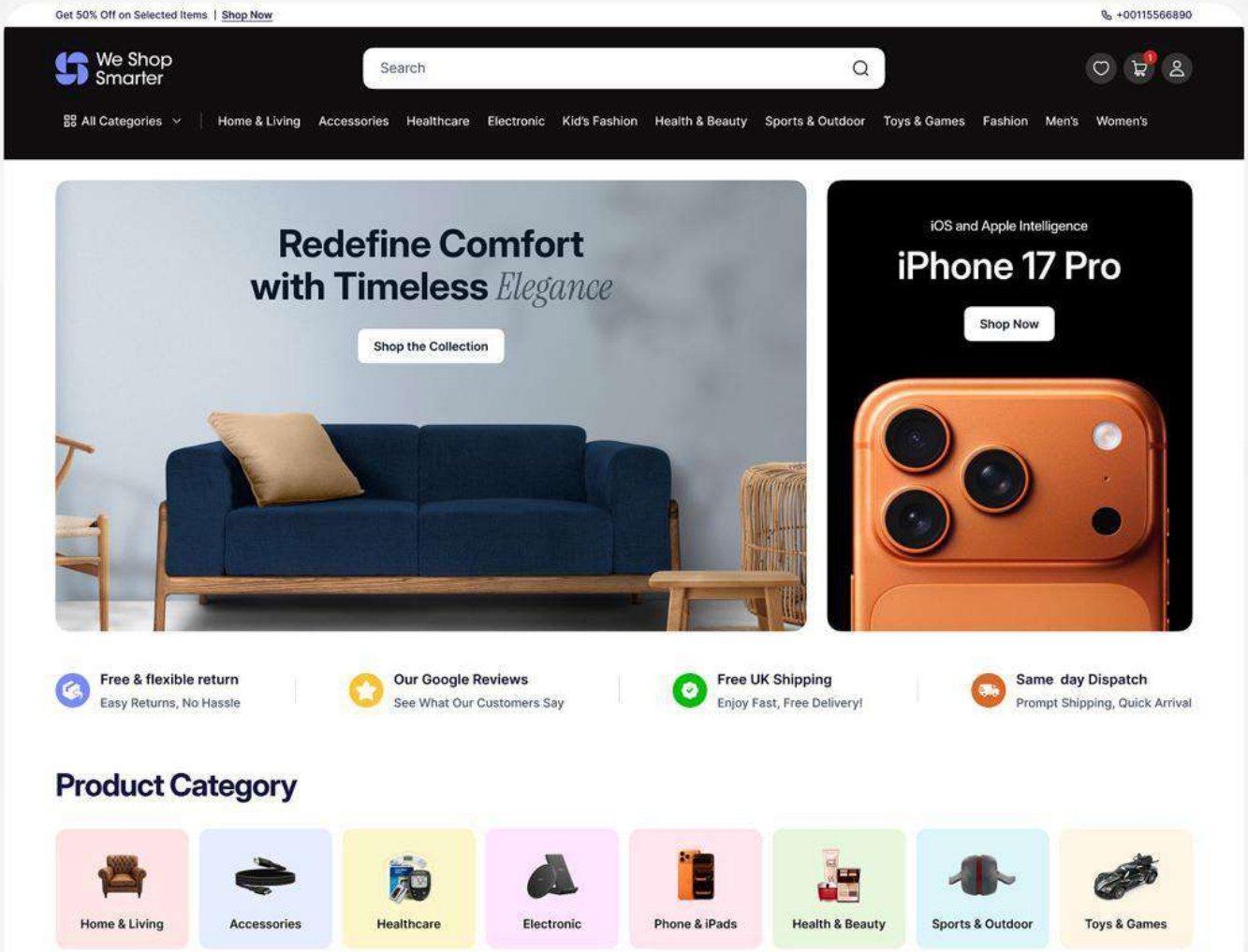
1. Webpages for learners

- Simple language.
- Attractive colours.
- Learning videos and pictures.
- Revision questions and quizzes.
- Easy-to-use navigation.



