

## About the book

Education is a key for a country's development, but it becomes a hindrance when it is unequally distributed. This big problem of disparity in Education system can be solved through technology. Hence it's high time we embrace technology in Education sooner than later.

Teachers will therefore use the book in their laptops to teach and even give students notes to read online after revision.

The design of this book make it lively and interesting for both teachers and students as it take us away from the monotony of black and white books. The book is divided into two parts: Theory and Accounting.

We have past K.CSE questions at the end of every topic for further understanding and testing.

## CHAPTER ONE

### INTRODUCTION TO COMPUTERS

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) State the different parts of a computer;
- b) Explain how computers have developed;
- c) Classify the various types of computers;
- d) State the safety precautions and practices in a computer laboratory;
- e) Demonstrate basic hands-on-skills on the use of a computer.

#### Content

- a.) Definition of a computer
- b.) Parts of a computer
- c.) Development of computers
- d.) Classification of computers
  - Physical Size
  - Functionality
  - Purpose
- e.) Areas where computers are used
- f.) Definition of a computer laboratory
- g.) Safety precautions and practices in a computer laboratory
  - Behavior
  - Handling of materials and equipment
  - Fire
  - Cabling
  - Stable power supply
  - Burglar proofing
  - Ventilation
  - Lab layout
  - Dust/damp control
  - Lighting
  - Standard furniture
- h.) Hands-on skills
  - Start-up
  - restarting and shut-down (Booting)
  - Keyboard layout
  - Practical keyboard and mouse skills

## Introduction

### Definition of a Computer

- ✓ It is an electronic device that transforms data to information.

Data: Raw facts. Information:

Processed data.

A computer system is made up of two parts: **Hardware** and **Software**.

#### Hardware

- ▶ These are the physical parts of the computer e.g **printers, keyboard etc.**

#### Software

- ▶ These are the programs (sets of instructions) that are used to run the computer e.g. Word processor, spreadsheet, database, presentation software etc.

### Parts of hardware

- ✓ Hardware consist of three parts as follows.

#### **Input Devices**

- ▶ These are devices that are used to feed the computer with data for processing within. Examples include: Keyboard, mouse, scanners, digital cameras etc.

#### **Output Devices**

- ▶ These are devices that are used to give out information (processed data) from the computer to the user. Examples include: Monitors, Plotters, speakers etc. The output could take any of the following forms:
  - **Soft copy**-this is output that is shown on the screen.
  - **Hardcopy**-this is information printed on paper e.g. from a plotter, printer.
  - **Machine readable form**- this is output that can only be read using the computer e.g. information stored on disks.

### Central processing Unit

- ✓ The Central Processing Unit (CPU), motherboard, storage devices and other peripheral devices.

#### **Peripheral Devices**

- ✓ Devices connected directly or indirectly to the mother board.

### Parts of the CPU.

- ✓ CPU is made up of three parts, namely:

#### Arithmetic Logic Unit

- ▶ The work of the ALU is to perform mathematical functions as well as do comparisons between units of data presented to it.

#### Control Unit

The work of the CU is to take data from an input device, to the processor/memory, then to an output device.

#### Memory

- ▶ The work of memory is to store data before, during and after processing.

## Classification of Computers

1. Size and Memory
2. Purpose
3. Functionality

### Classification according to Size and Memory

- i. Supercomputer
- ii. Mainframe
- iii. Minicomputer
- iv. Microcomputer
- v. Desktop
- vi. Laptop
- vii. Palmtops

### Advantages of laptops

- Portable
- Ruggedness: Designed to withstand travelers
- Display active color screen
- Power batteries serve as ups

### Disadvantages

- Less expansion options
- They are easily stolen

### Classification according Purpose

#### 1. General computers

This computer can do or handle a variety of tasks when loaded with appropriate programs.

#### 2. Special computers

They are designed to serve a specific purpose or to accomplish one particular task.

#### 3. Dedicated Computers

They can handle any task but it is a dedicated to one task.

### Classification according to Functionality

**1. Digital computers:** They handle discrete data.

**2. Analog computers:** Deals with data that keeps on changing in time (Continuous data).

**3. Hybrid computers:** The computers can handle both analog and digital data.

### Elements of a Computer System

1. **Input:** Data or raw facts.
2. **Processing:** Act of transferring raw facts into meaningful output or information.
3. **Output:** Processed data or information.
4. **Storage:**

## Control unit:

Functions of the control unit are-

- Avails instructions in sequence
- Interprets instructions
- Initiates the appropriate actions thereby controlling all the processes

## Development of Computers

### First Generation Computers (1940 - 1958)

Used thermionic valves or vacuum tubes

#### Advantages

- Vacuum tubes technology made it possible with advent of electronic digital computers
- It was the fastest calculating device at that time.

#### Disadvantages

- Too bulky
- Unreliable
- Had limited memory
- Generated a lot of heat
- Consumed a lot of power

#### Examples

IBM 650, UNIAC

## Second Generation Computers (1958 – 1964)

They used transistors

#### Advantages

- Smaller than first generation computers
- More reliable
- Generated less heat than the first generation
- Less prone to hardware failure

#### Disadvantages

- Required air condition for cooling
- Required frequent maintenance
- It was very expensive

#### Examples

IBM1401, Honeywall200, CDC1604 e.t.c.

## Third Generation Computers (1964 – 1970)

They used Integrated Circuit (IC)

#### Advantages

- Smaller in size
- More reliable than the previous ones

- Emitted lesser heat than the previous ones
- Less maintenance cost
- Less power consumption than the first and the second generation

### Disadvantages

- Highly sophisticated for the manufacture of Integrated Circuit
- Costly

### Examples

IBM360, BurroughsB5600

## Fourth Generation Computers (1970-1989)

The are characterized by the use of Large Scale Integrated Circuit (LSIC)

### Advantages

- Smaller in size
- More reliable than previous generation computers
- Generated negligible heat
- Faster than previous generation computers
- Less prone to hardware failure
- Portable

### Disadvantages

Highly sophisticated technology in manufacturing of Large Scale Integrated chip

### Examples

IBM3033, Burroughs67700

## Fifth Generation Computers (From 1989)

- Expected to do parallel processing
- Based on logical inference operations
- Expected to make use of artificial intelligence

## Features of a Computer

- Automation: Computers work with minimum human intervention once supplied with data and instructions.
- Accuracy: Computers are ever accurate but entirely depend on the data entered.
- Speed: Performs tasks in very short period.
- Storage: Computers can store large volumes of data and information.
- Versatile: Ability of doing different tasks as per instructions.
- Diligence: Work for a long period of time without getting bored

### Disadvantages of Computers

- Computers are very expensive
- Cuts down on employment opportunities
- Needs expertise which is expensive to hire and maintain
- They create eye problems
- Loss of information if not well managed

## Areas where Computers are used

1. Supermarkets: Used to keep in stock control i.e. keep accounts of what is in the store, what has been sold, what is out of stock e.t.c
2. Offices: First access and receiving information, automate faster message distribution and document processes.
3. Banks: Special cash dispensing machines called Automated Teller Machine (ATM for cash withdrawal and deposition service. They provide better record keeping and document processing.
4. Industries: Monitoring and controlling industrial processes e.g. using robots
5. Hospitals: Keeping patients records for easier access to treatment and diagnosis. Computerized diagnosis in laboratories.
6. Communication: Sending and receiving emails, teleconferencing, telecommuting, facsimile and e-calling.
7. Transport: Monitoring automobile traffic, aircraft navigation and making flight reservation.
8. Law enforcement
  - Biometric analysis- study of human biological characteristics to know fingerprints, voice and facial features.  
Video cameras e.g. in banks.
  - Development of strong military bases which have international coordination by use of computer radar.
  - Jet fighters are computerized with connection to control centres.
9. Education: Computer Aided Learning (CAL) and Computer Aided Teaching (CAT).
10. Domestic and entertainment/ home: used at home for recreation purposes and keeping budgets.
11. Library services: Easy access and update of books and other library materials.

## Advantages of a Computer

- Stores large amount of information in a limited space
- Speed: performs tasks in very short periods.
- Efficiency: creates an all round saving on space and time.
- Consistency: gives the same results given the same data and instructions.
- Secrecy: information is fairly protected if computer system is well managed.
- Versatility: Can do the same thing over and over again without being worn out.

## Disadvantages

- Computers are very expensive
- Cuts down employment opportunities
- Needs expertise which is expensive to hire and maintain
- They create eye problem

- Loss of information if not well managed.

## Computer Laboratory, Safety Precautions and Practice

### Considerations for a Computer Laboratory

1. The number of computers to be installed.
2. Size of the laboratory.
3. The number of user that the laboratory can accommodate.
4. Reliability of a source of power.

## Safety Precautions and Practices

### 1. Behavior in Computer Laboratory

- Avoid smoking or exposing computer to dust. Smoke and dust damage computer components.
- Avoid carrying food and beverages: may damage components and liquids may cause rusting and electrical shocks.
- Avoid unnecessary movement because you may accidentally knock down peripherals.
- Follow the correct procedure for storing and shutting down computers.
- Reporting accidents immediately.
- Ask for assistance.

### 2. Ventilation: to avoid suffocation and overheating. This avoids damage of electronic parts.

### 3. Lighting: to avoid eyestrains that leads to headaches, stress and fatigue. User may adjust brightness of computer monitor. Also radiation filter screen may be fitted.

### 4. Protection against fire: Use or fit gaseous fire extinguisher.

### 5. Dust and dump control

- Special curtains reduce dust entry
- Covering computers

### 6. Regulate humidity to remain at an optimum of 50% by the use of humidifier and dehumidifier.

Low humidity allows static electricity to build up and cause damage to computer components. High humidity causes corrosion, destroy devices and electrical faults.

### 7. Furniture: Strong and wide enough to accommodate all peripheral devices. User seats must be

comfortable and have straight back rest that allows someone to sit upright to avoid muscle pains and aches.

### 8. Burglar proofing:

- Fit strong metallic grills and locks on doors and windows
- Don't welcome strangers to computer room
- Install security alarms at strategic access points to alert security personnel incase of break in.

### 9. Stable power supply: Functions of Uninterrupted Power Supply (UPS)-

- Regulate high voltage
- Regulate low voltage
- Provide temporary power
- Notify when power goes off.



## Keyboard Layout

### 1. Alphanumeric Keys

Comprises of numbers and all alphabets, symbols like @,!,\$,%,&,\*,(,),?,>,< e.t.c. Other keys include Caps lock, Enter key, Tab, Spacebar, Back space.

- a) Caps Lock: When on letters typed appear in uppercase and when off letters appear in lowercase.
- b) Enter keys: When pressed it forces the cursor to move to the beginning of the next line.
- c) Tab keys: Used to move the cursor at set intervals.
- d) Back space: Deletes characters to the left from the cursor position.

### 2. Function keys

They are always located along the top of the keyboard. They are labeled F1, F2 to F12.

### 3. Cursor Movement and Editing Keys

#### Cursor Movement Keys

- a) Arrow Keys: Used to move the cursor up, down, left and right.
- b) Page up and page down keys: Moves the cursor one page up or down.
- c) Home and End keys: Pressing Home key moves the cursor to the beginning of the current line. End key moves the cursor to the end of the current line.

#### Editing Keys

- a) Insert key: It helps the user to insert or replace a character at the cursor position.
- b) Delete (Del) key: This key deletes characters at the cursor position from left to right.

### 4. Special PC Operation Keys

They are rarely used singly but in combination with other keys to give special instructions to the computer. They include SHIFT, CTRL, ALT and ESC.

### 5. Numeric Keypad

Consist of a set of numbers 0 to 9 and the arithmetic signs +,-, \*, / and are located on the right side of the keyboard.

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

### 1. (a) Clearly define a computer

- A computer is an electronic device that operates (works) under the control of programs stored in its own memory unit
- An electronic device that accepts data, as input and transforms it under the influence of a set of special instructions called programs, to produce the desired output (referred to as information)

### (b) Give one reason why a computer is referred to as an electronic device

- It uses electrical signals to process data
- It is made up of electronic components and uses electric energy to operate

### 2. Explain the following terms as used in computer science

#### (i) Data

A collection of raw facts, figures or instructions that do not have much meaning to the user

#### (ii) Program

A computer program is a set of related instructions which specify how data is to be processed

A set of instructions used to guide a computer through a process

#### (iii) Data processing

It is the process of collecting all terms of data together & converting them into information

#### (iv) Information

Data which has been refined summarized & manipulated in the way you want it, or into a more meaningful form for decision-making

### 3. State any three functions of a computer

- Accepting data
- Processing the data
- Producing information

### 4. Explain the following input/ output terms as used in computer systems. Give an example for each

(a) Read - To transfer data from an input device to the computer, e.g. the computer

reads data from a disk, a keyboard, etc

- To move or copy data from backing storage to the main storage
- (b) Write - To transfer information from the computer to an output Device e.g. the computer writes output on a printer or onto a disk.
- To move or copy data from the main storage to a backing storage

**5. State four different parts that make up a computer** (2 mks)

- System unit
- Monitor
- Keyboard
- Mouse
- Printer
- Modem
- Scanner
- Speakers
- Graph plotters

**6. (a) Explain the term system Unit**

This is the casing that houses the internal components of the computer such as the CPU and storage devices

**(b) List four devices located under the cover of the system unit**

- Central processing Unit (CPU)
- Motherboard
- Power supply unit
- Main memory
- Hard disk
- Disk drives
- Battery
- Buses
- Input/ output ports
- Video card
- Expansion slots

**(c) Give two differences between tower – style and desktop system units**

- Tower style system unit is designed to stand alone or to be placed on the floor, desktop units lie on the desk with the monitor placed on top
- Tower style units have more space for expansion than the typical desktop units

(2 mks)

**7. Computers have evolved through a number of generations. List any 4 characteristics of the first generation of computers.**

- Large in physical size
- Relied on thermionic valves (vacuum tubes) to process and store data

- Consumed a lot of power
- Produced a lot of heat
- The computers constantly broke down due to the excessive heat generated; hence were short-lived, and were not very reliable
- Their internal memory capacity/ size was low
- Processing speed was very slow
- Very costly
- Used magnetic drum memory

## **8. Briefly explain the classification of computer according to historical development (generations)**

### **First generation computers**

- Used vacuum tubes in their memory
- Large in physical size
- consumed a lot of power
- Produced a lot of heat
- The computers constantly broke down due to the excessive heat generated; hence were short-lived and were not very reliable
- Their internal memory capacity/ size was low
- Slow in processing data
- Very costly
- Used magnetic drum memories
- Cards were sued to enter data into the computers

### **Second generation computers**

- Used transistors in their memory
- They consumed less power & produced less heat than the first generation computers
- They were relatively faster than the 1<sup>st</sup> generation computers
- Used magnetic core memories
- Were less costly than first generation computers
- RAM memory capacity was 32 KB

### **Third Generation computers**

- Used integrated circuits in their memory
- They were faster than second generation computers
- RAM memory capacity was 2 GB
- Slightly smaller in size than 1<sup>st</sup> & 2<sup>nd</sup> generation computers
- They used a wide range of peripheral devices
- Could support remote communication facilities/ more than one user at the same time
- Magnetic disks were introduced for storage purposes

### **Fourth generation computers**

- Used large scale integrated (LSI) circuits & very large scale integrated (VLSI) circuits in their memory

- They were small & very fast
- Had storage (memory) capacity
- Magnetic disks, bubble memories & optical disks were used for storage
- The first operating system was introduced

### **Fifth generation computers**

- Are the modern computers
- Are designed/ constructed using parallel architectures, 3 -D circuit design & superconducting materials
- Are very powerful, with very high processing speeds
- The computers can perform multiprocessing
- Have virtually unlimited ( very high) memory sizes
- Can support complex programs
- Use advanced hard disks and optical disks for storage, e.g. DVDs
- Use of zip disks
- Use of multi user operating systems & advanced application programs

### **9. State four factors used to classify computers**

- Physical size & processing power
- Power
- Functionality (mode/ method of operation)
- Type of processor (CPU)

### **10. State the differences between desktop computers and laptop computers**

- Desktop is designed to be used when placed on a desk in an office environment. A laptop can be used comfortably when placed on the User's lap
- A laptop is small & portable; desktop computers are not portable

### **11. (a) Explain the emerging trends in microcomputer technology in relation to size**

- PCs are becoming small and portable, e.g. personal Digital Assistant (PDA).

### **(b) Give two reasons why smaller computers like Laptops tend to be more expensive than Desktop computers**

- The technology of producing smaller devices is expensive
- They are convenient because they are portable
- They have advanced power management capabilities (they consume less power since a laptop can operate on rechargeable batteries)

### **12. Which category of computers would you place an N- series Nokia phone**

- Microcomputer/ palmtop

### **13. Give three reasons why a mobile phone is regarded to be a computer**

- It is electronic \* uses electric energy to operate
- It has a display unit (screen)

- It has a keypad
- It has a memory for storage
- It is programmable

**14. (a) Mention three Analogue devices**

- Computer used to control a flight Simulator for training pilots
- Bathroom scale
- Thermometer
- Speedometer
- Post- office scale
- A radio with a knob that slides in a slot to increase volume

**(b) Give three example of special – purpose computers**

- Robots
- Mobile phones used for communication only
- Calculators that carry out calculations only
- Computers used in digital watches & in petrol pumps
- Computers used in petrol pumps
- Computers used in washing machines
- An automatic pilot
- A word processor

**15. State a specific example where each of the following types of computers can be used****(a) Supercomputer**

- Weather forecasting
- Petroleum research
- Defense and weapon analysis
- Aerodynamic design and simulation

**(b) Mainframe computer**

( 1 mk)

- Banks for preparing bills, payrolls, etc
- Hospitals
- Airports (i.e., in Airline reservation systems for booking & storing flight information)
- Communication networks as servers

**(c) Minicomputer**

(1 mk)

- Scientific laboratories & research institutions
- Engineering plants for controlling chemical or mechanical processes
- Space industry
- Insurance companies & banks for accounting purposes
- Communication centers as servers

**(d) Microcomputer / personal computer**

(1 mk)

- Training & Learning institutions, e.g. schools

- Communication centers as terminals
  - Small business enterprises e.g. shops, small offices and homes
- 16. (a) Define a microcomputer ( 1 mk)**
- A computer who's CPU (processor) has been implemented with a microprocessor
- (b) Differentiate between a microcomputer and a personal computer ( 2 mks)**
- A microcomputer is larger in physical size than a PC
  - A microcomputer is more powerful than a PC
  - A PC was designed to be used by one person only
- (c) List three factors to be considered when purchasing a microcomputer (3 mks)**
- Type of processor
  - Processing speed
  - Amount of main memory (RAM)
  - Storage capacity of the hard disk
  - Cost of the computer
  - Speed of output devices
  - Number of users who can access the computers at the same time
- 17. Explain four reasons which make microcomputers suitable for personal computing work**
- Reduced cost, i.e. are cheaper than the minicomputers & mainframe computers
  - Have high processing speed
  - Are small in size (occupy less office space)
  - Are more energy efficient (i.e. consume less power)
  - Are more reliable in doing various functions than the early mainframe computers
  - Are versatile (i.e. can be used for many different tasks)
- 18. (a) Identify and explain five areas where computers are used to process data ( 10 mks)**
- Supermarkets**
- For stock control i.e. records of what is in store, what has been sold, and what is out of stock
    - For calculating customer's change
    - For production of receipts
    - It can be used as a barcode reader
- Banks**
- Manage financial transactions through the use of special cash dispensing machines called ATMs used for cash deposit & withdrawal services
    - Processing of cheques
    - For preparation of payrolls
    - Better record keeping & processing of documents
    - Provide electronic money transfer facilities
- Homes**

- Entertainment e.g. watching movies, playing music, playing computer games
- For storing personal information/ documents
- For calculating & keeping home budgets

**Industries**

- To monitor and control industries processes through the use of robots
- For management control, i.e. to keep track of elders, bills and transactions
- For advertisement purposes, which enable an industry to attack more customers

**Police stations**

- Matching, analyzing & keeping databases of fingerprints
  - For taking photographs & other identification details
  - For record keeping
- For face recognition, scene monitoring & analysis which help the police carry out criminal investigations speedily

**Transport industry**

- Airports; to control the movement of aircrafts, their take off & landing using radar equipment
- For making reservations (booking purposes)
- Storing flight information
- Automobile traffic control; to monitor vehicle traffic in busy towns
- In Railways corporations; to coordinate the movement of goods & wagons
- In shipping control, for efficient management of fleets, cargo handling & communication Offices
- For receiving & sending of information through e-mails, fax, etc
- Production of documents
- Keeping of records

**19. Identify three advantages of using computers in banking****(3 mks)**

- Speed and accuracy
- Easy to access information
- Easy to update records
- Requires less space for storage
- Improves data security and privacy

**20. (a) Define the term ‘ computer laboratory’****( 2 mks)**

- A computer laboratory is a room that has been specially prepared to facilitate installation of computers, and provide a safe conducive environment for teaching & learning of Computer studies.

**(b) Give two factors to be considered when preparing a computer laboratory (2 mks)**

- Security of computers
- Reliability of the source of power
- Number of computers to be installed and the amount of space available

- The maximum number of users that the laboratory can accommodate

**21. List down three safety precautions one should observe when entering a computer laboratory**

**(3 mks)**

- Avoid smoking or exposing computers to dust
- Avoid carrying foods & drinks/ beverages to the computer room
- Avoid unnecessary movements as you may accidentally knock the peripheral devices
- Only authorized people should enter the computer room
- Computers users should be trained on how to use computers frequently
- Computer illiterates should not be allowed to operate the computers
- collect any waste papers which might be lying in the computer room & put them into the dustbin
- Shut the door of the computer room properly

**22. Describe the ideal environment for a computer to work properly**

**(3 mks)**

- Should be free from dust, water and magnets
- Should be kept in well ventilated rooms with optimum (medium) humidity

**23. Explain why smoke and Dust particles are harmful to a computer**

- Dust and smoke particles settle on storage devices and may scratch them during read/ write operation
  - It affects the cooling of the computer

**24. Identify three facilities that will ensure proper ventilation in a room**

- Large & enough windows and doors
- Installing fans
- Installing air conditioning system
- Avoid overcrowding of either machines or people in the room

**25. Why must foods and beverages be kept out of the computer room?**

- Food particles may fall into the moving parts of the computer and damage them. Liquids may spill into the computer parts causing rusting or electrical faults

**26. Why would it not be good to install Powder or Water – based fire extinguishers in the computer room?**

- Powder particles settle on storage devices and may scratch them during read/ write operation
  - Water causes rustling of metallic parts and short – circuits if used

**27. (a) State one reason why a computer needs to be connected to a stable power supply (1 mk)**

- To prevent damage to the computer's secondary storage media
- To avoid damage and loss of important data or information such as application software stored on the media
  - Prevent loss of data/ information that had not been saved before the failure

**(b) List down four functions of the uninterruptible Power Supply (UPS) (4 mks)**

- It prevents sudden power surges that might destroy the computer
- It supplies power to the Computer during blackouts and brownouts
- It provides stable (clean) power supply
- Alerts the user of power loss (by beeping)
- Allows the user to save his/ her work, and switch off the system using the correct procedure

**28. Mention two things that are likely to cause strain- in the computer room**

- Poor lighting of the room
- Bright monitors
- Flickering monitors
- Very bright wall paints reflect too much light

**29. Identify three proper sitting postures while using the computer**

- Adopt relaxed and straight back position to avoid bending forward or leaning far backwards
- The feet should be firmly placed flat on the floor
- The seat must be high enough allowing the eyes to be the same level with the top of the

**Screen**

- The seat must have a straight backrest that allows someone to sit upright. This prevents muscle pains & backaches caused by poor sitting posture
- The height of the chair or working surface must be high enough such that your forearms are parallel with the floor and your wrists are straight.
- The seat must be high enough relative to the table to enable the user use the hands on the peripheral devices comfortably.

**30. State two methods of minimizing dust in a computer laboratory**

- Fit the computer room with special curtains to reduce entry of dust particles
- Cover the floor with carpets in order to absorb dust
- Regular cleaning of the laboratory
- Cover the computer devices with dust covers when cleaning the room

**31. Name two main causes of fire in the computer laboratory and give the precautions that should be taken to guard against them**

- Inflammable chemical such as those used to clean the computer equipment
  - Keep the chemicals away in store after use
- Open wires/ cables
- Ensure that all electrical wires are properly insulated
- Ensure that the computer room has a gaseous fire extinguisher containing carbon dioxide in case of any accidents
- Smocking

**32. What is the purpose of labeling a diskette?**

- To prevent confusing the data in the different diskettes
- To prevent mixing diskettes that are used everyday with those used for long- term storage

of important data.

**33. List three things that can spoil a printer if they are not of the correct specification, and explain what damage may be caused**

- (i) Printer Paper: Different printers have different sensitivity to printing papers. Using the wrong quality paper in a particular printer can make the paper get stuck
- (ii) Cartridges & Ribbons: Printers are very specific to manufacturer's cartridges & ribbons

Use of clones or imitations ( i.e., the wrong make & model) can damage the printer mechanism

(iii) Refilling of cartridges or re-inking of ribbons: It can spoil the printer due to leakage or use of poor quality materials

**34. Explain three ways that computer technology could make office more efficient (3 mks)**

- There is easier & faster retrieval of data, i.e. they reduce the time and effort needed to access and retrieve information
- Increased accuracy of data
- Better presentation of data
- Ensure faster processing of data
- Ensures economic use of storage space

**35. (a) Explain the steps you would follow to set up a new computer**

- Gently and carefully connect the interface cable of each device to the correct port and to the device.
- Connect the computer to the source of power and switch it on.
- Observe boot up information on the screen to see whether Power-On Self Test (POST) displays any error message. A successful boot means that the computer was properly setup.

**(b) Outline three reasons why it is important to first shut down the computer before turning it off**

- To avoid damaging storage devices that may still be in use
- To avoid damaging system and application files
- To avoid loss of data and information

( 3 mks)

**36. A computer must go through the process of booting/ initialization before use**

**(a) Briefly explain the term “computer booting”.**

Booting refers to the starting up of a computer. It is the entire process that makes the computer ready for use.

**(b) Explain what happens in the computer during the booting process**

When the power is switched on, internally, it first checks whether all the components are in good working condition, i.e. the RAM, CMOS (BIOS), hard disk & floppy disk drive controllers, and the keyboard. If no problem is found, it then loads the operating systems

**(c) Give and explain two types of booting**

**(i) Cold booting:**

It happens when a computer which was originally off is switched on by pressing the power

button on the systems unit

The Computer starts by checking all its components to determine whether they are functioning properly

**(ii) Warm Booting**

This happens when a computer that was originally on is forced to restart by pressing the restart button on the system unit by pressing a combination of keys on the keyboard ( CTRL + ALT + DEL)

**(d) What type of memory is used to store the boot up program (the first program to be executed on switching on a computer)?**

Read – only Memory (ROM) ( 1 mks)

**37. (a) What is a computer keyboard**

An input device that lets the user enter commands into the computer for execution by typing

**(b) List four types of keys found on a computer keyboard, giving an example of each ( 4 mks)**

- Function/ command keys (F1- F12)
- Alphanumeric Keys (A-Z, 0-9)
- Numeric keypad (0-9)
- Cursor control keys (PgUp, PgDn, Home, end, Arrow keys)
- Special PC keys (Ctrl, Shift, Alt, Ins, Enter, Spacebar, Caps lock, Num lock, etc)
- Editing keys (Del, Backspace, and spacebar)

**(c) Name the keyboard keys that will help you: (2 mks)**

- (i) Type the upper character in a key - SHIFT Key
- (ii) Execute a selected command - ENTER Key

## CHAPTER TWO

### COMPUTER SYSTEM

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Describe a computer system;
- b) Explain the functional organization of the elements of a computer system;
- c) Describe input devices of a computer system;
- d) Describe the central processing unit (CPU);
- e) Describe the output devices of a computer system;
- f) Describe the types of secondary storage devices and media;
- g) Distinguish between power and interface cables;
- h) Explain basic computer set-up and cabling;
- i) Distinguish between system software and application software;
- j) Evaluate the criteria for selecting a computer system.

#### Content

- a.) Description of a computer system
  - b.) Functional organization of the elements of a computer system
    - Hardware
    - Software
    - Live-ware
  - c.) Input devices e.g.
    - Keying devices
    - Pointing devices
    - Scanning devices
    - Speech recognition devices
    - Other digital devices
  - d.) Central Processing Unit (CPU)
    - Control Unit
    - Arithmetic and Logic Unit (ALU)
    - Memory
    - Processors
      - (i) types
      - (ii) clock speeds
  - e.) Output Device
    - Soft copy output devices e.g.
- i) Visual display unit - Liquid Crystal Display (LCD), flat panel, cathode tube (CRT)
  - ii) Sound output
  - iii) Light emitting
    - Hard copy output devices e.g.

- i) Printers (impact, non-impact)
- ii) Plotters
- f.) Secondary/Auxiliary Storage Devices and Media
  - Fixed e.g. Hard disk
  - Removable e.g.
- i) Floppy disks
- ii) Tape
- iii) Optical disks (CD-R, WORM, CD-RW, DVDs)
- iv) Zip disks
- g.) Power and Interface Cables
  - Power cable
  - Parallel cable
  - Serial cable
- h.) Basic computer Set-up and Cabling
  - Connecting basic computer components
  - Connecting other computer peripherals
- i.) Classification of software
  - Purpose
    - System software
    - Application software
  - Acquisition
    - (i) standard software
    - (ii) user developed (in-house)
- j.) Criteria for selecting a computer system (specifications)
  - Hardware considerations

## Introduction

## Definition of computer system

- ✓ Collection of entities that work together to process and manage data to information.

## Elements of a Computer System

1. **Hardware**- Physical or tangible computer components e.g. keyboard, mouse etc.
2. **Software**- Programs installed.
3. **Liveware**- The computer user.

## Central Processing Unit (CPU)

- ✓ It processes data and controls all computer operations. Elements of the CPU are:

**Arithmetic and logic unit (ALU)**- Performs the actual data manipulation.

- Control Unit-**
1. Fetch phase-Access instruction in sequence
  2. Decode phase-Interprets instructions
  3. Execution phase-execution of commands

### Main memory

It forms an integral element of the processor. It's tasks are;

- Holds data awaiting processing
- Holds data being processed
- Holds data that has been processed awaiting to be output

### Read Only Memory (ROM)

- ✓ Its content can be read but cannot be changed during normal computer operations.
- ✓ It is normally used for permanent storage of data and instructions that remains unchanged for a long period of time.

### Types of ROMs

- i. Mask Read Only Memory (MROM): contents cannot be changed once written on it by manufacturers.
- ii. Programmable ROM (PROM): the user rather than the manufacturers can after store data but once only.
- iii. Erasable Programmable ROM (EPROM): the content can be reprogrammed by exposing it to ultraviolet light.
- iv. Electrically Erasable Programmable ROM (EEPROM): the content can be erased and programmed using electricity.

## Characteristics of ROM

- The content cannot be changed unless written in a special type.
- Non-volatile: data cannot be lost when the computer is switched off.

## Random Access Memory (RAM)

1. Static RAM: the data doesn't need to be refreshed, it is capable of handling data extremely faster. It is also reliable.
2. Dynamic: The data must be refreshed i.e. data must be read and written periodically. It stores more information than static RAM.

## Types of DRAM

- 1) **Fast Page Mode (FPM)**
- 2) **Extended Data Out (EDO):** improvement on FPM
- 3) **Extended Correcting Code (ECC):** Special DRAM, corrects errors, and used on servers.
- 4) **Synchronous Dynamic Random Access Memory (SDRAM):** twice fast as EDO. Run at a speed of system bus up to 100 – 133 MHz
- 5) **Rhombus Dynamic RAM (RDRAM):** has a data transfer rate of 800 MHz
- 6) **Double-Data rate (DDR):** fast DRAM with module speed at which SRAM can transfer data to the processor.
- 7) **Video RAM (VRAM):** Special type of memory that is used only with video adapter.
- 8) **Window RAM (WRAM):** a faster version of video memory.

## DRAM in system unit on memory chamber of laptops

- 1) Dual-inline Package (DIP)
- 2) Single-inline Memory Module (SIMM)
- 3) Dual Inline Memory Module (DIMM)
- 4) Small Outline DIMM (SODIMM)
- 5) Micro DIMM

## Characteristics of RAM

- Information can be accessed at any time (random)
- Data can be changed

## Special Purpose in RAM

1. **Buffers:** They provide temporary storage for finished tasks so that the CPU is set free to carry out other activities instead of waiting for all data to be entered in information to be output.
2. **Registers:** They hold a piece of data at a time and they are inside the CPU. Examples
  - a) An accumulator: temporarily holds the result of the last step of the Arithmetic and Logic Unit.
  - b) An address register: Temporarily holds the next piece of data waiting to be processed.
  - c) Instruction register: Temporarily holds an instruction just before it is interrupted into a form that the CPU can understand.
  - d) Storage register: It temporary holds a piece of data that is on its way to and from the CPU and the main memory.

## Cache Memory

It helps the processor to access data and instructions faster due to incorporation of small high-speed type of Static RAM than it would have taken to fasten it from the relatively slow Dynamic RAM.

## Types of Cache Memory

- Level 1 (Primary cache): located inside microprocessors.
- Level 2 (Extended cache): may be inside microprocessors or mounted on the motherboard.
- Level 3 (Latest cache): works like level 2 to optimize system performance.

## Terms used in the CPU

1. **Chip:** A small rectangular piece of silicon on which most circuits are implemented by extension.
2. **Integrated Circuit (IC):** It is a device that is integrated or joint to connect a circuit of several electronic components in a single package.
3. **Large Scale Integration (LSI):** Refers to the technology that integrates thousands of transistors on a single Integrated Circuit (IC). If more than 20000 transistors are integrated the Very Large Scale Integration (VLSI) is used.
4. **Microprocessor:** This is the brain of the PC.
5. **Microcomputer system:** This refers to computer set of devices require using and operating the computer. This includes peripheral devices.

## Input Devices

Devices that accept data from external environment and encode it into a form understandable to the computer for processing.

## Classification of Input Devices

1. Keying devices: use buttons to make entries e.g. keyboard and keypad
2. Pointing devices: Mouse, trackball, joystick, lightpen
3. Scanning: capture data directly from source

## Optical scanners

1. **Optical Mark Recognition (OMR):** Detects marks made on a piece of paper using a soft pen or pencil.

### Advantages

- Low error rates
- Conspicuous errors are corrected
- Minimize manual work

### Disadvantages

- Relatively slow
- Difficult verification of worked data
- Not widely used in business

### Application

- Making of multiple choice exams
- Market research questionnaires
- Payroll entry
- Traffic surveys

2. **Optical Bar Recognition (OBR):** Used to read bar codes.

### Advantages

- Barcodes can be printed by normal printing methods
- Type of item or price doesn't have to be repeatedly written or retyped

### Disadvantages

- Bar codes can be read by machines
- Only numbers can be coded this way
- Are relatively fixed, so they are unsuitable for recording prices which can change frequently

### Applications

- On labels and on shelves for stock taking
- Printed on shop goods e.g. supermarkets
- In libraries

3. **Optical Character Recognition (OCR):** Not only does it scan characters but also can scan real objects, pictures and drawings

### Advantages

- Limited errors
- Early methods
- Document design is less complicated
- Character can be read by people

### Disadvantages

- Expensive or costly
- May require redesigning quite frequent
- Only certain font is applicable

## Magnetic scanners

1. **Magnetic Ink Character Recognition (MICR):** Allows special devices to read magnetic characters written in a special format.

### Advantages

- Fast, accurate and automatic
- Codes are both machine and human readable
- Reduces forgery

### Disadvantages

- Limited to only 14 characters
- Based on magnetism and can easily

### Application

- Banking industry for cheques

2. **Magnetic Strip Recognition (MSR):**

### Advantages

- Simple to produce
- Not easily damaged
- Stores fairly large number of characters

### Disadvantages

- Data can be changed or erased by magnetic fields

### Applications

- On credit card
- On bank cards
- As tags on clothes
- As a phone card

## Keying devices

1. Traditional Keyboard
2. Flexible keyboard: can be folded
3. Ergonomic Keyboard: designed to provide comfort and allocate wrist strain.
4. Keypad: Miniature keyboard used in PDAs, laptops and mobile phones.
5. Braille keyboard: designed for the blind.