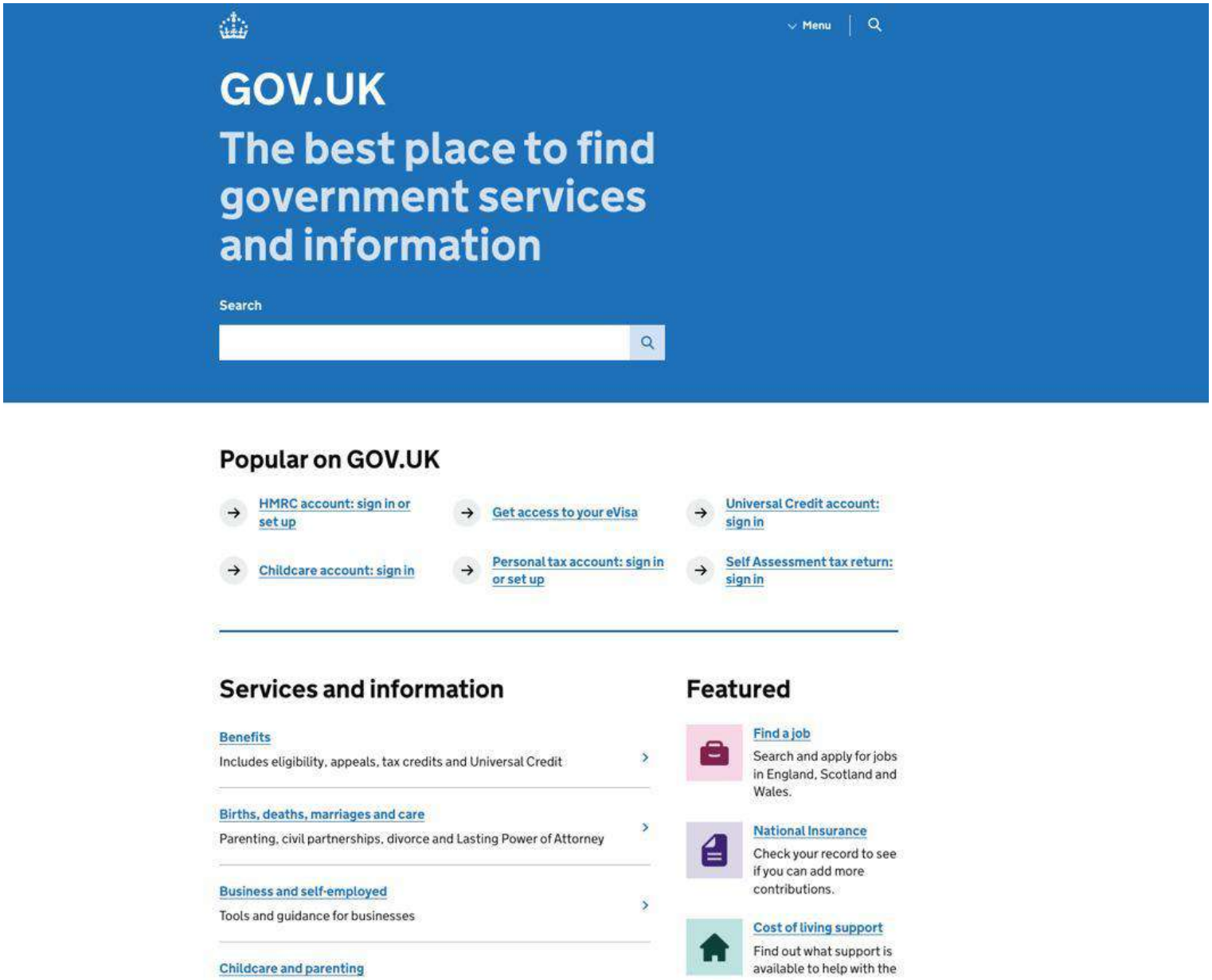
2. Webpages for teachers

- Teaching notes and schemes of work.
- Assessment materials.
- Lesson-planning resources.
- Professional layout.
- Downloadable teaching materials.



3. Webpages for customers

- Product photographs.
- Prices and product descriptions.
- Shopping cart.
- Secure payment information.
- Customer support contacts.



4. Webpages for the general public

- Clear public information.
- Simple navigation.
- Contact details.
- Service information.
- Accessible content.

12.5 Steps involved in creating webpages for a target audience

Step 1: Identify the target audience

Determine the people who are expected to use the website.

Example: Grade 11 ICT learners.

Step 2: Identify the needs of the audience

Establish the type of information and services the users require.

Example: ICT notes, diagrams, practical activities and revision questions.

Step 3: Determine the purpose of the webpage

Decide what the webpage should achieve.

Example: To provide learning materials for ICT learners.

Step 4: Select suitable content

Choose relevant text, images, videos and other resources.

Step 5: Plan the webpage layout

Arrange the content into sections such as:

- Header.
- Navigation menu.
- Main content.
- Sidebar.
- Footer.

Step 6: Select suitable colours and fonts

Choose readable fonts and colours that make the webpage attractive.

Step 7: Develop the webpage

Use HTML to create the content and CSS to control its appearance.

Step 8: Test the webpage

Check whether the website works properly on different devices and browsers.

Step 9: Obtain feedback

Ask members of the target audience to use the webpage and provide suggestions.

Step 10: Improve the webpage

Make necessary changes based on users' feedback.

13.0 COMPLETE PRACTICAL PROJECT: DEVELOPING AN EDUCATIONAL WEBSITE

Project title: Creating a webpage for Grade 11 ICT learners

Project description

A school intends to develop an educational webpage to provide Grade 11 learners with ICT learning resources.

The webpage should contain:

1. School name.
2. Website heading.
3. Navigation menu.
4. Information about ICT.
5. Learning resources.
6. Subject topics.

7. Contact information.
8. Attractive colours and formatting.

Step 1: Create a project folder

Create a folder called:

Grade11ICTWebsite

Inside the folder, create the following files:

Grade11ICTWebsite

index.html

style.css

images

Step 2: Create the HTML document

Open index.html and enter the following code.