## Pointing devices

### Mouse

1. Standard mouse: has a ball underneath, two buttons and optical scroll button located between left and right buttons.
2. Optical mouse
3. Cordless/ wireless mouse: battery powered mouse that uses radio or infrared waves instead of being physically connected to the system unit



### Trackball

Its advantage over mouse is that it neither requires an extra space nor a flat surface for movement.



### Joystic

An input device like a car gear that can be moved sideways, upwards or downwards to control the position of the cursor.

### Light pen and style

The lightpen is a hand held device that has just a light sensitive point. It can make selections, place images, draw and indicate dimensions by simply touching the screen. Doesn't emit light but reacts to light emitted by the display using a photosensitive detector at its base.

**Speech Recognition/ Voice input:** This is where microphone is used to enter data/information or spoken words into a computer. Situations for speech recognition:

- Where hands are busy handling documents
- Due to movement
- Disability e.g. blind without hands

### Uses

- i. Electronic fund transfer
- ii. House/ car security i.e. voice activated locks
- iii. Offer security for room access
- iv. Voice activated toys and scanners
- v. Quality control and automation in factories
- vi. Automated material handling
- vii. ComputerAid Design

### Limitations

- i. Existence of homophones
- ii. Word separation is difficult
- iii. Slow recognition
- iv. Speaker variability
- v. It is still at the early stage of development
- vi. Limited vocabularies

## Touch screen, Digitizers and Cameras

**Touch screen:** Use touch sensitive screen where the computer detects the position of the finger on the screen and responds accordingly.

**Digitizers:** Almost similar to light pen but has a graph tablet on which user writes using a pen like device called a style

**Cameras:** Store images in digital form.

## Other Examples of Input Devices

### Point of sale (POS) Terminal

This consists of numeric keypads and a few controls or function keys. They are normally used in computerized wholesale or retail organizations like supermarkets.

### Input Facility Considerations

- Cost
- Input Speed

- Volume
- Accuracy
- Reliability
- Mode of operation
- Appropriateness

## Problems faced while collecting data

- Preparation of source document is slow hence prone to mistakes.
- Low typing speed leads to keyboard bottleneck.
- It is wasteful to use a media which can only be used once like punched cards.
- Mistakes can be made when copying data from one medium to another.
- Translation delays or losses can occur if data is physically transferred to the computer.
- Data entry can be expensive

## The Main methods of data entry

1. Source document reader: Orders, sheets and forms are batched and converted into computer acceptable medium.
2. Online data entry (keyboard entry): Data is entered directly into computer one translation at a time under program control.
3. Direct data capture: Data capture directly without conversion stage.

## Outputs Devices

Devices that accept information from internal environment and then decodes it in a form understandable to user

## Classification of Output Devices

1. Soft copy: includes monitors/ VDU and the speakers
2. Hard copy: Printers and plotters
3. Microfiche: Computer Output on Microform (COM)

## Visual Display Unit (VDU)/ Screen

### Types

- a) Monochrome- Display images and text in only one colour
- b) Color- Display in multiple colours

## Examples of Graphic Adapters

1. Monochrome Display Adapter (MDA)- display text in only one color.

2. Hercules Graphic Adapter (HGA)- Support monochrome image and text
3. Color Graphic Adapter (CGA)- Display using sixteen colours.
4. Enhanced Graphic Adapter (EGA)- An improvement over colours but use 16 colours.
5. Video Graphic Array (VGA) – Offers at most 256 colors.
6. Super Video Graphic Array (SVGA) – an enhanced VGA

### Common Types of Flat panel Display

1. Liquid Crystal Display (LCD): Doesn't emit light of their own instead have tiny liquid crystals that reflect light falling on them from the environment.
2. Electro Luminescent: Improved LCD. Emit light when electrically charged.
3. Gas plasma: Use gas that emits light in presence of electric charge.
4. Thin Film Transistor (TFT): This is the latest technology advancement that provides high quality resolution.

## Printers

### How printers are classified

- a) Speed
- b) How they produce the print; character, line or page printers
- c) How they provide prints on the stationery; impact or non-impact printers

### Types

- a) Impact printers: Dot matrix, daisy wheel, golf ball and chain printers.
- b) Non-impact printers: Thermal, inkjet, electrostatic and laser printers

Impact	Non-impact
Slow	Fast
Use ink ribbon	Thermal/electrostatic principle
Cheaper	Costly due to technology involved
Noisy	Quiet
Multiple copies produce is	Multiple copies produce almost

### Printers Consideration

1. Printers initial price, subsequent maintenance cost and cost of consumable items.
2. Volume of printing expected.
3. Nature of report to be generated.
4. Range of capability for the selected printer.
5. Interface with computer at hand on for family particular make.

## Plotters

They are used to produce graphical output e.g. maps and diagrams.

1. Flatbed plotters: Has a flat surface which the stationery is placed for the pen to be moving over it in all directions to produce graphical output.
2. Drum plotters: Has a drum onto which stationery is placed for the drawing to be possible.

### Difference between a printer and a plotter

Printer: produces hardcopy of information on papers.

plotter: Produces big charts e.g. maps, pictures and drawings. Used for printing geographical, architectural and engineering drawings e.g. maps, advertisements posters to be placed on bill boards, machinery parts etc.

## Computer Output (originated) microform (COM)

Provides photograph type of output into the microform (photographs reduced documents on films)

### Advantages

1. Saves stationery and space
2. Faster than printing
- 3 Non-bulky hence conveniently transportable
4. Guarantee security as content cannot be ready by naked eyes

5. Longer lifespan compared to paper medium output

### Disadvantages

1. Expensive
2. Cause eyestrains
3. Expensive additional equipment for viewing contents

## Computer Bus

Communication medium within a computer that allow different elements of the computer to communicate with one another.

1. **Address bus:** Pathway used to locate storage position in memory for the data to be executed.
2. **Data bus:** Pathway where the actual data transfer takes place.
3. **Control bus:** Pathway for all timings and controlling functions sent by the control unit to the parts of the system

## Auxiliary/secondary storage

### Factors to consider when choosing a storage device

- Volume of data to be stored
- The cost
- The quantity or size of data it can hold

### Magnetic Tapes

These are sequential access devices. Implies that information is at the end of tape the program will have to read almost entire tape which may take time to read. Data recorded as series of magnetic dots across tracks on the tape cassette when characters are stored serially down the length of the tape.

Sequential access medium: Data is stored across magnetic tape

Serial access medium: data is stored along the media

#### Advantages

- Light and easy to carry
- Effective for batch applications since they are cheaper

#### Disadvantages

- Slow since they are sequential access media
- Gaps between (called Inter Record Gap, IRG) waste storage space.

### Magnetic Disks

#### Floppy Disks (Diskettes)

Information is recorded on number of concentric circles called tracks. Tracks are divided into sectors. Sectors and tracks have same storage capacity because inner tracks have a high density. Diskettes are direct access storage medium (DASM) and access time is made up of 3 parameters.

1. Seek time: Time taken by the read/write (R/W) head to locate right track that contains content.
2. Rotational delay time: Time taken by drive motor to spin the diskette past R/W head.
3. Data transfer time: Time taken by the R/W head to interpret content and send it as computer input.

### Advantages

1. Exchangeable and easy to carry
2. Can be used with PCs with no hard disk
3. They are cheap
4. Used for back up

### Disadvantages

1. Slower than hard disk
2. Less storage capacity
3. Damaged by light, magnet and dirt

### Zip Disks

Come with portable external drive and are slightly large and thicker in size and has a capacity of up to 250MB

### Jaz Disks

Come with portable external drive and have a capacity of 1GB to 2GB and have high access speeds.

### Advantages of Magnetic Disks

1. Light and portable
2. Effective for batch application
3. Cheap

## Care of Magnetic Storage Media

- a.) Keep away from extreme temperature
- b.) Never touch the disk surface
- c.) Keep them away from magnets
- d.) Never use clips to hold disk
- e.) Keep them away from dust, moisture and high humidity.

## Optical Laser Disk

They are recorded using a laser beam (very strong concentrated light)that burns patterns as fine circular tracks (indentations) on the surface. Data is retrieved using relatively low power laser.

## Super disk (SD) LS-120

They resemble 3 ¼ floppy disk but has a high capacity of 128 MB

## Compact Disk (CD)

They have a high recording density of about 700MB. There are three types of compact disks:

1. CD-ROM (Read Only Memory): The recorded data cannot be changed, deleted or added.
2. CD-R (Recordable): They are initially blank but when data is recorded it becomes permanent.
3. CD-RW (Re-writable): Data can be overwritten/ added or erased.

CD-ROM and CD-R are referred to as WORM (Write Once Read Many) since you cannot write the second time but you can read many times

## Digital Versatile Disk (DVD)

They resemble the compact disks but have a greater storage capacity up to 17GB

## Optical Tapes

They resemble magnetic tapes but they use optical technology

## Hard disk

### Advantages

1. They offer cheap storage
2. They are well protected since they are housed in the CPU
3. Fast in terms of access retrieval and saving of data

### Care for the Hard disk

- a) Keep them away from smoke and dust.
- b) Use the right procedure to switch off the computer to allow the R/W head to move from the disk surface to avoid scratching on rotating surface
- c) Exposure to magnetic property

## Minimal Requirements for a multimedia computer

- A Video Graphic Array (VGA)/ Super Video Graphic Array (SVGA) card and monitor.
- A sound card
- 128MB RAM or higher
- CD or DVD drive
- FM/TV card

## Ports

### Power and Interface Cables

Power cables are used to connect the computer to main power outlet.

Interface cables connect all peripherals to the motherboard and transmit data signals.

Power supply unit supplies power to motherboard and other internal device

### Types of Cables and Ports

1. **Parallel ports:** They transmit data simultaneously using a set of connectors- 8bit parallel cables. They are faster over short distance. Printers, removable storage drives and network adapter. Port is (PT1) 25 PIN
2. **Serial ports:** They transmit one bit at a time. They are slower than parallel ports but they support two way communications. They are 25 pin and 9 pin. COM 1 and COM2. Used by the serial printers.

### 3. Universal Serial Bus (USB)

They transmit one bit at a time but at a very high speed and provide quality data transmission about 15m distance. – External storage devices, cameras etc.

Advantages of USB

- Provide very high speed
- Quality data transmission over long distance
- Support a wide range of peripheral devices

4. **Small Computer System Interface (SCSI)** - Use parallel method but faster than parallel cables. The port connects up to 8 peripheral devices.

### Other ports and connectors

- 5 PIN DIN and 6 pin (PS/2): used by keyboard and mouse
- 9 pin D and 15 HI-pin-D: monitors
- Audio connectors: jack plugs found on sound adapter for connecting speakers, microphone and other portable audio equipments.

## Classification of software according to purpose

### System software

#### Operating system

A set of computer programs that normally reside in the main memory and used to control the basic computer hardware resources & the operation of the entire system.

#### Firmware (Store Logic)

A combination of both software and hardware recorded permanently on electronic chips mounted on the motherboard. May hold operating system, utility programs, language processors etc.

### **Utility Software**

A special program that performs commonly used services that make certain computing aspects go on smoothly e.g. sorting, copying, disk management etc. There are two types:

1. System level: Help user to work with the operating system and its function. It tells whether the command entered is wrong and give suggestion on how the error can be corrected.
2. Application level: Make use of an application program smoother and efficiently.

### **Functions of utility software**

- Reporting of errors which occur during program execution
- Control input and output devices
- Protect use hardware and data from misuse
- Provide program testing routines
- Provides communication between computer user and each program
- Memory management
- Maintenance of internal time clock and log of system usage by all users.

### **Network software**

Establish communication between two or more computers by linking them using a communication channel like cables to create a computer network e.g. Novell Netware

### **Application (packages) software**

Programs that are designed to help user accomplish specific tasks.

Software	Uses	Examples
Word processors	Typing long documents	MS-Word, Word Pro
Spread sheet	Calculating budgets	MS-Excel, Quattropro
Desktop Publishing (DTP)	Designing publications	Adobe PageMaker, MS-Publisher
Computer Aided Design (CAD)	Technical drawing	AutoCAD
Database	Keeping records and files	MS-ACCESS, Dbase
Graphic Design	Creating and manipulating graphics	Corel Draw, Adobe Photoshop

### **Internet Software**

Used in communication and perusing the internet.

### **Programming Software**

Used to create programs that behave like software

## Classification according to Acquisition

### 1. In-house developed programs/ Custom design programs

They are designed to meet the needs of a specific user or organization

### 2. Standard/ Vendor of the shelf software

Designed by software engineers to be used by different users. When closely related software are put under one software it is known as suit/ integrated/ general software. While packages are known as single purpose software e.g. Lotus Suite, MS Office etc.

#### Advantages of Standard Software

- Less expensive
- They're readily available for almost any tasks
- Well tested before they are released hence chances of errors are minimal
- Easily modified (customized) to meet specific user needs
- Other software can be linked to it and use the same data

#### Disadvantages

- Easily pirated
- Do not meet all user requirements

## Consideration for a Computer System

### Criteria for selecting a computer system

- Identify the user requirement
- Evaluate the hardware requirements that will meet users' needs
- Evaluate the software requirements

### Hardware Considerations

- a) **Processing speed:** For faster data processing the speed of the processor must be relatively high.
- b) **Memory capacity:** At least 128MB RAM. There are also factors to be considered when buying a memory module-The type of module supported by motherboard
  - Whether there is an empty slot on the motherboard
  - Compatibility of the module with the existing one
  - Module capacity
- c) **Warranty:** Arrangement between the buyer and the seller whereby incase the product fails during the agreed period of time it is taken care by the seller free of charge or for an agreed fee. Things to consider in a warranty –The scope of cover
  - Call out response and liability agreement
  - Regular preventive maintenance
- d) **Cost:** The cost is determined by the processor, size, and the memory capacity.
- e) **Upgradability and compatibility:** Whether the hardware chosen can be easily upgraded to accommodate emergent technologies.

- f) **User's needs:** Can it meet the unique needs like for the disabled?
- g) **Monitor:** Always consider the size, resolution and the technology involved.
- h) **Multimedia capability:** It should have speakers, CD/DVD drive, sound card, VGA or SVGA card.

### Software Requirements

- a) **Authenticity:** Always consider genuine, valid and legitimacy and developers license.
- b) **Documentation:** Manual from the developers that guide the user on installation, usage and maintenance. –User guides
  - License
  - Manual guide
  - Installation process
  - Quick reference
  - Warranty
- c) **Reliability and security:** Consider whether the software offers good security to confidential and private information.
- d) **User friendliness:** How easily the user can interact with the software.
- e) **Compatibility and system configuration:** Consider whether the software can work with the computer at hand.
- f) **Cost:** Always consider the cost and whether it serves the purpose.
- g) **Users' needs:** The purpose of the software.
- h) **Portability:** Consider whether it can be installed in different computers.

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

### Solved KCSE Questions on the topic

1. Define the following terms as used in computing

(i) **System**

A collection of independent entities that collectively work together to achieve a desired goal

(ii) **Computer system**

- ◆ A collection of entities that work together to process and manage information using computers
- ◆ A collection of hardware software and live- ware all working together in data inputting, processing and production of required output from a computer

## 2. Differentiate between a computer and a computer system

A computer is made up of both hardware and software, while a computer system integrates hardware, software and user

3. (a) List and explain three functional elements of a computer system ( 6 mks)

◆ **Hardware**

They are the physical & tangible devices that make up a computer systems, e.g system unit, input devices, output devices and storage devices

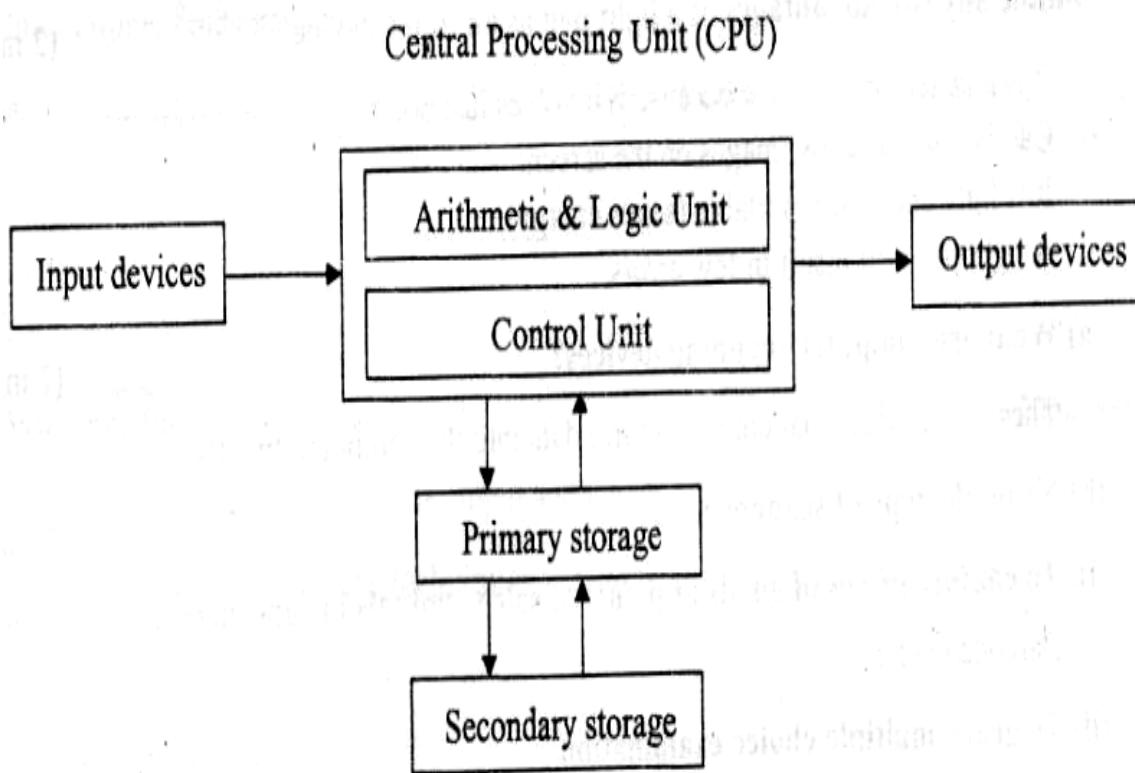
◆ **Software**

These are programs & data used in a computer system that enable it perform a number of specific functions, e.g. operating systems, application programs, utility programs, programming languages & device drives

◆ **Live – ware ( people – ware)**

These are the people who coordinate the various activities which are necessary to make a computer system perform useful tasks e.g. data entry clerks, computer operators, programmers, system analysis, etc

(b) Draw a well – labeled diagram showing the functional units of computer hardware



**4.**

**(a)**

**Give two main functions of a computer input device. (2 marks)**

- Accepts data & instructions from the user and sends them into the CPU. V
- Converts data into a form that the computer can understand (i.e., machine-Sensible/readable form)

**(b) Give an example of a: (3 marks)**

**Device that reads data (scanning device).**

- Scanner,
- Digital cameras,
- Barcode readers.
- ~ Credit/smart card readers,
- Kimball tag readers.
- OMR, OCR, MICR, etc

**Keying device.**

- Keyboard,
- Keypad.

**Pointing device.**

- Mouse.
- Trackball.
- Light pen
- Joystick.

**Voice input device.**

- Microphone.

**Printing device.**

- Printer.
- Plotter.

**5. State two advantages of using a mouse instead of a keyboard. (2 marks)**

- The mouse is easy & convenient to use.
- Modern software includes an option to use it.
- It selects a position on screen much more quickly than a keyboard.

**6. Outline any two advantages of a light pen as an input device, (2 marks)**

- It is a faster input device because it involves just pointing on the screen and selecting options.
- Can be used to draw images on the screen.
- ~ It is light and easily portable (saves energy).
- A light pen will result in few errors.

**7. (a) What are computer scanning devices? (2 marks)**

These are devices that enter (capture) data into the computer directly.

**(b) Name the type of scanner used: (2 marks)**

- (i). To capture prices of goods at points of sale terminals in supermarkets and superstores.

Barcode reader

**(ii).To grade multiple choice examination**

Optical mark reader (OMR)

-12- Computer studies

**8. Mr. Otieno a French teacher used speech method to store students oral answers to an exam into a computer**

**(a) What is a speech input?**

It is a type of input where a microphone connected to a computer system is used to enter data in form of spoken words into the computer

**(b) State two advantages and two disadvantages of using this method of data input  
(4 mks)**

**Advantages**

- Voice input is fast
- Its suitable for people with special needs especially those with impaired hands
- Can be used in emergency situations

**Disadvantages**

- Voice input is complex to develop
- Voice input does not take care speech related problems such as accents, tone etc
- The response rates of speech input devices are relatively slow
- Most speech input devices can recognize a limited, standard vocabulary of spoken words, and the voice of only one speaker
- Cannot differentiate words that have same sounds (homophones)

**(c) State four areas where speech input would be used**

- For people with special needs or disabilities (e.g. the handicapped especially those with impaired hands.)
- Emergency situations
- Where faster data input is required
- In language translator or programs
- Voice tags for voice dialing
- In automated materials handling e.g. in airports, a good handlers give spoken commands that direct the luggage to the appropriate conveyor belt.
- For house/ office or car security where voice activated locks are used for access control
- In voice- activated toys and games
- In electronic funds transfer

**9. Name two examples of scanning (data capture) devices used at point of sale terminals in supermarkets**

- Barcode reader
- Light pen
- Cash registers

**10. (a) What are turnaround documents**

These are documents produced as output and which can be re-used as input by the computer

**(b) Name any two data capture techniques that make use of turnaround documents**

**( 2 mks)**

- Optical character recognition (OCR)
- Optical Mark Recognition (OMR)
- Magnetic Ink Character Recognition (MICR)
- Optical Bar Recognition (OBR)

- Magnetic Stripe Recognition

**11. List five factors one would consider when selecting a data input device (4 mks)**

- The needs of the user
- Type of data to be input
- Volume of data to be entered
- Input speed
- Cost, i.e. the initial cost of the input device & cost of using the device on a day – to – day basis.
- Availability & reliability of the data entry device
- Accuracy required
- Availability of space
- Appropriateness of the device in reference to where it is to be used

**12. Describe three functions performed by the CPU ( 3 mks)**

- (i) It carries out processing of data
- (ii) System control- it controls the sequence of operations within the computer
- (iii) It gives commands to all parts of the computer
- (iv) It controls the use of the Main Memory in storing of data & instructions
- (v) Storage of data- It provides temporary storage (RAM) & permanent storage (ROM)

**13. Explain the functions performed by each of the following central processing unit elements**

- (i) Control Unit ( 2 mks)**
- Interpreting instructions

- Issuing control instructions to the operating system

**(ii) Arithmetic and logic Unit**

- Performs arithmetic calculations such as addition, or multiplication of figures
- Performs logical operations & comparison on data
- Performs output of logical functions (variables)

**(iii) Registers**

- Holds data and instructions temporarily just before and after processing

**(iv) The main memory**

- Stores data just before and after processing
- Stores instructions waiting to be obeyed/ executed
- Holds program instructions & the data currently being processed
- Stores intermediate results of processing awaiting transfer to the output devices

**(v) The system clock**

It determines the processing speed of the CPU

**14. In reference to ALU, explain the meaning of logic operations and give an example of this processing operation**

Logic operation is the ability to compare two quantities or numbers to determine which is greater than, less than, equal to, or not equal to the other.

It also involves the testing for existing of a condition encountered during the processing of an application & altering the sequence of instructions accordingly.

**15. Give four types of registers found in the CPU**

- Accumulator
- Instruction
- Address register
- Storage register

**16. (a) Name the basic unit used to measure the processing speed of a computer ( 1 mk)**

Hertz (Hz)

**(b) A computer processor speed is measured in Hertz. What fraction of a second is the following?**

(i) 1. Nanosecond

$$\frac{1}{1 \times 10^9} = \frac{1}{1,000,000,000} \text{ seconds}$$

(ii) 1. Microsecond

$$\frac{1}{1 \times 10^6} = \frac{1}{1,000,000} \text{ seconds}$$

**17. (a) What is a computer bus? ( 1 mk)**

- ◆ A communication path/ medium within the computer that connects the basic computer components. It allows different elements or sections of the computer to communicate with each other.
- ◆ A parallel collection of conditions that carry data & control signals from one element to another

**b. State the functions of each of the following computer bus ( 3 mks)**

- ◆ Data bus- carries data from the processor to memory during the write operations and from memory to the processor during the read operations
- ◆ Address bus- it conveys addresses, i.e it carries the address of the memory location or device to be acted on by the processor
- ◆ Control bus- it carries the timing & control signals necessary to coordinate the activities of the entire system

**18. (a) What is the computer Motherboard?**

This is the electronic board where all electronic components such as processor, memory chips, BIOS, bus connections etc are assembled

(b) State any four components found on the computer motherboard

- Processor (CPU)
- SIMM/DDR sockets
- Memory chips
- BIOS
- Interface chips
- Buses

**19. (a) What is a Drive?**

A drive is a computer device for reading data from or writing data into a storage media, e.g. a tape or disk

**(b) State any two types of computer drives, giving an example of a storage device used by each ( 3 mks)**

- ◆ Hard disk drive (HDD)
- ◆ CD- ROM drive
- Floppy Disk drive (FDD)
- DVD – ROM drive

- ◆ Tape drive
- Zip drive
- ◆ USB port – for flash disk

**20. (a) Give two reasons why there are many forms of computer storage devices ( 2 mks)**

- Permanency of storage
- Cost of implication
- Capacity of storage systems

**(b) State three different examples of auxiliary storage devices**

- Magnetic tape
- Floppy disk
- Cassette tapes
- Hard disk
- Zip disks
- Jazz disks
- Flash disks
- Video Compact Disk (VCD)
- Digital video Disks (DVD's)
- Punched cards
- Optical discs (e.g., Compact Disks LS- 120 super disks, optical card, optical tape)

**21. Using examples, distinguished between:**

**(i) Primary and secondary (2 mks)**

Primary storage devices are accessed directly by the CPU, while secondary storage is not

**(ii) Fixed and removable disks**

Fixed disks are mounted inside the computer system unit, e.g. Hard disk.

Removable disks are not housed inside the system unit & are portable, e.g. floppy disk, Jazz disk, Zip disk, flash disk, CD- R, CD – RW, DVD

**22. Explain the following storage devices****(i) Hard disk**

A fixed storage device housed inside the Computer System Unit

**(ii) Flash disk**

A high capacity plug-in portable storage device. Usually attached at the USB port of the computer

**(iii) Zip disk**

High capacity disk that resembles a floppy disk, but is slightly larger and thicker in size

**23. (a) Compare a floppy disk and zip disk in relation to size ( 2 mks)**

A floppy disk is physically small in size and capacity, while a zip disk is slightly large in size and has large storage capacity.

**(b) Give three disadvantages of floppy disks as storage devices**

- Floppy disks are slower than hard disks
- Highly affected by viruses
- Low storage capacity
- Not reliable
- Affected by environmental factors, exposure to sunlight, magnetism and dirt

**24. (a) State three advantages of using hard disks as medium of storage**

- They provide permanent storage of data

- They have a large storage capacity
- Are cheap per unit of storage
- Are rewritable (provide read & write facilities)
- Are very fast compared to other secondary storage devices in terms of data transfer

**(b) Describe three precautions you would take to avoid damaging the hard disk (3mks)**

- Do not drop the disk drive
- Do not expose it to strong heat
- Do not expose it to dust/ smoke particles
- Do not unprocedurally switch off the computer

**(c) Describe the structure of a hard disk in reference to cylinders, tracks and sectors**

The surface of hard disk is divided into circles called Tracks. Parallel tracks on several platters are called cylinders

The tracks are further subdivided into sectors. Several sectors can be grouped to form clusters.

**25. State two reasons why Magnetic tapes are not commonly used as computer data storage medium today**

- Are slow when retrieving data. This is because of the linear storage of data on the tape.
- Do not fully use their recording surface due to inter- record Gaps

**26. Differentiate between:**

**(i) Microcomputer and microprocessor**

A microcomputer is a computer whose Central Processing Unit (CPU) has been implemented with a microprocessor

A microprocessor is a small computer processor, mainly a combination of the ALU & CU manufactured on a single chip.

**(ii) Volatile memory and non- volatile memory**

Volatile memory is temporary, while non- volatile memory is permanent

**(iii) RAM and ROM**

RAM is a temporary and rewritable memory, while ROM is a permanent and read only memory.

**(iv) Hard disk and floppy disk**

Hard disk is a hard metallic platter used to store data and is encased in a metallic housing (casing)

Hard disk is metallic. Shinny and non- flexible

**(v) Magnetic and optical storage media**

In magnetic storage media, data is recorded using magnesium, while in optical storage media data is recorded using a beam of light (laser)

**(vi) Hardcopy and softcopy output**

Hardcopy is printed copy, e.g. printout on paper such as letters while softcopy is intangible information e.g. screen display or music.

**(vii) MICR and OCR scanners**

MICR uses magnetic technology to read magnetic characters, while OCR uses laser/ light technology to read characters

**27. Explain four rules for handling magnetic disks**

- Keep magnetic away from excessive heat. This is because heat energy weakens the ability of the magnetic media to store data.
- Store the media in their cases when not in use in order to protect/ safeguard their recording surfaces against environmental influences such as dust, touch, direct sunlight, radiations, etc
- Do not drop the disk on the ground
- Never bring them near moving or strong magnetic bodies. Such bodies might demagnetize the recording surfaces making recording in terms of magnetism impossible
- When mounting the media into its reading/ writing unit, avoid brushing the recording surfaces against the mechanical components of the drive
- Put on the power before mounting the media and off after removing the media from the drive.

This is because; the fluctuation in power might cause demagnetization

**28. (a) Calculate the capacity in MB of a two sided floppy disk with 6 sectors per surface, and 512 bytes per sectors**

$$\text{No. of sectors} = (2 \text{ sides} \times 6 \text{ sectors})$$

$$= 12 \text{ sectors}$$

$$\text{If 1 sector} = 512 \text{ bytes}$$

$$(12 \times 512) = 6,144 \text{ bytes}$$

$$1,000,000 \text{ bytes} = 1 \text{ MB}$$

$$6,144$$

$$1,000,000 = 0.006144 \text{ MB}$$

**(b) A double – sided disk contains 40 tracks on each side. The tracks are divided into 9 sectors of 512 bytes each. What is the total capacity of the disk in megabytes? ( 2mks)**

$$\text{Total tracks} = (40 \times 2) = 80$$

$$\text{Total sectors} = (80 \times 9) = 720$$

Total bytes ( $720 \times 512$ ) = 368, 640 bytes

If 1 MB = 1,048, 576 bytes

? = 368, 640 bytes

368, 640

1,048, 576

= 0.352 MB

**29. By giving examples, differentiate between primary and Secondary Computer storage**

( 3 mks)

Primary Memory	Secondary Memory
<ul style="list-style-type: none"> <li>1. Used for holding data &amp; instructions required immediately by the CPU</li> <li>2. It is accessed directly by the CPU</li> <li>3. Provides fast access to information is accurate &amp; reliable</li> <li>4. It is expensive per bit of memory due to the technology involved</li> </ul>	<ul style="list-style-type: none"> <li>1. Used for storing backup information that is not needed immediately by the CPU.</li> <li>2. It is not accessed directly by the CPU</li> <li>3. Provides slow access of information</li> <li>4. Secondary storage devices are cheap</li> <li>5. it has high storage capacity</li> <li>6. It is non-volatile i.e. stores data</li> </ul>

<p>5. It has low/ limited storage capacity</p> <p>6. It is volatile &amp; therefore it is used to store temporary programs &amp; data</p> <p>7. The speed of the processor depends on the size &amp; type of primary storage</p> <p>E.g. Read Only Memory (ROM) &amp; Random Access Memory (RAM)</p>	<p>permanently.</p> <p>E.g. punched cards, magnetic tapes, floppy disks, hard disks, etc</p>
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### 30. (a) State four functions of Read – Only Memory (ROM)

- ◆ It stores Firmware (bootstrap instructions) - the essential files the computer uses while booting/ starting up.
- ◆ It stores the system data & instructions that are necessary for the normal functioning of the computer hardware e.g. the Kernel / supervisor of the OS
- ◆ It stores translation programs (code converters) used for converting a user's program into machine language
- ◆ It stores special functions (facilities) peculiar to a given machine
- ◆ It stores character generators for printers & Video displays
- ◆ It stores instructions used in special – purpose computers & computerized fuel pumps

### (b) Give three characteristics of ROM

- ◆ It can only be read, but cannot be written to (i.e., the user can only read the information in the ROM, but cannot write on it unless it is a special type of ROM).
- ◆ Provides permanent or semi-permanent storage of instructions & data from the manufacturer.

- ◆ It is nonvolatile memory
- ◆ Forms a small proportion of the main storage (i.e. it contributes 30% of the internal Memory).
- ◆ Stores essential files for starting the computer (Bootstrap programs)

**(c) Name two different types of ROM**

- Masked ROM
- Programmable Read- Only Memory (PROM)
- Erasable Programmable Read- Only Memory (EPROM)
- Electrically Alterable Read- Only Memory (EAROM)

**31. (a) Outline three characteristics of Random Access Memory (RAM)**

- Stores data & programs temporarily during the times when they are needed in the Main Memory (or during execution).
- Provides “read & write facilities” i.e. it allows instructions to be written, read out & to be changed at will.
- The contents in RAM are user – defined, i.e. the user dictates what is to be contained in the RAM
- Its contents are temporary
- It is a volatile memory
- Forms the major proportion of main storage

**(b) Name the two types of RAM clearly starting their differences (3 mks)**

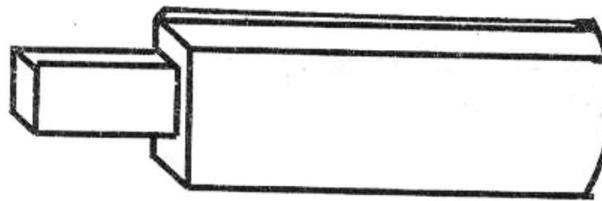
- (i) Static RAM

A static RAM can retain its data/ content as long as power is provided to the memory chips, i.e. it does not need to be re-written periodically

(ii) Dynamic RAM

- Dynamic RAM can only hold its content for a short while even when power is on. Therefore, in order to maintain its content/ data, a DRAM must undergo the refreshing process (i.e. it must be re-written continually)
- Static RAM is much faster than Dynamic RAM
- SRAM chips are physically large & much more expensive than DRAM chips
- Dynamic RAM has a much higher packing density than SRAM, i.e., a DRAM chip is able to store more information than a SRAM chip of the same size.

**32. The diagram below shows as example of a secondary**



**(i) Identify the name of the devices**

Flash Disk

**(ii) List down two advantages of this device over a floppy disk in storage ( 2 mks)**

- Smaller in size than a floppy disk, hence, easily portable
- Has a high data storage capacity compared to a floppy disk
- Flash disks are more reliable than floppy disks

**33. (a) List any four examples of optical storage devices**

- Compact Disk Read – Only Memory (CD – ROM)
- Compact Disk Recordable (CD-R)
- Compact Disk Rewritable (CD-RW)
- LS- 120 super disk
- Digital Versatile Disk (DVD)
- Optical card
- Optical tape

**(b) Give two advantages of a digital Versatile Disk over a normal Compact disk**

- DVD has a larger storage capacity than a CD ( 2 mks)
- A DVD offers better data storage quality

**34. (a) State the two types/ forms of computer output**

- Softcopy
- Hardcopy

**(b) List any four examples of output devices in a computer**

- Monitors
- Printers
- Sound output, e.g. speakers
- Audio response units
- Plotters
- Sound cards

- Digital projectors
- Computer output on microforms (COM)
- Storage devices

**(b) Identify three Functions of computer devices**

- Transmit the intermediate & final results to the users
- Convey messages e.g. error messages to the operators
- Provide immediate response to queries
- Convert the coded results produced by the computer to human- readable form

**35. (a) State one function of the screen (monitor)**

- Used to display the results of all the data that has been processed from the computer
- It converts machine- coded outputs results from the processor into a form that can be understood by people

**(b) Show two differences between a CRT monitor and a flat- panel display**

- CRT monitor uses a cathode ray tube to display information, while a flat panel does not.
- CRT has a protruding back, while a flat panel does not.
- Flat panel displays are light & easily portable, while CRT's are heavy
- CRT can display a wide range of colours, while a flat panel displays a limited number of colours
- CRT consumes more electrical power than flat panel displays
- The screen of a flat panel is much thinner & smaller than that of a CRT
- The screen resolution of a CRT is adjustable, while that of a flat panel is often set

(c) Give there examples of flat- panel monitors available in the market today

- Liquid crystal displays (LCD)
- Electro luminescent (EL)
- Gas plasma
- Thin Film Transistor (TFT)

36. (a) What are pixels?