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">

    <meta name="viewport"
        content="width=device-width, initial-scale=1.0">

    <title>Grade 11 ICT Learning Centre</title>

    <link rel="stylesheet" href="style.css">
</head>

<body>

<header>
    <h1>GRADE 11 ICT LEARNING CENTRE</h1>
    <p>Learn, Create and Innovate</p>
</header>
```

```
<nav>
  <a href="#home">Home</a>
  <a href="#about">About ICT</a>
  <a href="#topics">Topics</a>
  <a href="#contact">Contact</a>
</nav>

<main>

<section id="home">
  <h2>Welcome to ICT Learning</h2>

  <p>
    This website provides Grade 11 learners
    with ICT learning resources and practical
    activities.
  </p>
</section>

<section id="about">
  <h2>About Information Technology</h2>

  <p>
    Information and Communication Technology
    involves the use of digital technologies
    to create, process, store and communicate
    information.
  </p>
</section>

<section id="topics">
  <h2>Grade 11 ICT Topics</h2>

  <ul>
```

```
        <li>Internet and Web Technologies</li>
        <li>Web Authoring</li>
        <li>Computer Networks</li>
        <li>Digital Communication</li>
    </ul>
</section>

<section id="contact">
    <h2>Contact Us</h2>

    <p>School ICT Department</p>
    <p>Email: ict@school.example</p>
</section>

</main>

<footer>
    <p>Grade 11 ICT Learning Centre</p>
    <p>Copyright 2026</p>
</footer>

</body>
</html>
```

Step 3: Create the external CSS file

Open style.css and enter the following code.

```
/* General webpage styling */

body {
    font-family: Arial, sans-serif;
    margin: 0;
    background-color: #f2f5f9;
    color: #222;
}
```

```
/* Header styling */

header {
    background-color: navy;
    color: white;
    text-align: center;
    padding: 25px;
}

/* Navigation styling */

nav {
    background-color: #1673a5;
    padding: 15px;
    text-align: center;
}

nav a {
    color: white;
    text-decoration: none;
    margin: 12px;
    font-weight: bold;
}

/* Main content styling */

main {
    padding: 20px;
}

section {
    background-color: white;
    margin-bottom: 20px;
```

```
    padding: 20px;
    border-radius: 8px;
}

/* Heading styling */

h2 {
    color: navy;
}

/* Footer styling */

footer {
    background-color: navy;
    color: white;
    text-align: center;
    padding: 15px;
}

/* Responsive styling */

@media (max-width: 600px) {
    nav a {
        display: block;
        margin: 10px;
    }
}
```

Step 4: Save the files

Save both files inside the Grade11ICTWebsite folder.

Ensure that the names are:

- index.html
- style.css

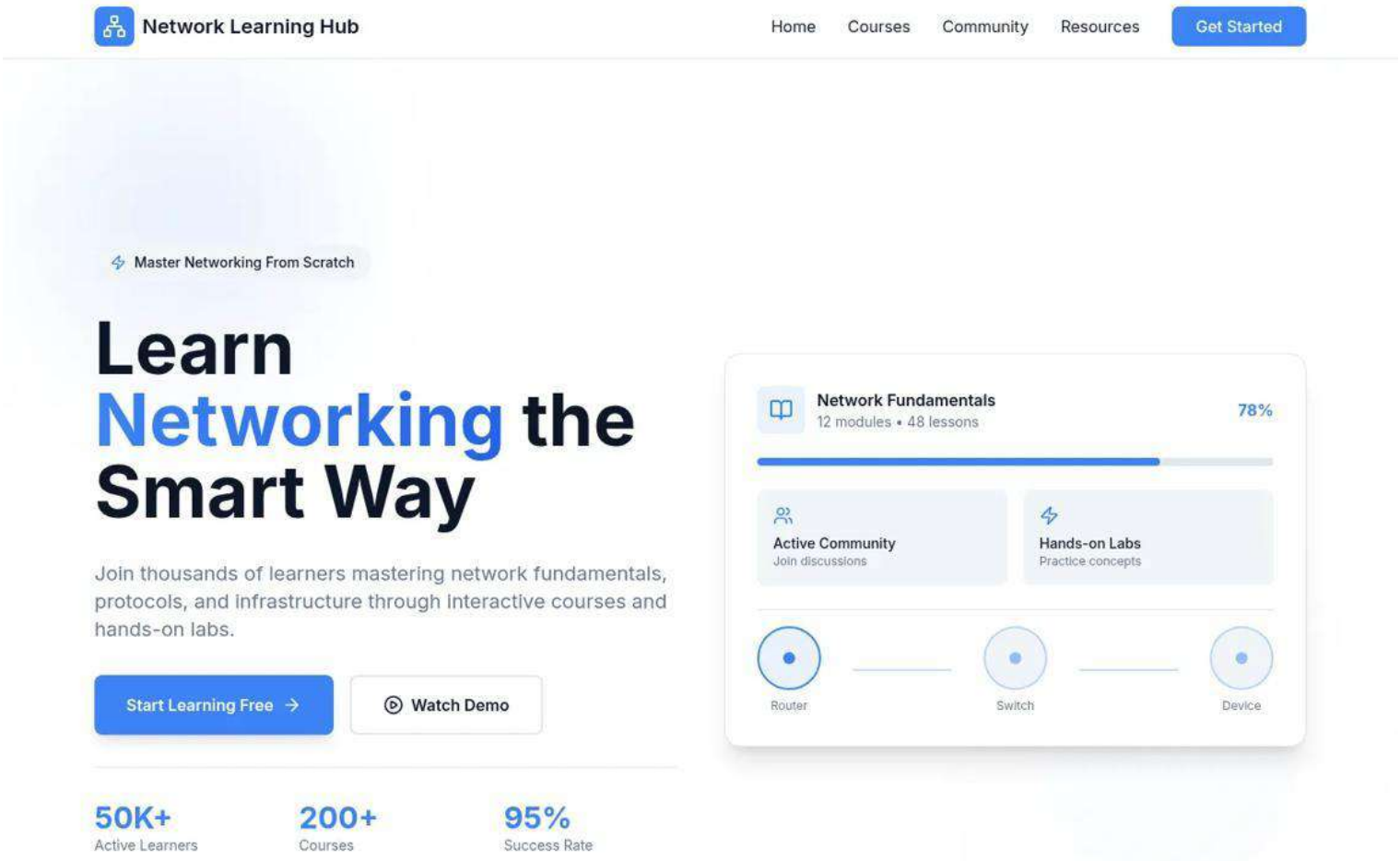
Step 5: Open the webpage

Locate index.html and open it using Google Chrome, Firefox or Microsoft Edge.

Step 6: Observe the webpage

Check whether:

1. The school heading is displayed.
2. The navigation links appear.
3. The ICT information is displayed.
4. The topics are arranged in a list.
5. The footer appears at the bottom.
6. The colours and fonts are properly displayed.



Step 7: Modify the webpage

Make the following changes:

1. Change the heading to your school name.
2. Change the background colour.
3. Add a school photograph.
4. Add two additional ICT topics.
5. Change the footer information.

6. Add a link to an educational website.
7. Test the webpage on a smartphone-sized screen.

Step 8: Evaluate the completed webpage

The webpage should:

- Communicate relevant information.
- Be easy to navigate.
- Have readable text.
- Display correctly in a browser.
- Have an attractive presentation.
- Be suitable for Grade 11 learners.
- Work on different screen sizes.

14.0 COMMON PROBLEMS IN WEB AUTHORING AND THEIR SOLUTIONS

Problem	Possible solution
Webpage fails to open.	Check the filename and .html extension.
CSS styles are not appearing.	Check the stylesheet link and filename.
Images are not displaying.	Check the image filename and file path.
Webpage contains unexpected formatting.	Check HTML and CSS syntax.
Hyperlink does not work.	Check the href attribute and URL.
Text is difficult to read.	Adjust font size and colour contrast.
Webpage does not fit a mobile screen.	Add responsive CSS and viewport settings.
Some content is missing.	Check whether HTML tags are correctly written.

15.0 GOOD PRACTICES IN WEB AUTHORING

When creating webpages, developers should observe the following practices:

1. Use clear and meaningful headings.
2. Use simple and understandable language.
3. Organise content into logical sections.
4. Use appropriate colours and fonts.
5. Avoid excessive animations and distracting effects.
6. Use properly sized images.

7. Provide alternative text for meaningful images.
8. Ensure that hyperlinks work correctly.
9. Use consistent formatting throughout the website.
10. Ensure that webpages are responsive.
11. Test webpages using different browsers.
12. Protect users' personal information.
13. Use secure HTTPS connections when publishing websites.
14. Keep website information accurate and up to date.
15. Respect copyright when using images, text and other materials.

16.0 SUMMARY OF KEY CONCEPTS

Concept	Key points
Web authoring	Creating, designing and maintaining webpages.
Webpage	A single document on the World Wide Web.
Website	A collection of related webpages.
Browser	Software used to access and display webpages.
Web authoring software	Tools used to create and edit webpages.
Web server	Stores and delivers website resources.
Content layer	Contains webpage information; mainly HTML.
Presentation layer	Controls webpage appearance; mainly CSS.
Behaviour layer	Controls user interaction; mainly JavaScript.
HTML	Structures webpage content.
CSS	Controls webpage presentation.
Inline CSS	Styling applied directly to an HTML element.
Internal CSS	Styling written inside the HTML document.
External CSS	Styling stored in a separate CSS file.
Target audience	Intended users of a webpage.
Responsive design	Enables webpages to adapt to different screen sizes.

REVISION QUESTIONS AND PRACTICAL ACTIVITIES

Section A: Multiple-choice questions (30 marks)

Instructions: Answer all questions. Choose the correct answer from alternatives A, B, C and D.

1. What is web authoring?

A. Repairing computer hardware.

B. Creating, designing and maintaining webpages.

C. Installing computer operating systems.

D. Processing numerical data.

2. Which language is mainly used to structure webpage content?

A. CSS

B. JavaScript

C. HTML

D. SQL

3. A collection of related webpages is called a:

A. Web browser.

B. Website.

C. Web server.

D. Search engine.

4. Which of the following is a web browser?

A. Microsoft Excel.

B. Google Chrome.

C. Adobe Photoshop.

D. Microsoft Word.

5. Which software can be used to write HTML code?

A. Notepad++.

B. Microsoft Calculator.

C. Windows Media Player.

D. Microsoft Access.

6. Which of the following is an example of web server software?

A. Apache.

B. Excel.

C. PowerPoint.

D. Paint.

7. Which layer of a webpage determines its appearance?

A. Behaviour layer.

B. Content layer.

C. Presentation layer.

D. Storage layer.

8. Which technology is mainly responsible for the behaviour layer?

A. HTML.

B. CSS.

C. JavaScript.

D. XML.

9. Which HTML tag is used to create a paragraph?

A. <h1>

B. <p>

C.

D. <table>

10. Which HTML tag is used to insert an image?

A. <img>

B. <image>

C. <picturefile>

D. <src>

11. Which attribute specifies the destination of a hyperlink?