Pixels (picture elements) are dots on the screen that form characters and images

(b) What role do pixels play in screen display?

They determine the clarity of images on the screen

(c) Give two advantages of the higher number of pixels per square centimeter (2 mks)

- Higher screen resolution
- Displays of sharp & clear images
- The screen is able to display a higher number of different images

37. (a) What are character printers? (1 mk)

Are usually low- speed printers that print one character at a time?

(b) Give two examples of character printers

- Dot matrix
- Thermal

- Daisy wheel
- Inkjet
- Golf ball

**38. Distinguish between impact and non impact printers and give two examples of each**

Impact printers print by striking mechanism & are noisy, e.g Dot matrix, Daisy wheel, and Golf Ball, drum and chain printer.

Non- impact printers print either by laser, ink or thermal transfer mechanism & are silent, e.g. Laser, Inkjet, thermal printer, electrostatic and xerographic

**39. (a) Distinguish between a line printer and a page printer**

A page printer prints documents page by page, while a line printer prints documents line by line

**(b) State three advantages and one disadvantages of:****(i) Laser Printers**

- Advantages**
- Cheap running cost
  - Produces high quality of printouts
  - Has a very high speed of printing ( it is fast)
  - Economical in maintenance
  - It is very silent

- Disadvantages**
- Expensive to purchase & maintain
  - Involves expensive multiply colour printing

**(ii) Inkjet Printers**

- Advantages** - Cheap to purchase

- Cheaper multiple colour printing
- Produces high quality prints

**Disadvantage -** Expensive to run (i.e. to buy cartridges)

- Produces a water based print which fades easily

**40. Highlight four factors one should consider when purchasing a printer (4 mks)**

- Cost involved i.e. the printer's buying price, cost of maintenance & cost of consumable items like printing papers, ribbons/ cartridges
- Volume of printing expected ( speed of the printer)
- Quality of printing e.g. ability to print graphics & colour
- Capability of the selected printer, i.e. multiple copy production, paper size, etc
- Compatibility with other computers
- Environment in which the printer will operate
- Ease of maintenance
- Reliability of the printer
- Application it is required for (i.e. purpose/ use of the printer)
- Type of paper used by the printer
- Documentation
- Availability

**41. List three advantages of a plotter over normal printer machines**

- Plotters produce information in an easily understandable form
- Their presentation is quick & reliable
- Produces large graphical designs of high quality, which are easy to read & use

- Can print on large sized papers, e.g. papers e.g. A1, Which a normal printer cannot

**42. Give two advantages of using sound output devices**

- Very fast making it useful in emergency situations
- One can receive the output even when a few meters away from the computer
- No reading ability is required of the user
- Suitable for the blind and people with poor sight
- Can be used for distant communication if done over telephone lines
- Errors are easily corrected, e.g. if used in a camera, one know when the film or exposure is set wrongly.
- Makes computing interesting and entertaining

**43. George connected new multimedia speakers to his computer and tried to play his favorite music CD, but no sound came out. Suggest two problems that might have occurred ( 2 mks)**

- Volume control was too low
- Loose or improper connection to the sound card
- Speakers not powered
- Multimedia not supported
- Lack of analogue cable connecting the optical drive to the motherboard or sound card
- Sound card drivers not installed

**44. List down 4 factors to consider when buying an output device**

- The volume of the data
- The speed at which the output is required
- Cost of the method chosen as compared with the benefits to be derived

- Suitability of the application
- Whether a printed version is required

**45. Define the following terms****(a) Port**

A special kind of socket found at the back of a computer used to connect an external peripheral device such as a printer, monitor, mouse, scanner, modem, flash disk, etc to the interface cards inside the computer

**(b) Data interface cable**

These are special cables that connect all the peripheral devices to the motherboard and the CPU. They transmit data signals and information to and from the devices

**(c) Power cable**

Cable for power supply to devices

**46. State the function of the power supply unit found in the system unit (1 mk)**

- It supplies stable power to the motherboard and other internal devices of a computer
- Converts the potentially dangerous alternating current (AC) into a steady low- voltage direct current (DC) usable by the computer.

47. (a) Name any two peripheral devices which get their power supply through ports

- Keyboard
- Mouse

(b) State the type of port that would commonly be used to connect the following devices

- |       |                   |                        |
|-------|-------------------|------------------------|
| (i)   | Mouse             | - PS/2, Serial, or USB |
| (ii)  | Modem             | - Serial               |
| (iii) | External CD drive | - Parallel             |

48. (a) Explain two differences between serial and parallel communication ports of a computer

- Serial ports have 9 pins, while parallel ports have holes for 9 or 25 pins
- Parallel cables transmit several bits of data simultaneously, while serial cables transmit

One bit at a time

- Serial cables are slower than parallel cable
- Serial cables allow for 2 ways communication (i.e. communication to and from the computer and the device connected to it) while parallel cables usually offer 1-way communication.

(b) Give two major advantages of a USB interface cable over other cables in the computer

- It is light & convenient to carry
- It provides faster transmission of high – quality data
- Its serial nature enables it to connect devices a longer distance away
- The USB port can be used to connect a wide range of peripheral devices due to its common universal interface

**49. Outline three precautions one should take when assembling a computer**

- Disconnect all diverts from the power source before starting to work on them
- Never work alone because you may need help in case of energy
- Discharge any static electricity that might have built up on the hands by touching an earthed metallic object and wearing an anti-static wrist member.

**50. State six factors which you would consider when selecting computer hardware for an organization**

- Cost of the system
- Processor type and speed
- Storage capacity of hard disk & RAM memory size
- Warranty (service contract)
- Upgradeability of the computer
- Compatibility of the system
- Portability (light to carry)
- User needs
- Popularity of the hardware manufacturer
- Availability of spare parts
- Multimedia capability

**51. List down any four hardware components you can add or upgrade in a computer system****(4 mks)**

- Processor (CPU)
- Ports e.g. USB ports/ SCSI ports

- Hard disk
- DVD drives/ tape drives
- RAM memory
- Expansion slots

**52. (a) What is warranty with reference to the purchase of computers**

A warranty is an agreement between the buyer and the seller that spells out terms and conditions of after selling a product in case of failure or malfunction.

A warranty is usually the duration in which your computer is supposed to work without any problem.

**(b) Why is it important to carefully study a warranty before committing yourself by signing it?**

In order to negotiate on sensitive items like duration, after sales services etc.

**(c) List down three issues to understand about warrants**

- Duration (scope of cover)
- How comprehensive is the warranty- good warranty should cover all the parts of the Computer.
- Liability agreement e.g. how long should the supplier take to repair a fault or replace the product, and if he/ she delays, who bears the cost.
- Does the warranty offer online support?
- Regularity of service or maintenance

**53. What are clones with reference to computers and what is their disadvantage?**

- Clones are locally assembled computers

## Disadvantages

- Their components are not optimized to work with each other
- They are not as reliable as their brand names like IBM, Compaq, Hewlett Packard (HP), Dell, Gateway etc.

### (i) What is in- house developed software?

These are programs that are uniquely designed & written by the user or a software house under contract, to meet the specific needs of a particular user or organization.

They are usually customized (tailored) to perform a specific job or solve only specific processing tasks in one organization

### (ii) Give two reasons that may be influencing these organizations for such a decision ( 2 mks)

- The user gets well tested program, which he/ she is able to use with confidence
- The program provides all the facilities required to solve a particular problem
- The purchaser has direct control over the package, as he/ she is involved in its Production
- The user is able to quickly implement the results obtained from the use of the package
- They can easily be modified to meet specific user's needs without involving expert programmers.

### 55. Differentiate between single- purpose programs and integrated software

- Single – purpose software is developed for only one purpose, while integrated software is a suite of more than one program and can be used to carry out a variety of tasks

### 56. Explain the following considerations when purchasing software ( 2 mks)

#### (i) Authenticity

It is the genuineness, validity or legitimacy of software. The copy of the software you buy should be accompanied by the license and certificate of authenticity of the developer.

#### **(ii) Portability**

It refers to whether a program can be copied or installed in more than one computer

### **57. Differentiate between portability with reference to hardware and software**

In hardware, the computer device should be sufficiently small & light to carry

In software, portability refers to whether a program can be copied from one computer to another or installed in more than one computer.

### **58. (a) Explain why documentation is necessary for any software package**

It contains details on how to install use and maintain the software. It also shows the purchaser how the program can be used to solve particular problem as well as provide the user with assistance on using the program.

### **(b) A firm intends to purchase new software. List three items of documentation that should accompany the software**

- A license
- Installation guide
- User manual (guide)
- Reference manual
- Warranty
- Upgrades
- Service pack

## CHAPTER THREE

### OPERATING SYSTEM

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Define an operating system;
- b) State the functions of an operating system;
- c) Describe types of operating systems;
- d) Describe how operating systems organize information;
- e) Manage files using an operating system;
- f) Manage disks using an operating system;
- g) Identify internal and peripheral devices under Operating System control.

#### Content

- a.) Definition of an operating system
- b.) Functions of an operating system
- Job scheduling
- Resource control
- Input/output handling
- Memory management
- Error handling
- Interrupt handling
  - c.) Types of Operating Systems
- Number of users
  - i) single user
  - ii) multi user
- Number of tasks
  - i) single tasking
  - ii) multi tasking

- Interface
  - i) command line
  - ii) menu driven interface
  - iii) Graphical user interface (GUI)
- d.) Organization of Information using an operating system
  - Files
  - Directories/folders
  - Storage media
- e.) File management using an operating system
  - Description of files
  - Types of files
  - i) System files
  - ii) Application files
- Functions of files
  - i) storage of data
  - ii) organization of information
- Creating files
- Manipulating files
  - i) Viewing files and directories
  - ii) Organization of information
  - iii) Creating files/directories
  - iv) Opening
  - v) Editing
  - vi) Renaming
  - vii) finding/searching
  - viii) sorting
  - ix) Copying
  - x) Moving
  - xi) Deleting
- f.) Disk Management using an operating system
  - Formatting
  - Partitioning
  - Defragmentation
  - Disk diagnostics/Disk compression
  - Back up
- g.) Devices under operating system control
  - Processor
  - Memory (Ram)
  - Storage devices
  - Input/output devices and ports
  - Communication devices and ports

- h.) Installation and configuration of an operating system
- Trouble shooting

### Application packages

- a.) Word processors
- b.) Spreadsheet
- c.) Database
- d.) Desktop publishing
- e.) Internet and E-Mail

## Introduction

### Definition of Operating System

A set of complex programs that work together to control execution of user programs called applications.

#### Examples:

MS Windows, UNIX, LINUX, Macintosh (Mac OS) and OS/2.

### Functions of an operating system software

#### (i) Memory allocation & loading of programs

- Loads application programs from an external storage into the available locations in the Main memory (RAM)
- It keeps track (monitors) of the parts of the memory that are in use, and those which are free

#### (ii) Processor management:

The processor can only execute one program at any one time. Therefore, in a multi-tasking system access to the CPU must be carefully controlled & monitored. The OS must decide, which program will be allowed into the system, and for how long

**(iii) Job scheduling**

It schedules & loads programs in order to provide a continuous sequence of processing. This is necessary when more than one application program is occupying the main storage

**(iv) Error reporting and interrupt handling**

The OS reports any errors that occur during program execution.

**(v) Management of CPU time**

In a multi-taking system where several user programs share the computer resources, the processing is done according to the job priorities allocated and in a continuous process until all the jobs in the queue within the memory are executed. This ensures that the CPU does not remain idle at any given time.

**(vi) Manages the input and output devices**

The OS controls the allocation of I/O devices and tries to resolve any conflicts that arise. It also monitors the state of each I/O device and signals any faults detected

**(vii) File management**

OS is concerned with the logical organization of the files in the computer & provides ways for sorting, retrieving & sharing of the files

It also provides a means of protecting the data files & programs against unauthorized access and corruption.

It controls the selection & operation of the hardware devices used for input, output & storage

It interfaces the user to the system's hardware, i.e. it provides a quick means of communication between the computer user and his programs

**(viii) Logging & accounting**

The OS keeps records (internal logs) on how the computer resources (e.g. CPU time, memory, peripherals) are being used

It also keeps a complete record of all what happens during processing (usually in the form of a printed log)

## Resources under the Operating System

- Processor:** The operating system arranges all tasks accordingly to prioritize and decides which task to continue and which task to stop.
- Main memory:** The operating system determines which task to remain in memory for execution and what to send back to backing storage to wait.
- Input Output devices and ports:** It controls the input of the data and output of information.
- Secondary storage device:** The operating system manages the storage (saving) and the retrieval of data and information in storage devices. It utilizes hard disk space by holding take not need currently by the RAM.
- Communication devices and ports:** Operating system controls the exchange of data and information.

## Types of Operating System

### Classification according to task handled currently

1. **Single program operating system:** It allows processing of only one program at a time like the Microsoft Disk Operating System (MS DOS)
2. **Multitasking operating system:** It allows a single CPU to execute more than one program at a time

### Classification according to number of user

1. **Single user operating system:** Can only be used by one application at a time e.g. Windows95/98, MS DOS.
2. **Multi-user/ multi-access operating system:** can be used by more than one user at a time e.g. UNIX, LINUX, Windows NT/2000/XP/VISTA, and Novell.

## Human Computer Interface (HCI)

This is a method of interaction between the user and the computer.

1. **Command line interface:** The user interacts with the computer by typing the command in the command prompt then pressing the enter key for execution.
2. **Menu driven interface:** They give the user a list of options to select from
3. **Graphical user interface:** It represents commands in form of graphics or icons.

## Operating System Consideration

1. Hardware configuration: memory size, hard disk capacity and the processor type.
2. Basic design of the computer
3. User friendliness and the human computer interface (HCI)
4. Availability in the market
5. Cost
6. Reliability: can it run without crashing/ hanging i.e. stop responding to commands

## Common features in Windows Operating System

- Similar interface/ interaction
- Long file name
- Plug n play (PnP) windows automatically accept a new hardware once installed
- Support multi-tasking and multi-user

## Factors that dictate how an operating system organizes information

**Rapid access:** organization method should allow quick access to stored data.

**Ease of update:** by keeping a record of the date modified.

**Economy of storage:** should use the least storage possible because memory is a scarce resource.

**Simplicity of maintenance:** organization method should enable quick navigation through the file system and make it easy for it to be maintained.

**Reliability:** organization method must be reliable.

## Properties operating system display about a file

- Capacity
- Location
- Extension
- Date

## Two types of Windows

1. **Application Window:** Screen that appears when an application program is opened.
2. **Document window:** this represents the work area

## File

Common storage unit in a computer where

## Types of files

- System files: files that contain information required for the operation of the computer
- Application files: Files that hold programs or start an application.

## File Extensions

Importance

## Examples

DAT- data

TXT- text

DOC- document

XLS- excel

SYS- system files  
command file BAK-  
back up  
PPT- PowerPoint  
BAT- batch file

**Folder/ directory:** A named storage area created for storing files for easy access.

**Subfolder:** divided folder

**Windows desktop:** This is the first screen after successful booting.

## Desktop Elements

**Icons:** This is the graphical/ pictorial representation of items.

**Taskbar:** It allows the user to switch between different files and programs. Start button: It displays the start menu.

**Task manager:** Display buttons of the current running tasks.

**System tray:** Has icons of tasks running in the background but not displayed on the screen.

## Parts of an application window

**Title bar:** Display name of current application program or task. Minimize button: Reduces a window to a button on the taskbar.

**Restore/ maximize:** It stretches a window to cover the entire screen or return to the original screen. Close button: Exits the document but not the application.

**Menu bar:** provides a list of commands in form of buttons. **Toolbar:** represents shortcuts to menu commands.

**Work area/ document window:** Where data is being entered.

## Disk management

**Formatting:** Preparing a disk for use by imprinting tracks and sectors.

**Scanning:** -scanning for virus

-scanning for errors: **SCANDISK:** Check up for minor storage problems e.g. lost storage location or damaged surface

**Defragmenting:** Re-arranging scattered folders to speed up access and retrieval.

**Compressing:** Squeezing disk contents to free space on the media.

**Backing up data:** Creating duplicate copies of data on separate storage device for security purposes.

**Boot up (start-up)/ system disk:** System disk created to start the system in case the components of starting up fail or when the hard disk is seriously damaged. The booting instructions are copied on the disk.

**Portioning:** Subdividing a large physical disk into two or more partitions called logical drives.  
Reasons for disk partitioning:

- When user intends to install more than one operating system on the same disk.
- For back up purposes

## Troubleshooting Windows Related Problems

- This is a process of diagnosis and trying to fix hardware or software related problems.
- Some problems Windows experience
- Failure to boot
- Computer hanging now and then
- Abnormal restart

## These problems may result from

1. Problem in installing process missing files
2. Insufficient system memory
3. Problems with hard disk boot sector may be due to virus infection
4. Corrupted window registry system
5. Due to interrupt request conflicts

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

1. The central processor and peripheral devices of a computer system are coordinated by the operating system  
**(a) Define the term ‘operating system’**

- ◆ A set of computer programs that normally reside in the main memory and used to control the basic computer hardware resources & the operation of the entire system
- ◆ The main program that controls the execution of user applications, and enables the user to access the hardware & software resources of the computer

**(b) List two resources/ components that an operating system manages**

- Processor
- Memory (RAM)
- Secondary storage devices
- Input/ output devices
- Communication devices
- I/O & communication ports
- Files

**(c) There are several types of operating systems in use today. State two examples of Operating systems which you are familiar (2 mks)**

- Disk Operating System (DOS)
- Windows
- MacOS
- Unix
- Linux

**2. Name the two latest operating systems from Microsoft corporation(2 mks)**

- Windows XP
- Windows Vista

**3. Explain any four functions of an operating system software ( 8 mks)****(i) Memory allocation & loading of programs**

- Loads application programs from an external storage into the available locations in the Main memory (RAM)
- It keeps track (monitors) of the parts of the memory that are in use, and those which are free

**(ii) Processor management:**

The processor can only execute one program at any one time. Therefore, in a multi- tasking system access to the CPU must be carefully controlled & monitored. The OS must decide, which program will be allowed into the system, and for how long

**(iii) Job scheduling-** it schedules & loads programs in order to provide a continuous sequence of processing. This is necessary when more than one application program is occupying the main storage

**(iv) Error reporting and interrupt handling-** The OS reports any errors that occur during program execution.

**(v) Management of CPU time:**

In a multi- tasking system where several user programs share the computer resources, the processing is done according to the job priorities allocated and in a continuous process until all the jobs in the queue within the memory are executed. This ensures that the CPU does not remain idle at any given time.