A. src

B. href

C. alt

D. width

12. Which CSS property changes text colour?

A. background

B. font-size

C. color

D. margin

13. Inline CSS is applied using which HTML attribute?

A. href

B. style

C. src

D. class

14. Where is internal CSS written?

A. Inside the <style> element.

B. Inside the <footer> element.

C. Inside the <img> element.

D. Inside the <title> element.

15. Which file extension is commonly used for external CSS?

A. .html

B. .docx

C. .css

D. .xlsx

16. Which HTML element links an external stylesheet?

A. <style>

B. <link>

C. <script>

D. <body>

17. What is the main advantage of external CSS?

A. It removes the need for HTML.

B. It allows several webpages to share one stylesheet.

C. It automatically creates images.

D. It replaces a web browser.

18. Which CSS property controls the size of text?

A. font-size

B. text-align

C. background-color

D. border

19. Which CSS property controls the space outside an element?

A. Padding.

B. Margin.

C. Colour.

D. Width.

20. Which CSS property controls the space between content and its border?

A. Margin.

B. Padding.

C. Height.

D. Display.

21. What is a target audience?

A. The person who develops a browser.

B. The group of users for whom a webpage is designed.

C. The computer storing website files.

D. The person repairing a computer.

22. Which feature helps a webpage adapt to different screen sizes?

A. Responsive design.

B. File compression.

C. Disk formatting.

D. Data encryption.

23. Which HTML element creates a numbered list?

A.

B.

C.

D. <p>

24. Which HTML element creates a table row?

A. <td>

B. <th>

C. <tr>

D. <table>

25. Which of the following is an advantage of CSS?

A. Makes webpages harder to maintain.

B. Prevents the use of HTML.

C. Improves webpage presentation.

D. Replaces internet connectivity.

26. Which protocol is commonly used to transfer webpages?

A. HTTP.

B. FTP only.

C. SMTP.

D. Bluetooth.

27. What does HTTPS provide in addition to HTTP?

A. Image editing.

B. Encrypted communication.

C. Faster typing.

D. Automatic printing.

28. Which HTML element defines the main visible content of a webpage?

A. <head>

B. <body>

C. <title>

D. <meta>

29. Which selector is used to identify an HTML class in CSS?

A. #

B. .

C. @

D. &

30. Which of the following is a good web authoring practice?

A. Using unreadable fonts.

B. Ignoring mobile users.

C. Testing webpages before publishing.

D. Using broken hyperlinks.

Section B: Structured questions (50 marks)

Answer all questions.

31. Basic web technology (8 marks)

a) Define the term web authoring. (2 marks)

b) Differentiate between a webpage and a website. (2 marks)

c) State four examples of web browsers. (2 marks)

d) State two functions of a web server. (2 marks)

32. Layers of a webpage (6 marks)

a) Name the three main layers of a webpage. (3 marks)

b) Explain the role of each layer. (3 marks)

33. HTML web authoring (10 marks)

a) Explain the meaning of HTML. (2 marks)

b) State four functions of HTML in webpage development. (4 marks)

c) Write HTML code to create a webpage containing:

- A heading reading MY SCHOOL.
- A paragraph reading Welcome to our school.
- An unordered list containing Mathematics, English and ICT. (4 marks)

34. CSS styling (10 marks)

a) Define CSS. (2 marks)

b) Explain the three methods of applying CSS to an HTML webpage. (3 marks)

c) Write a CSS rule to:

- Change the heading colour to blue.
- Centre the heading.
- Set the paragraph font size to 18 pixels.
- Change the webpage background to light yellow. (4 marks)

d) State one importance of CSS. (1 mark)

35. Creating webpages for target audiences (8 marks)

a) Define the term target audience. (2 marks)

b) Identify four factors to consider when designing a webpage for a particular target audience. (4 marks)

c) Give two reasons why responsive web design is important. (2 marks)

36. Practical web authoring (8 marks)

A school wants to develop a website to provide information to learners and parents.

a) Identify four webpages that could be included on the website. (2 marks)

b) State three HTML elements that could be used to develop the website. (3 marks)

c) Explain three steps involved in testing the website before publishing it. (3 marks)

PRACTICAL LEARNER ACTIVITIES

Activity 1: Creating a basic webpage

Individual activity

Create an HTML webpage containing:

- Your name as the main heading.
- A paragraph introducing yourself.
- An ordered list of five subjects.
- A photograph.
- A hyperlink to an educational website.

Activity 2: Applying inline CSS

Modify your webpage by:

- Changing the heading colour to green.
- Making the paragraph font size 20 pixels.
- Changing the background colour to light blue.

Activity 3: Applying internal CSS

Create a new webpage and use internal CSS to:

- Centre all main headings.
- Change paragraph text to Arial.
- Apply a yellow background.
- Add borders to selected sections.

Activity 4: Applying external CSS

Create two HTML webpages and one external CSS file.

Link both webpages to the same stylesheet and demonstrate how one stylesheet can control the appearance of both pages.

Activity 5: Designing for a target audience

Design an educational webpage for Grade 7 learners.

Include simple language, appropriate images, clear headings, readable fonts and easy navigation.

GRADE 11 ICT – TOPICAL REVISION QUESTIONS AND MARKING SCHEME

STRAND 3.0: INTERNET AND WEB TECHNOLOGIES

SUB-STRAND 3.1: WEB AUTHORING

Total: 80 Marks

Section A: 30 Marks

Section B: 50 Marks

PART I: LEARNER'S QUESTION PAPER

GRADE 11 ICT

TOPICAL REVISION QUESTIONS

STRAND 3.0: INTERNET AND WEB TECHNOLOGIES

SUB-STRAND 3.1: WEB AUTHORING

TIME: 2 HOURS

TOTAL: 80 MARKS

INSTRUCTIONS

1. Answer all questions in Section A and Section B.
2. Section A consists of 30 multiple-choice questions.
3. Choose the correct answer from alternatives A, B, C and D.
4. Section B consists of structured questions.
5. Write your answers clearly and neatly.

SECTION A: MULTIPLE-CHOICE QUESTIONS (30 MARKS)

Answer all questions. Each question carries 1 mark.

1. What is web authoring?

A. The process of repairing computer hardware.

B. The process of creating, designing and maintaining webpages.

C. The process of installing operating systems.

D. The process of preparing spreadsheets.

2. Which of the following best describes a webpage?

A. A collection of computer programs.

B. A computer used to store information.

C. A single electronic document available on the World Wide Web.

D. A software application used for calculations.

3. A collection of related webpages under a common domain name is referred to as a:

A. Web browser.

B. Website.

C. Web server.

D. Search engine.

4. Which of the following is an example of a web browser?

A. Microsoft Excel.

B. Adobe Photoshop.

C. Google Chrome.

D. Microsoft Access.

5. Which of the following software can be used to create and edit HTML documents?

A. Notepad++.

B. Windows Media Player.

C. Microsoft Calculator.

D. Microsoft Defender.

6. The main function of a web server is to:

A. Create computer viruses.

B. Store and deliver webpages to users.

C. Print documents.

D. Prepare presentations.

7. Which of the following is an example of web server software?

A. Apache HTTP Server.

B. Microsoft Word.

C. Microsoft Excel.

D. Adobe Illustrator.

8. Which webpage layer contains text, images, tables and hyperlinks?

A. Behaviour layer.

B. Presentation layer.

C. Content layer.

D. Security layer.

9. The presentation layer of a webpage is mainly controlled by:

A. HTML.

B. CSS.

C. JavaScript.

D. SQL.

10. Which technology is mainly responsible for adding interactive behaviour to webpages?

A. HTML.

B. CSS.

C. JavaScript.

D. XML.

11. What does HTML stand for?

A. HyperText Markup Language.

B. HighText Machine Language.

C. HyperTransfer Markup Language.

D. High Transfer Machine Language.

12. Which HTML tag is used to create the largest heading by default?

A. <h6>

B. <p>

C. <h1>

D. <head>

13. Which HTML tag is used to create a paragraph?

A.

B. <p>

C. <hr>

D. <title>

14. Which HTML element is used to insert an image into a webpage?

A. <image>

B. <picture>

C. <img>

D. <src>

15. Which attribute specifies the location of an image in HTML?

A. href.

B. src.

C. alt.

D. width.

16. Which HTML tag is used to create a hyperlink?

A. <a>

B. <p>

C. <h1>

D. <table>

17. Which HTML element is used to create an ordered list?

A.

B.

C.

D. <tr>

18. Which of the following is a void HTML element?

A. <p>

B. <h1>

C.

D. <title>

19. Which HTML section contains the information displayed as the main visible content of a webpage?

A. <head>

B. <body>

C. <title>

D. <meta>

20. What is the main purpose of CSS?

A. To structure webpage content.

B. To control the appearance and layout of webpages.

C. To store website files.

D. To retrieve information from databases.

21. Inline CSS is applied directly to an HTML element using the:

A. href attribute.

B. src attribute.

C. style attribute.

D. alt attribute.

22. Internal CSS is written inside which HTML element?

A. <body>

B. <style>

C. <footer>

D. <title>

23. Which file extension is commonly used for an external CSS stylesheet?

A. .html

B. .docx

C. .css

D. .xlsx

24. Which HTML element is used to link an external CSS file?

A. <script>

B. <link>

C. <style>

D. <meta>

25. Which CSS property is used to change the colour of text?

A. background-color.

B. font-size.

C. color.

D. margin.

26. Which CSS property controls the space outside an element's border?

A. Padding.

B. Margin.

C. Border.

D. Font-family.

27. Which CSS property controls the space between an element's content and its border?

A. Margin.

B. Padding.

C. Width.

D. Height.

28. What is a target audience in web authoring?

A. The person who owns the computer.

B. The people for whom a webpage or website is designed.

C. The software used to create websites.

D. The computer that stores webpages.

29. Which of the following helps a webpage adjust to different screen sizes?