**(ix) Manages the input and output devices**

The OS controls the allocation of I/O devices and tries to resolve any conflicts that arise. It also monitors the state of each I/O device and signals any faults detected

**(x) File management**

OS is concerned with the logical organization of the files in the computer & provides ways for sorting, retrieving & sharing of the files

It also provides a means of protecting the data files & programs against unauthorized access and corruption.

- (xi) It controls the selection & operation of the hardware devices used for input, output & storage
- (xii) It interfaces the user to the system's hardware, i.e. it provides a quick means of communication between the computer user and his programs

**(xiii) Logging & accounting**

The OS keeps records (internal logs) on how the computer resources (e.g. CPU time, memory, peripherals) are being used

It also keeps a complete record of all what happens during processing (usually in the form of a printed log)

**4. What is an interrupt?**

An interrupt is break from the normal sequential flow of instructions processing in a program

**5. Give three ways in which operating system are classified (3 mks)**

- ◆ The number of users they handle
- ◆ The number of tasks they execute concurrently
- ◆ Human computer interface

**6. Giving an example in each case, explain the following types of operating systems****(a) Single – user / single tasking**

A system that allows only one user to run one user program at a time in an interactive, conversational mode. E.g. Ms- DOS, PC- DOS.

**(b) Multi- User/ Multi- tasking**

A multi- user computer system can allow interactive facilities to several at a time. A Multi- tasking Computer system can allow more than one program which are in the memory to be processed at the same time. E.g. Microsoft Windows, Linux.

**7. A computer user may interact with a computer either through Graphical User Interface (GUI) or though typed commands****(a) Give one advantage of using GUI based operating system over a command line interface ( 1 mk)**

- ◆ User friendliness
- ◆ Easy to learn & use even by those who do not have much knowledge about them

- ◆ One does not need to master any commands
- ◆ It is faster to work with than a command line interface as it only relies on clicking the icons by use of a pointing device

**(b) Some computer systems still use command line interfaces. State two advantages of command line interface**

- They are more flexible than menu- driven interfaces
- There is security of data as only those who know how to use the commands will access it.
- They use cheap hardware & software facilities
- One has a better control over the system resources

**8. What is a deadlock in reference to operating systems?**

- It is a situation in an OS when a particular task holds a needed resource and refuses to release it for use by other tasks

**9. Explain briefly the following concepts as used in the windows environment:**

**(a) Desktop**

Desktop is mostly an empty screen that appears when windows starts and has some standard icons that show that the computer is ready for use.

**(b) Window**

A rectangular area on a computer screen in which text, graphical images or the contents of a folder or disk may be displaced

**(c) Icon**

A little picture on the computer screen representing a program, disk file folder or any other item

**(d) Sidekick menu**

A submenu that appears either on the right or left of a main menu

**(e) Taskbar**

A long bar/ strip that runs across the desktop and displays the start button and any other active tasks.

**(f) Task**

Any activity taking place in windows and is displayed on the taskbar, e.g. running program

(3 mks)

**10. Identify three functions of taskbar**

- ◆ Indicates what programs are running
- ◆ Holds minimized programs
- ◆ Provides a shortcut menu for arranging programs

**11. State two differences between Disk Operating System (DOS) and Windows operating system** ( 2 mks)

DOS	Windows
(i) Single - tasking	(i) Multi- tasking
(ii) Single- user	(ii) Multi- user
(iii) Command driven interface	(iii) Graphical User Interface
(iv) Not easy to use	(iv) User friendly

**12. Identify three factors you would consider when choosing an operating system for use in a computer** ( 3 mks)

- (i) Hardware configuration of the computer, e.g. RAM memory size, Hard disk capacity, type of processor, etc
- (ii) Basic design of the computer – It is an IBM compatible, or apple computer?
- (iii) Hardware compatibility
- (iv) User (type of work to be done), i.e. the applications intended for the computer
- (v) User friendliness or human computer interface, i.e. it is command line based, Menu driven or graphical user interface?
- (vi) Availability in the Market, e.g. Microsoft Windows based operating systems are very common
- (vii) Portability
- (viii) Cost- how expensive the OS is
- (ix) Reliability, i.e. can it run without crashing (stop responding to commands)?
- (x) The method of communicating with the computer, e.g. the number of peripherals
- (xi) The method of operating the computer

**13. Explain how windows organizes information in reference to files and folders**

It stores related data & information records into files, and related files into folders & subfolders

**14. (a) Distinguish between systems files and application files** ( 2 mks)

System files hold critical system information while application files hold programs data

**(b) State the extensions used signifying the following file types** (2 mks)

- (i) Driver or system file - DLL, SYS,INI
- (ii) Batch file – BAT

**15. (a) List and explain down the three parts of the windows Taskbar** ( 3 mks)

- ◆ Start button - Provides access to the start menu
- ◆ Task Manager - Displays buttons of currently running tasks
- ◆ System tray - displays icons of applications that automatically start and run in the background

**(b) Outline the procedure of renaming a file or folder using windows operating system****(3 mks)****Method 1:**

- ◆ In an explorer window, click the file/ folder you want to rename
- ◆ Click on file, choose rename
- ◆ Type the new name, then press enter

**Method 2:**

- ◆ In an explorer window, right- click the file/ folder you want to rename
- ◆ Choose Rename from the shortcut menu that appears
- ◆ Type the new name, then press Enter

**16. (a) What is a dialog box?**

Window that appears temporarily to request or supply information. It contains options (settings) one must select to complete a task

**(b) List five settings that may be found in a dialog box**

- ◆ Textbox- a box you can type data in
- ◆ List box – a box that contains a list of options, one of which is selected
- ◆ Checkbox- a small, square box that can be selected or cleared. It appears with an option that you can turn on or off. When the checkbox is selected, a selected, a checkbox ( or ) appears in the box
- ◆ Radio button – a round button that can either be blank or can contain a dot. If the button contains a dot (●), it is selected.
- ◆ Pull down menu – A box with a downward – pointing triangular button at its right end (▼). When the triangular button is clicked, it displays a menu.
- ◆ Command button- A button that can click to carry out or cancel the selected action. E.g. the OK or cancel button.

**17. (a) Define ‘ folder/ directive tree’**

Directory tree is the hierarchical arrangement of folders and storage locations from the root downwards.

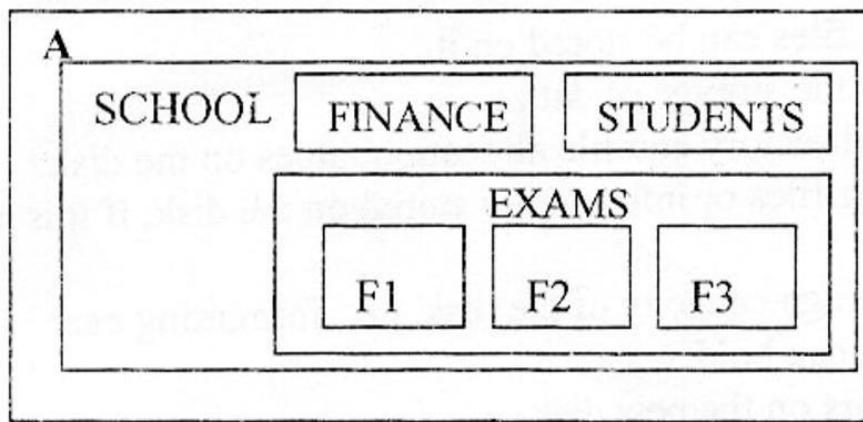
**(b) Give two examples of root directories you know****(1 mk)**

- A:\
- C:\
- D:\
- E:\

**(c) Give three uses of sub- directories or subfolders****(3 mks)**

- Used to store files that are not required currently until they are needed again
- Used to store the files of one program separately from the files of another program
- It allows each user to keep his/ her files separately, even if all the users are using the same systems.

- 18.** The Hierarchical system represented below shows how a school organizes its files. Study it and answer the questions below.



The F2 directory has the files: classlist.doc, Districts.xls, and the tribe.mdb. Write down the path of accessing the Districts.xls file.

A:\SCHOOL\EXAMS\F2\Districts.xls (2 mks)

- 19. (a) (i) Explain the meaning of backup (2 mks)**

It means making of duplicate copies of data or programs from the hard disk into storage media so that in case the system fails, or originals are corrupted or lost, the data can be reconstructed from the backups. This is used to protect data from accidental erasure or hardware problems

- (ii) Explain two methods you can use in windows to back up data into a storage device (2 mks)**

- Using copy and paste commands on the Edit Menu
- Using the send to command on the file menu
- Using the backup facility to compress the data into another disk

- (b) Identify two reasons why a user needs to know the space available for data storage in the hard disk**

- To know the amount of data that can be stored in the hard disk
- To know how much space is left in the hard disk in case a new program needs to be installed
- To detect the likelihood of a virus infection

- 20. Name the command one would use to repair cross-linked files in graphical user interface software (1mk)**

Scandisk

- 21. (a) Explain the team Disk Defragmenter, and give two advantages of this feature (3 mks)**

Disk defragmenter is a tool that is used to re- arrange scattered files & folders on a storage media

#### **Advantages**

- Rearranges scattered folders & files on storage media
- Reduces the time by the read / write head to locate files or folders on the storage media this speed up access to files & folders, hence, makes files to open more quickly
- Consolidates related data close to each other, hence, frees space on the storage media

#### **(b) Distinguish between disk compressing and disk defragmenting**

Compressing is creating more space on a disk by squeezing disk contents (files) into a smaller storage location on the disk.

Defragmenting is rearranging scattered related files/ folders closer to each other on the surface of a storage unit.

#### **22. Give two reasons why a new disk must be formatted before using it (2 mks)**

- To prepare a new disk so that files can be stored on it
- To create sectors & tracks for the storage of data
- To create/ prepare a new root directory and file allocation tables on the disk
- To remove/ delete any existing files or information stored on the disk, if it is no longer needed
- To determine the effective storage capacity of the disk, i.e. formatting enables the user to know how much data the disk can hold.
- It can also check for bad sectors on the new disk.

#### **23. (a) What is meant by the term ‘disk partitioning’?**

It is the process of dividing a large physical disk into 2 or more partitions/ volume

#### **(b) Give two reasons why the hard disk may be partitioned**

- To install more than one operating systems on the same disk
- For the purposes of backup on the same disk, so that if one partition fails the other will still be working.

#### **24. A Form four computer student is attempting to print a programming documentation. The printer is not responding to the print command. Explain three possible causes for the anomaly. (3 marks)**

- The printer may not be installed.
- The printer may not have been set as the default printer.
- The data interface cable to the printer could be loose. Make sure it is firm at the ports.
- The printer could still be off. Switch it on, and it will start printing.
- The wrong printer could have been selected. Select the right printer in the print dialog box and send the print job again.

#### **25. State two purposes of the recycle bin. (2 marks)**

- Contains the files and folders that have been deleted.
- Can be used to restore files & folders accidentally deleted from the computer.

## CHAPTER FOUR

### APPLICATION PACKAGES

Application packages include the following:

- Word processors
- Spreadsheet
- Database
- Desktop publishing
- Internet and E-Mail

### WORD PROCESSORS

#### Specific Objectives

By the end of the topic the learner should be able to know:

- a) Define a word processor;
- b) State the purpose of word processing;
- c) Use a word processing package;
- d) Format and edit a document;
- e) Create and edit a table;
- f) Create and update a mail-merge document;
- g) Print a document;
- h) Insert and edit objects.

#### Content

- a.) definition of a word-processor
- b.) Purpose of word processing eg
  - Letter preparation
  - Reports
  - Newsletters
- c.) Using a Word processing package
  - Getting started
  - Screen layout
  - Running the program
  - i. Creating a document
  - ii. Saving
  - iii. Retrieving

- iv. Closing
- v. Exiting

#### d.) Editing and formatting a document

- Editing a document
- Block options
  - i. Selecting
  - ii. Moving
  - iii. Copying
  - iv. Deleting
  - v. Inserting and type over
- Find and replace
  - i. Search/find
  - ii. Replace
- Proof-reading
  - i. Spelling and grammar checking
  - ii. Thesaurus
  - iii. Auto-correct
  - iv. Undo and redo

- Formatting a document

##### a) Text formatting

- i) Bolding
- ii) Italizing
- iii) Underlining
- iv) Fonts
- v) Drop caps
- vi) Change case
- vii) Superscript/subscript

##### b) Paragraph formatting

- i) alignment
- ii) indenting
- iii) spacing
- iv) section breaks
- v) bullets and numbering

##### c) Page formatting

###### Layout

- i) columns
- ii) headers/footers

##### Setup

- i) Margins

- ii) Orientations
- iii) Paper size
- iv) Tabs

### Creating and Editing a Table

- Create a table
- i) Rows
- ii) Columns
- Enter data
- Editing tables
- i) Resizing rows/columns
- ii) Inserting rows/columns
- iii) Deleting rows/columns
- iv) Merging rows/columns
- v) Splitting rows/columns
- Formatting tables
- i) Borders
- ii) shading
- Table conversions
- i) Converting text to table
- ii) Converting table to text
- iii) Importing
- Arithmetic calculations
- i) Perform calculation
- ii) Insert formulae
- Sorting

### e.) Sorting creating and updating a mail merge document

- Creating main document
- i) Form letters
- ii) Labels
- iii) envelopes
- create/import data source
- i) editing
- ii) saving
- Merging Fields
- Main and data source to
- i) Printer or
- ii) New window or
- iii) Fax or
- iv) E-mail
- Updating merged document

### f.) Printing a document

- i) Printer setup
- ii) Print preview

## iii) Print option

- printer selection
- orientation
- page and copies

## iv) Printing

## g.) Inserting Graphics

## • Types of graphics

- i) Drawing
- ii) Pictures
- iii) Charts

## • Inserting

- i) importing
- ii) drawing

## • Editing graphical objects

- i) Updating
- ii) Resizing
- iii) Enhance

## Introduction

### Definition

This is the creation of long document, reports, memos etc.

### Main types of Word Processors

1. Dedicated: This word processor is the only program in the computer.
2. Non-dedicated: the word processor is among other programs installed in that computer.

## Terms in Word Processing

**Word wrap:** This is the way the word processor detects whether the last word on a certain line will fit if not the whole word is pushed to the beginning of the next line.

**Hyphenation:** The way the word processor detects if the last word on a certain line will fit if not it adds hyphenation after the first words then part of word in argument is pushed at the beginning of the next line.

**Justification:** Position of line according to the centre of the page, left and the right margin. There are four ways

- Full: All lines in a paragraph start at the same point and end at the same point.
- Left: All lines in a paragraph start at the same point but end at different points.
- Right: All lines in a paragraph start at different points but end at the same point.
- Centre: All lines in a paragraph are centered along the page.

**Indentation:** Way lines(s) start and end from the normal starting or ending point by the use of Tab key indent tools from format command in the main menu. Ways of indenting;

- Indenting a paragraph from the left margin
- Indenting the first line of a paragraph from the left margin
- Hanging indent
- Indenting a paragraph from the right margin
- Indenting from both margins

**Bolding:** Increasing the intensity of text such that when printed it appears darker than normal text.

**Blocking:** Separating part of text by highlighting so that any issued command affects the highlighted text.

**Orphan:** The last line in the last paragraph of a page that becomes the first line on the next page after the first page is filled up.

**Widow:** First line in the last paragraph of a page that becomes the last line on that page while the other part is moved to the next page after the first page is filled up.

**Superscript:** Character above the normal typing line.

**Subscript:** Character below the normal typing line.

**Header:** Text/ message appearing on top of each page of a document.

**Footer:** Text/ message appearing at the bottom of each page of a document.

**Pagination:** Default page numbering that the word processor provides.

**Repagination:** Situation where the default page numbering is altered by the user.

**Softcopy:** Document that is in computer memory or the screen where changes are applicable.

**Hardcopy:** Document that is already printed.

**Soft return:** Situation where the cursor automatically moves to the next line before it reaches the end of the current line.

**Hard return:** Situation where the user forces the cursor to move to the beginning of the next new line by pressing the enter key on the keyboard before it reaches the end of the current line.

**Soft page:** Automatic page ending as per the settings that comes when one page is filled up.

**Hard page:** Forced page ending before the current page is filled up.

**Continuous stationery:** Situation where the printer uses rolls of papers therefore one does not need to keep on inserting a paper after the other.

**Preprinted stationery:** One needs to insert a paper after the other is printed.

**Toggle switch:** How word processor behaves depending whether certain keys are on or off like Insert and the Caps Lock keys.

**Margin:** Blank space around the edges of a page.

**Boarder:** Printable edges around the page.

### **Paper Orientation**

Portrait

Landscape

### **Difference between Elements and Features Features:**

Inbuilt facilities that can be activated on text.

**Elements:** Physical components that can be viewed on the screen.

### **Features of a word processor**

1. Enables one to create a file and save it again for retrieval, editing and formatting.

2. Have spell checker, thesaurus and grammar checkers.
3. Provides headers and footers, indexing, footnotes
4. Ability to create and import text and graphics from other applications

### **Advantages of Word Processor**

1. It is faster to create a document because of the availability of facilities like formatting and editing features.
2. Enables the users to proofread and spell check the document on the screen before printing.
3. It allows multiple copies printing unlike the typewriters.
4. Enables the user to store the document for future editing/ reference if need be.
5. Has a superior document formatting features.