A. Responsive web design.

B. File deletion.

C. Disk formatting.

D. Data compression.

30. Which of the following is a good practice when creating webpages for learners?

A. Using complicated language.

B. Using very small fonts.

C. Providing clear headings, readable text and relevant images.

D. Including unnecessary animations.

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

Answer all questions.

31. BASIC ELEMENTS OF WEB TECHNOLOGY (8 MARKS)

a) Define the following terms:

i. Web authoring. (2 marks)

ii. Web browser. (1 mark)

iii. Web server. (1 mark)

b) Differentiate between a webpage and a website. (2 marks)

c) State two examples of web authoring software. (2 marks)

32. LAYERS OF A WEBPAGE (8 MARKS)

a) Name the three main layers of a webpage. (3 marks)

b) Explain the function of each of the three layers identified in (a). (3 marks)

c) Identify the web technology mainly associated with each of the following layers:

i. Content layer. (1 mark)

ii. Presentation layer. (1 mark)

33. CREATING WEBPAGES USING HTML (10 MARKS)

a) Explain the meaning of HTML. (2 marks)

b) State four functions of HTML in webpage development. (4 marks)

c) Write HTML code to create a webpage containing the following:

- A webpage title reading My ICT Page.
- A main heading reading WELCOME TO ICT.
- A paragraph reading ICT helps learners develop digital skills.
- An unordered list containing Mathematics, English and ICT. (4 marks)

34. STYLING WEBPAGES USING CSS (12 MARKS)

a) Define CSS. (2 marks)

b) Explain the following methods of applying CSS to an HTML webpage:

i. Inline CSS. (2 marks)

ii. Internal CSS. (2 marks)

iii. External CSS. (2 marks)

c) Write CSS instructions to perform the following tasks:

i. Change the heading colour to blue. (1 mark)

ii. Centre the heading. (1 mark)

iii. Set paragraph font size to 18 pixels. (1 mark)

iv. Change the webpage background colour to light yellow. (1 mark)

35. CREATING WEBPAGES FOR TARGET AUDIENCES (12 MARKS)

A school intends to develop a website to provide educational information to Grade 11 learners, teachers and parents.

a) Define the term target audience. (2 marks)

b) State four factors to consider when designing a webpage for a particular target audience. (4 marks)

c) Explain three reasons why CSS is important in web authoring. (3 marks)

d) State three reasons why responsive web design is important when developing a school website. (3 marks)

PART II: MARKING SCHEME

Teacher's marking guide

SECTION A: MULTIPLE-CHOICE ANSWERS (30 MARKS)

Award 1 mark for each correct answer.

Question	Answer	Question	Answer	Question	Answer
1	B	11	A	21	C
2	C	12	C	22	B
3	B	13	B	23	C
4	C	14	C	24	B
5	A	15	B	25	C
6	B	16	A	26	B
7	A	17	C	27	B
8	C	18	C	28	B
9	B	19	B	29	A
10	C	20	B	30	C

Total: 30 marks.

SECTION B: STRUCTURED QUESTIONS (50 MARKS)

QUESTION 31: BASIC ELEMENTS OF WEB TECHNOLOGY (8 MARKS)

a) Definitions

i. Web authoring (2 marks)

- The process of creating webpages and websites. (1)
- Involves designing, editing, developing and maintaining web content. (1)

ii. Web browser (1 mark)

- An application software used to access, retrieve and display webpages on the internet. (1)

iii. Web server (1 mark)

- A computer system or software application that stores, processes and delivers webpages to users through a network. (1)

b) Difference between a webpage and a website (2 marks)

- A webpage is a single electronic document available on the World Wide Web. (1)
- A website is a collection of related webpages linked together under a common domain name. (1)

c) Examples of web authoring software (2 marks)

Award 1 mark each for any two:

- Visual Studio Code.
- Adobe Dreamweaver.

- Notepad++.
- Sublime Text.
- BlueGriffon.

Total: 8 marks.

QUESTION 32: LAYERS OF A WEBPAGE (8 MARKS)

a) Three main layers (3 marks)

1. Content layer. (1)
2. Presentation layer. (1)
3. Behaviour layer. (1)

b) Functions of the layers (3 marks)

1. Content layer – provides the actual information displayed on a webpage, such as text, images, headings and tables. (1)
2. Presentation layer – controls the visual appearance of webpage content, including colours, fonts, sizes and layout. (1)
3. Behaviour layer – controls how a webpage responds to user actions such as clicking buttons, submitting forms and selecting options. (1)

c) Technologies associated with the layers (2 marks)

i. Content layer – HTML. (1)

ii. Presentation layer – CSS. (1)

Total: 8 marks.

QUESTION 33: CREATING WEBPAGES USING HTML (10 MARKS)

a) Meaning of HTML (2 marks)

- HTML stands for HyperText Markup Language. (1)
- It is the standard markup language used to create and structure content on webpages. (1)

b) Functions of HTML (4 marks)

Award 1 mark each for any four:

1. Creates headings and paragraphs.
2. Inserts images into webpages.
3. Creates hyperlinks.
4. Creates ordered and unordered lists.
5. Creates tables.
6. Creates forms for collecting information.
7. Embeds audio and video.
8. Organises webpage sections.
9. Creates navigation menus.

c) HTML code (4 marks)

Expected answer:

```
<!DOCTYPE html>
<html>

<head>
   <title>My ICT Page</title>
</head>

<body>

   <h1>WELCOME TO ICT</h1>

   <p>
      ICT helps learners develop
      digital skills.
   </p>

   <ul>
      <li>Mathematics</li>
      <li>English</li>
      <li>ICT</li>
   </ul>

</body>
</html>
```

Mark allocation

Expected element	Marks
Correct HTML document structure, including opening and closing elements.	1
Correct webpage title.	1
Correct main heading and paragraph.	1
Correct unordered list with all three subjects.	1
Total	4

Accept equivalent correctly written HTML code.

Total: 10 marks.

QUESTION 34: STYLING WEBPAGES USING CSS (12 MARKS)

a) Meaning of CSS (2 marks)

- CSS stands for Cascading Style Sheets. (1)
- It is a stylesheet language used to control the appearance, formatting and layout of webpages. (1)

b) Methods of applying CSS (6 marks)

i. Inline CSS (2 marks)

- Styling instructions are written directly inside an HTML element using the style attribute. (1)
- It applies styling to the particular element on which it is used. (1)

Example:

```
<h1 style="color: blue;">Welcome</h1>
```

ii. Internal CSS (2 marks)

- CSS instructions are written inside the <style> element. (1)
- The <style> element is placed in the <head> section of the HTML document and styles the specified elements on that page. (1)

Example:

```
<head>
<style>
h1 {
    color: blue;
}
</style>
</head>
```

iii. External CSS (2 marks)

- CSS instructions are stored in a separate file with the .css extension. (1)
- The stylesheet is linked to an HTML document using the <link> element. (1)

Example:

```
<link rel="stylesheet" href="style.css">
```

c) CSS instructions (4 marks)

Expected answer:

```
h1 {
    color: blue;
    text-align: center;
}
```

```
p {
    font-size: 18px;
}

body {
    background-color: lightyellow;
}
```

Mark allocation

Requirement	Marks
color: blue;	1
text-align: center;	1
font-size: 18px;	1
background-color: lightyellow;	1
Total	4

Accept equivalent correct CSS syntax.

Total: 12 marks.

QUESTION 35: CREATING WEBPAGES FOR TARGET AUDIENCES (12 MARKS)

a) Meaning of target audience (2 marks)

- A target audience is a specific group of people. (1)
- These are the intended users for whom a webpage or website is designed. (1)

b) Factors to consider when designing webpages for target audiences (4 marks)

Award 1 mark each for any four:

1. Age of the users.
2. Educational level.
3. Language used by the audience.
4. Cultural background.
5. Accessibility needs.
6. Type of device used to access the website.
7. Internet connectivity.
8. Interests and preferences of users.
9. Purpose of the website.
10. Technical skills of the intended users.

c) Importance of CSS in web authoring (3 marks)

Award 1 mark each for any three explained points:

1. Improves webpage appearance by applying colours, fonts and attractive layouts.
2. Promotes consistency by allowing similar styles to be used across webpages.
3. Simplifies website maintenance by allowing styles to be updated more easily.
4. Separates content from presentation, making code easier to organise.
5. Improves readability through suitable font sizes, spacing and colours.
6. Supports responsive webpage design.
7. Improves user experience through organised and attractive presentation.

d) Importance of responsive web design (3 marks)

Award 1 mark each for any three explained points:

1. Allows webpages to adjust to different screen sizes.
2. Improves accessibility on smartphones, tablets and computers.
3. Makes website content easier to read on smaller screens.
4. Reduces unnecessary horizontal scrolling.
5. Improves user experience and navigation.
6. Ensures that website content remains usable across different devices.

Total: 12 marks.

INFORMATION COMMUNICATION TECHNOLOGY NOTES

SENIOR SCHOOL CURRICULUM

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AUTHOR: COMPETENCE GROUP

COMPETENCE GROUP