## Mail merging Document

The process of generating personalized letters or documents by combining a main document with an existing document. Files involved in mail merging:

1. Primary file: Contains data that is to appear on all the letters after combining.
2. Secondary file: Content to appear in all the letters.
3. Merged file: Combined primary and secondary document.

## Ways of Mail Merging

- Previewing merged document
- Merging to a printer
- Merging to a new document
- Sending merged document via email or fax

## Editing a Document

### Deleting text

There are many ways to accomplish this operation

- highlighting the text then right click the highlighted text and choose delete or press delete key.
- Backspace Key: Deletes text on the left side of the cursor position.
- Delete key: Deletes text on the right side of the cursor position.

**Find and replace:** Fast way to search for a word in the document and if necessary replacing it with another word.

**Spelling and grammar:** Press F7 or go to Spell checker to correct wrongly spelled words and incorrect grammar

**Thesaurus:** Used to search for words with similar meaning (synonyms) or with opposite meaning (antonyms).

**Autocorrect and autotext:** Autocorrect automatically corrects wrongly spelled word during data entry while autotext completes words when the user types in the first letters of a word.

**Undo and Redo:** Undo (CTRL+Z) automatically cancels the last action done by the user while

Redo (CTRL+Y) automatically reverses the last command or action undone by the user.

## Formatting Document

### Text Formatting

Changing the font type, size and colour

### Changing the case

- Uppercase: automatically changes the highlighted text into capital letters.
- Lowercase: automatically changes the highlighted text into small letters.
- Sentence case: automatically makes the first letter of a sentence to a capital letter.

- Toggle case: automatically changes capitalized letters to small letters and vice versa.

### Superscript and subscript

Press (CTRL+SHIFT++) for superscript option or (CTRL+=) for subscript option.

## Paragraph Formatting

### Alignment or Justification

- Full: All lines in a paragraph start at the same point and end at the same point.
- Left: All lines in a paragraph start at the same point but end at different point.
- Right: All lines in a paragraph start at different points but end at the same point.
- Centres: All lines in a paragraph are centered along the page.

## Line spacing

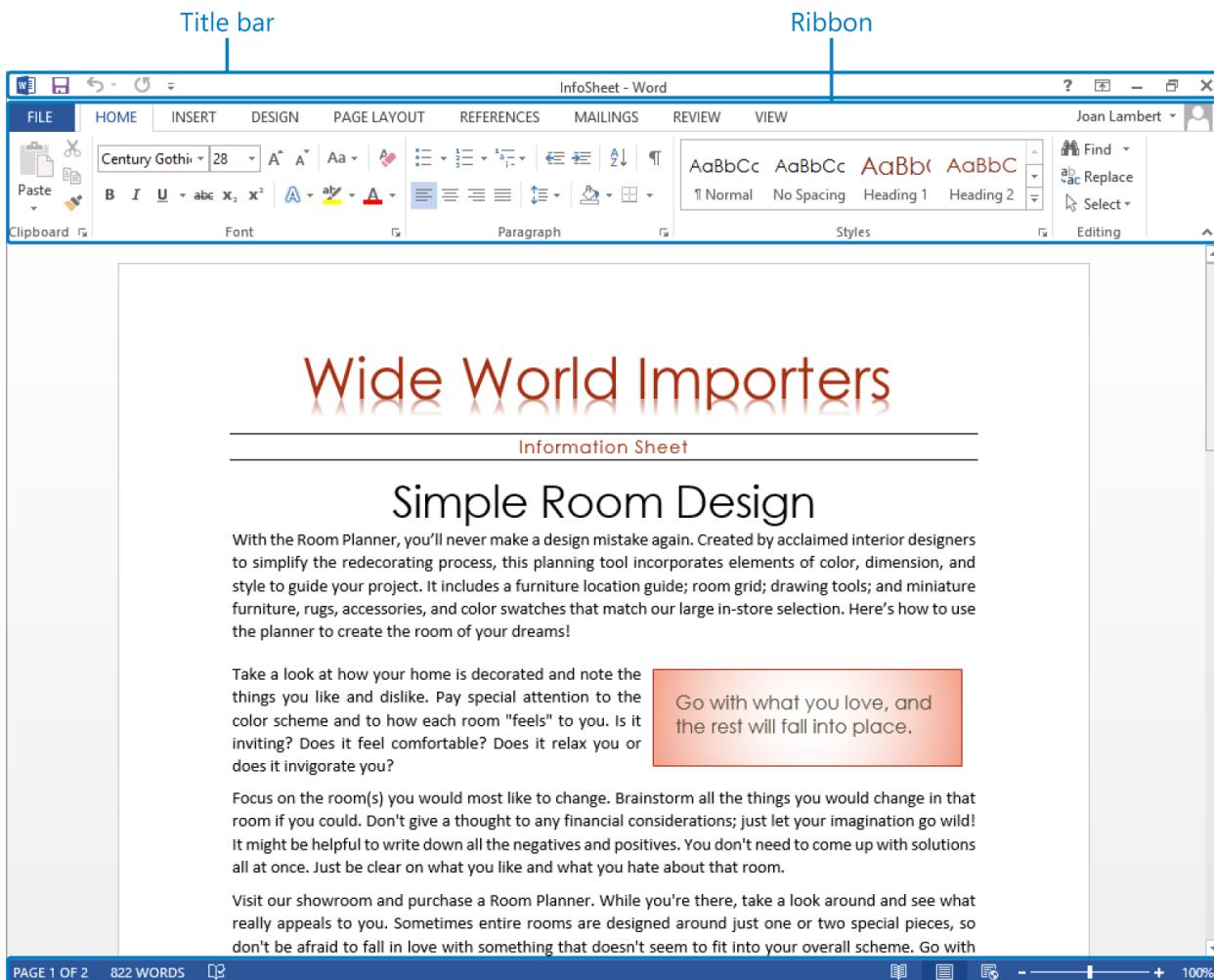
### Tab setting and Indents

- Indenting a paragraph from the left margin
- Indenting the first line of a paragraph from the left margin
- Hanging indent
- Indenting a paragraph from the right margin
- Indenting from both margins

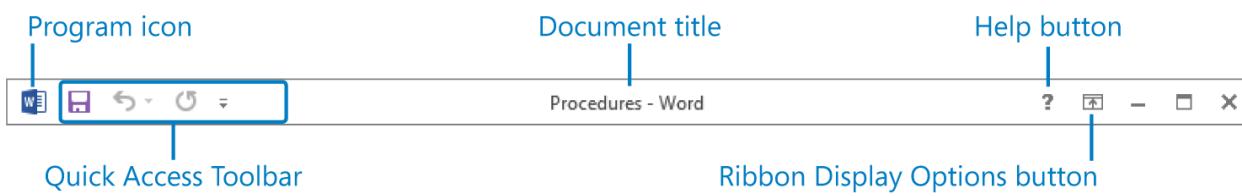
### Drop cap

Formatting the first letter of a paragraph to appear bigger and occupy several lines.

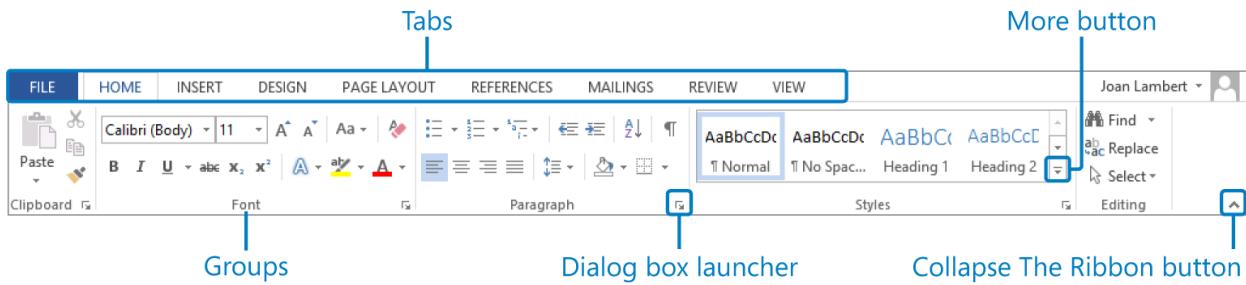
Bullet and numbering column page and column breaks.



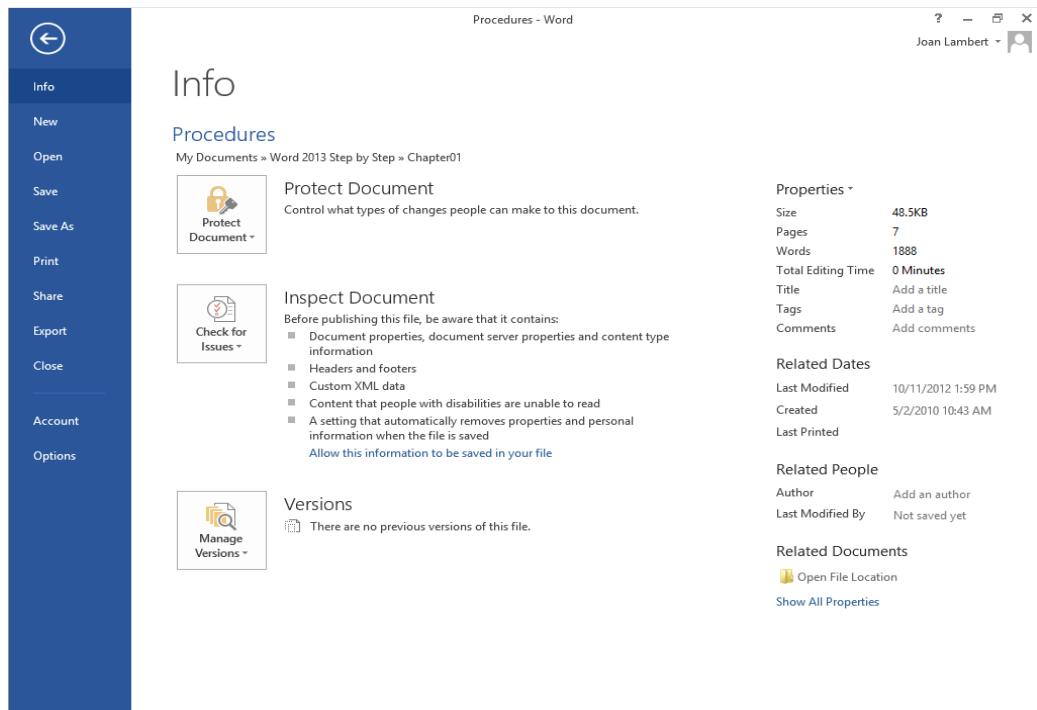
*The Word 2013 program window, displaying a document and the standard program window elements.*



*The title bar of a program window for an existing document.*



*The ribbon, showing the Home tab.*



*The Backstage view, where you can manage files and customize the program.*

## End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

**1. a) What is a word Processor? (1 mk)**

A computer program that enables a person to create, retrieve, edit, format, and print text based documents

**b) List two common examples of word processing software widely used in the market today. (2 mks)**

- Microsoft word
- WordPerfect
- Lotus WordPerfect
- WordStar
- WordPad

**2. Give three comparisons of the traditional method of typing a document on a Typewriter against using a word processor (6mks)**

- Correcting typing mistakes using a word processor is easy; it is hard to correct mistakes on a typewriter.
- Producing multiple copies of the same page is possible using a word processor, but it is not possible to produce multiple copies on a typewriter.
- Text formatting features are available on a word processor, e.g. front size, font type, font colour, boldfacing, italicization, etc.
- The documents created can be stored in the computer for future reference
- Typing using a word processor is easier & more efficient because most of the actions are automatic. For example; the word wrap feature automatically takes the text cursor to the beginning of the next line once it reaches the end of the current line.
- A new page is automatically inserted after reaching the end of the current page
- Graphics can be added within documents using a word processor
- Grammar& spelling mistakes can be checked & a text-editing tool that provides alternative words with similar meanings.
- A word processor allows mail merging, which makes it possible to produce similar letters and sent them to several people.

**3. a) What is a template? (1mk)**

It is a document that acts as a blue print or outline for other documents of the same type. It contains the standard text, graphics and formatting for use in all documents of this type.

**b) State two advantages of using a template to create a document.**

**(2mks)**

- It helps save time and makes creating of new documents easy
- It ensures that there is consistency between the documents being created.

**4. Explain the difference between overtypes and insert mode in word processing (2mks)**

Type over deletes the current text at cursor position and inserts new text.  
Inserting pushes the old text away as new text is inserted at cursor position.

**5. Veronica tried to retrieve a document file following all the steps correctly. The filename did not appear in file list box. State three causes for this.**

**(3mks)**

- The file may not have been saved
- The file may have been deleted
- The file may be located in a different folder from the one she was trying to retrieve from (or may have been moved).
- The file may have been destroyed by a computer virus.

**6. Mwikali selected a paragraph in word processing. Explain what happened after pressing the following keys on the keyboard: (3mks)**

- i) CTRL + B -Changes the paragraph to bold/removes bold from paragraph
- ii) CTRL +A -the whole document is selected
- iii) CTRL+ U -the selected text is underlined/removes underline from the selected text.

**7. Precisely explain the role of the following editing features of a word processor; (3mks)**

- i) Find and replace -To find words that you want replaced by others
- ii) Undo and redo -Undo reverses the previous/latest action, while redo does the undone action
- iii) Thesaurus -It gives suggestion of words or phrases with similar meaning (synonyms), and sometimes antonyms to the selected word.
- iv) Autocorrect-It checks for wrongly spelled words, and automatically replaces them with the correct ones as set by the user.

**8. Give the steps you would use to find and replace the occurrence of a particular word in Microsoft Word. (4mks)**

- Click on edit, select find (or replace)
- Type the word you want to replace with in the replace with box
- Click replaces or Replace all if you want to replace all the occurrences of that word in your document at once.

**9. Name and explain the use of any three buttons found in a spell-check dialog box**

(6mks)

Change: Accepts the current selection in the suggestions box

Ignore Once: Leaves the highlighted error unchanged (if the highlighted word is a valid word) & finds the next spelling or grammar error

Ignore all: retains all the occurrences of the same word or phrase in the document from another language, e.g. a Kiswahili.

Add: Adds the highlighted word in the Suggestions box to the Custom dictionary.

10. Clearly explain the meaning of the following terms as used in word processing:

(7mks)

- i) **Editing a document** - Making changes to an already typed/existing document.
- ii) **Blocking text**- Selecting a group of text in order to work with it as a whole, e.g. a word sentence or paragraph.
- iii) **Printing** – having your work copied on a piece of paper as output
- iv) **Saving**- Storing a file/document permanently in the computer's secondary memory (e.g., hard disk) so as to be used in the future.
- v) **Italicizing text**- making the text slant forward
- vi) **Header**- It is a standard text or information such as page numbers, chapter titles, etc that appears above the top margin of every page in a document or in a section
- vii) **Footer**-It is a standard text or information that appears below the bottom margin of every page in a document.

11. a) **What is document formatting?** (1mk)

Applying various styles to enhance the appearance of a document

b) **Give any five document formatting features of a word processor.**

(5mks)

- Bolding
- Font colouring
- Text alignment
- Font type
- Setting tabs
- Underlining
- Italicizing
- Font size.

c) **Differentiate between ‘superscript’ and ‘Superscript is text formatted to be at the bottom of a line.**

Superscript is text formatted to be at the top of a line, Subscript is text formatted to be at the bottom of a line.

12. **What are page margins?**

Non-printing but visible text-limiting borders that mark the distance that text starts on a page away from the edge of the page

**13. Differentiate between:**

- a) **A Hard page break and a Soft page break.** (2mks)

A hard page break is inserted on a page even before the end of the page, e.g. by pressing CTRL+ ENTER or setting a manual page break.

For a Soft page break, the text cursor moves or creates a new page automatically when at the end of the current page during typing.

- b) **Auto complete and AutoCorrect** (2mks)

AutoComplete helps a person to type quickly by completing automatically a word that he/she has already started to type

AutoCorrect automatically replaces mistyped words with the correct ones as set by the user.

- c) **Drawing and inserting a table in a document** (2mks)

Drawing – use the pen tool to draw the table

Inserting table- use the Table-Insert-table Command

**14. Explain how a paragraph can be moved from one page to another using a word processor.** (4mks)

- Select the paragraph
- Click Cut on the Edit menu/ standard toolbar, (or Press CTL + 'X')
- Click to place the insertion point here you want to put the text
- Click on Edit, then choose Paste (or Press CTRL + 'V')

**15. a) What is line spacing?** (1mk)

The vertical distance between two text lines in a document

- b) **Explain any three line spacing specification used in Microsoft Word.**

(3mks)

- i) Single space – accommodates the largest font in a line
- ii) 1.5 line space- 1 ½ time that of single line spacing
- iii) Double – twice that of single line spacing
- iv) Exactly – a fixed line spacing that word does not adjust
- v) At least – the minimum line spacing that is needed to fit the largest font or graphic on the line.
- vi) Multiple- a line spacing that is increased or decreased by a percentage that you specify .

(4mks)

**16. Give any four text alignment features** (4 mks)

- Left alignment
- centre alignment
- Right alignment
- Justified

**17. List any thee sources of graphics that can be used in Microsoft word.** (3mks)

- From Microsoft clip gallery
- From Scanner

- By drawing using the Drawing tools available in Ms-Word
- Import from another file

**18. a) Explain the concept of graphics that can be used in Microsoft word.(3mks)**

Getting ready-made objects and text from other applications into the word processor.

**b) What is the difference between object linking and embedding? (2mks)** In linking, the object imported can only be edited in the original application from which it was created.

In embedding, the object imported becomes part of the current application and can be edited there.

**19. Give a reason why it may be necessary to merge cells in a table.(1mk)**

To create larger cells in a table without increasing the height or width of the existing cells.

**20. a) Define mail merging. (2mks)**

- The process of generating personalized letters or documents by combining a standard document, but addressed to different recipients.

**b) Give two advantages of mail merge over copy and pasting several times to mass mail a document. (2mks)**

- combining of letters saves time when printing
- It allows producing of many documents at once
- The mailing list can be re-used on another document

**21. a) Give two advantages of previewing a document before printing. (2mks)**

- To check whether the page layout is OK
- To confirm that no details are outside the printable area
- to go through the document before printing
- To save on printing papers & printer toner because; errors on the printouts that may require reprinting will be minimal.

**22. a) Distinguish between Portrait and Landscape orientations. (2mks)**

- In Portrait, text & graphics are printed with the longest side of the page vertically upright, while in Landscape, text & graphics are printed with the longest side of the page placed horizontally.

**b) State two reasons why it is necessary to specify the correct paper size before printing a document? (2mks)**

- Select a paper size depending on the document page size needed
- To comply with printer capabilities

**23. Outline any three main features that make word processors popular**

**programs.**  
**(3mks)**

- Saving of documents for future reference
- Printing of multiple documents after editing
- formatting of documents into required form
- Mailing features such as mail merging of standard document with another saved file.

## Spreadsheet

**Specific Objectives**

By the end of the topic, the learner should be able to:

- a) Define a spreadsheet;
- b) Describe the components of a spreadsheet;
- c) State the application areas of a spreadsheet;
- d) Create and edit a worksheet;
- e) Explain different cell data types;
- f) Apply cell referencing;
- g) Apply functions and formulae;
- h) Apply worksheet formatting;
- i) Apply data management skills;
- j ) Apply charting and graphing skills;
- k) Print worksheet and graph.

**Content**

- a.) **Definition of a Spreadsheet**
- b.) **Components of a spreadsheet**
  - i. Worksheet
  - ii. Database
  - iii. graphs
- c.) **Application areas of a spreadsheet**
  - Statistical analysis
  - Accounting
  - Data management

- Forecasting (what if analysis)
- Scientific application

#### d.) Creating a worksheet/workbook

- Getting started
- Worksheet layout
- Running the program
  - i. Creating a worksheet
  - ii. Editing a cell entity
  - iii. Saving
  - iv. Retrieving
  - v. Closing a worksheet
  - vi. Exiting from spreadsheet

#### e.) Cell Data Types

- Labels
- Values
- Formulae
- Functions

#### f.) Cell referencing

- Cell addressing
- Absolute referencing
- Relative referencing

#### g.) Basic functions and formulae

- Functions
  - i. Statistical (average, count, max, min)
  - ii. logical (if, count-if sum-if)
  - iii. mathematical (sum, product, div)
- Arithmetic formulae (using operators +,-,/,\* ,

#### h.) Worksheet formatting

- Text
- Numbers
- Rows and columns
- Global

#### i.) Data management

- Sorting
- Filtering
- Total/subtotals function
- Forms

#### j.) Charts/graphs

- Types
- Data ranges
- Labels
- Headings and titles
- Legends

#### k.) Printing

- i. page set-up
- ii. print preview
- iii. print options

- select printer
- selection
- worksheet/workbook
- orientation
- pages and copies

### v) Printing

## Introduction

### Definition

An essentially large sheet that lets you enter, edit and manipulate numerical data.

## Types of Spreadsheet

Manual

Electronic

## Examples of Spreadsheet

Lotus 123

VisiCalc MS-Excel VP Planner

## Advantages of Electronic over manual spreadsheet

1. It utilizes powerful aspects of the computer like: speed, accuracy and efficiency to enable the user accomplish the task.
2. It offers a large virtual sheet for data entry and manipulation.
3. It utilizes large storage space on computer storage devices to store and retrieve documents.
4. Enables the user to produce neat work because traditional paper, pencil, rubber and calculator are not required
5. Has a better document formatting capabilities.
6. Has inbuilt formulas called functions that enables the user to quickly manipulate mathematical data.
7. Automatically adjusts the results of a formula if the data in the worksheet is changed-Automatic recalculation.

## Components of a Spreadsheet

1. Worksheet: where data is entered. It consists of cells, columns and rows.
2. Database: Does the actual management of data e.g. filtering records, using forms, calculating subtotals, data validation, pivot tables, pivot charts and reports.

3. Graph and charts: Pictorial representation of the base data in a worksheet.

## Types of charts

Line, bar, column, pie, scattered, histogram,

Legend: A key that explain what each colour or pattern of data representation in a chart means.

## Application Areas of Spreadsheet

1. Statistical analysis
2. Accounting: Recording daily transactions and keeping of financial records. Also in;
3. Track the value of assets overtime (Depreciation and Appreciation).
4. Calculate profits
5. Prepare budgets.
6. Data management: Sorting, filtering data, calculating subtotals, and using forms.
7. Forecasting/ What if analysis: Changing values of a cell or argument in a formula to see the difference the change would make to the calculation results.

## Worksheet Layout

- Cell:** Intersection between a row and column.
- Rows:** Horizontal arrangement of cells.
- Columns:** Vertical arrangement of cells.
- Range:** A group of rectangular cells that can be manipulated as a block.

## Cell Data Types

1. Label: Any text or alphanumeric characters entered in a cell.
2. Values: Numbers that can be manipulated automatically.
3. Formula: Designed mathematical expression that create a relationship cell and return a value in a chosen cell.
4. Functions: Inbuilt predefined formula that the user can quickly use instead of creating new one each time a calculation has to be carried out.

## Cell Referencing

Identifies a cell or range of cells on the worksheet and shows MS-Excel where to look for the values or data needed to be used in a formula.

1. **Relative cell referencing:** The formula keeps on changing automatically depending on the position on the worksheet.

2. **Absolute:** Cell reference that is always referring to a cell in a specified location of the worksheet even if they are copied from one cell to another.

A1 referencing style: A cell can be identified by its column label followed by the row number.

R1C1 referencing style: A cell is referred by its row number followed by its column number.

**A1 style**

**R1C1**

B2	R2C2
C2	R10C3
E20	R20C5

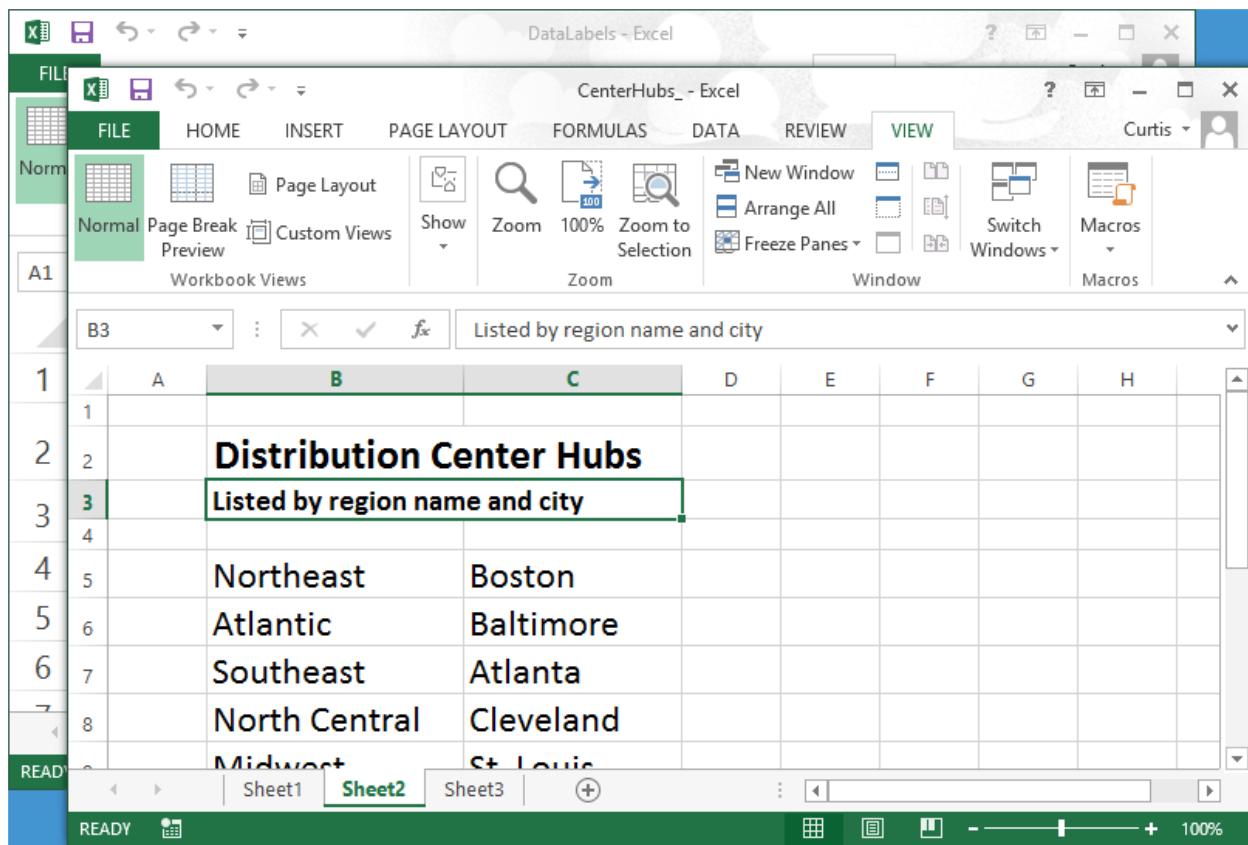
## Data Management

1. Sorting
2. Filtering data: Quick and efficient method of finding and working with a subset of data in a list.
3. Auto filter: Uses simple criteria and include filter by selection
4. Advanced filter: Uses more complex criteria.
5. Subtotal
6. Total function
7. Forms: Special prepared templates that the user can use to make data entry fast.

## Basic Functions and Formulas

### Statistical Functions

1. Average: Returns the average or mean of a certain formula which can be numbers or array.
2. Count: Counts the number of cells that contain values.
3. Max: Returns the largest value in a set of values.
4. Min: Returns the smallest value in a set of values.
5. Mode: Returns the most frequent occurring value in a set of values.
6. Rank: Returns the rank of a number in a list by comparing its size in relation to the others.



The screenshot shows a Microsoft Excel window titled "DataLabels - Excel". The ribbon tabs are FILE, HOME, INSERT, PAGE LAYOUT, FORMULAS, DATA, REVIEW, and VIEW. The FILE tab is selected. The ribbon bar also includes Normal, Page Break Preview, Custom Views, Show, Zoom, 100%, Zoom to Selection, and Window buttons. The View tab includes New Window, Arrange All, Freeze Panes, Switch Windows, and Macros buttons.

The worksheet is titled "CenterHubs\_ - Excel". Cell A1 contains "Normal". Cell B3 contains "Listed by region name and city". The main data starts at row 4:

	A	B	C	D	E	F	G	H
1	1							
2	2	<b>Distribution Center Hubs</b>						
3	3	<b>Listed by region name and city</b>						
4		Northeast	Boston					
5		Atlantic	Baltimore					
6		Southeast	Atlanta					
7		North Central	Cleveland					
8		Midwest	St. Louis					

The bottom of the screen shows the ribbon bar again, followed by the status bar which includes "Sheet2", "Sheet3", and a zoom level of "100%".

## Logical Functions

1. If: Returns a specified value if a condition is executed and found to be true and another value if it is false.
2. Count if: Counts a number of cells within a specified range that meet the given condition of criteria. Example A10:E10 contain eggs, in cell 6, 5 and 2 =COUNTIF (A10:E10,"eggs") will return 3.
3. Sum If: Adds values in the specified cells by giving a condition or criteria. Example A10:E10 contain 10, 50, 60, 30, 70 sum all values greater than 50 =SUMIF (A10:E10,">50") returns 180.

## Mathematical Functions

1. Sum: Adds values in a range of cells as specified and returns the result in a specified cell.
2. Product: Multiplies values in a range of cells as specifies and returns result in a specified cell.

### Order of execution

Operator	Name	Precedence
-	Negative as in -1	1
%	Percentage	2
^	Exponential	3
*and /	Multiplication and Division	4
+and -	Addition and Subtraction	5
=,<,>,<=,=	Relation	6

## End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

- What is electronic spreadsheet software? (2mks)**
- A computer program that looks like the manual ledger sheet with rows & columns for entering data that can be manipulated mathematically using formulae.
- 2. Give any two application programs classified as spreadsheets. (2mks)**
- Microsoft Excel
  - Lotus 123
  - -Corel Quattro Pro
  - -super calculators
  - -Multiplan
  - -VP-Planner
  - -VisiCalc
- 3. Differentiate between the traditional analysis ledger sheet and an electronic spreadsheet. (5mks)**

An electronic spreadsheet;

- Has a large worksheet for data entry & manipulation as compared to manual worksheet
- Has inbuilt formulae (called functions) that are non-existent in manual worksheets
- Uses the power of the computer to quickly carry out operations
- Has better document formatting & editing qualities than a manual worksheet
- Utilizes the large storage space available on computer storage devices to save & retrieve documents.
- Can easily be modified, while manual spreadsheets involve a lot of manual calculations & are very difficult to amend
- The user can very quickly & efficiently perform complicated computations using the information stored in an electronic spreadsheet.
- Enables the user to produce neat work
- Offers graphical representation of data leading to comprehensive decisions.
- It is accurate in its calculations & allows automatic recalculation on formulae. For a manual worksheet, changing one value means rubbing the result & writing the correct one again.

- 4. Explain five application areas where spreadsheet software can be used. (5mks)**

- i) **Accounting:** - spreadsheet software can be used by accountants to record their daily transactions & also keep financial records, e.g. they can record

sales & purchases, produce invoices, compile financial statements, calculate profits, prepare budgets, etc.

ii) **Data management:** - a spreadsheet enables data & information to be arranged neatly in tables, produced easily and also kept up-to-date, e.g. one can edit, save, sort, filter, use forms to enter and view records, and worksheet data.

iii) **Scientific applications:** - spreadsheets can be used by scientists & researchers to compile and analyze their results.

iv) **Statistical analysis:** - spreadsheets provide a set of statistical Functions/tools that can be used to develop complex statistical or engineering analyses, e.g., teachers can compile their students' marks and produce results.

v) **Forecasting:** - using the 'what if' analysis technique, spreadsheets can be used to find out the effect of changing certain values in a worksheet on the other cells. This helps in financial forecasting, budgeting, etc.

#### 5. State five features of spreadsheets that are useful in financial modeling. (5mks)

- Have inbuilt functions & formulae which can be used to perform most mathematical statistical, trigonometric or financial calculations
- Allows automatic recalculation on formulae
- #have ability to perform 'what if' analysis, which can be used to find out the effect of changing certain values in a worksheet on the other cells
- Have the ability to sort & filter data
- Have a data validation facility, which ensures that the correct data is entered into the spreadsheet.
- Have a chart facility that can be used to draw Line graphs, Bar charts, Pie charts, Histograms, etc.
- Some spreadsheets have a SOLVER facility that is used to uncover the best uses of scarce resources so that desired goals such as profit can be maximized, or undesired goals such as cost can be minimized.
- They enabled printing of entire worksheets, portions of a worksheet or several worksheets within the shortest time possible
- Have the ability to summarize data using Consolidation and Pivot tables.

#### 6. Define the following terms as used in a worksheet: (3mks)

##### i) **Columns**

These are the fields that make up the worksheet of a spreadsheet, and are identified by letters.

They run vertically from top downwards

##### ii) **Rows**

These are the records that form a worksheet, and are identified by numbers. They run horizontally from left to right.

##### iii) **Cell**

A box formed when a row & a column intersect in a worksheet where the data is entered

#### 7. Explain the following concepts as used in spreadsheets: (4mks)

##### i) **Automatic recalculation**

This is whereby an electronic spreadsheet will adjust the result of a formula automatically when the values are changed, so that they correspond with the different input.

**ii) ‘What if’ analysis**

‘What if’ analysis is a feature in spreadsheets that is used to find out the effect of changing certain values in a worksheet on the other cells.

It involves changing the values of one of the arguments in a formula in order to see the difference the change would make on the result of the calculation.

**iii) Sheet tabs**

These are names of the worksheets that appear at the bottom of the worksheet window. They enable the user to move from one worksheet to another.

**iv) Worksheet**

A page (single sheet) stored in a workbook

**8. Name four data types used in spreadsheets (2mks)**

- Labels
- Values
- Functions
- Formulae

**9. An Agrovet Company wants to analyze its employee’s personal details using Microsoft Excel. The company has five employees: Mary Anne, Francis Kihara, Lena Achieng, Hellen Wanjiku, and mwangi Peter. Their ages are 20, 45, 90, 45 and 34 years respectively. Mary department; Mwangi Peter in finance department and Hellen Wanjiku in Computer department**

Mary Anne and Hellen Wanjiku are single whereas Francis Kihara, Lena Achieng and Mwangi Peter are married.

Construct a worksheet showing the above information. Use appropriate column headings

(6mks)

	A	B	C	D
1	AGROVET COMPANY			
2	NAMES	AGE	DEPARTMENT	STATUS
3	Mary Anne	23	Research	Single
4	Francis Kihara	45	Personnel	Married
5	Lena Achieng	90	Research	Married
6	Hellen Wanjiku	45	Computer	Single
7	Mwangi Peter	34	Computer	Married
8				

**10. a) What is a cell reference? (1mk)**

A cell reference is the identity of a cell in a worksheet. A cell is identified by use of the column letter and the row number headings.

**b) For each of the following, state the type of cell reference. (4 mks)**

- i) A5 Relative reference
- ii) \$F\$5 Absolute row reference (only the row reference is absolute)
- iii) H\$21 Absolute column reference (only the column reference is absolute)

## Database

### Specific Objectives

By the end of the topic, the learner should be able to:

- a) Define a database;
- b) Explain the concepts of a database,
- c) Explain data organization in a database;
- d) Create a database;
- e) Edit a database;
- f) Design a form;
- g) Apply basic concepts of queries;
- h) Create report and labels;
- i) Print queries, forms and reports.

### Content

- a.) Definition of Database
- b.) Database concepts
  - Traditional filing methods (manual flat files)
  - Functions of databases
  - Types of database models
  - Database software
  - Features of a database (e.g. data structures, report generating, query language, modules)
- c.) Data Organization

- Character types
- Fields
- Records
- Files
- Database

d.) Creating a database

- Design a database structure
- Field properties and data types
- Key-fields and index
- Data entry

e.) Editing a database

- Modify structure
- Updating database

f.) Form design

- Form layout
- Data manipulation
- Formatting fields

g.) Queries

- Creating
- Updating
- Viewing
- Printing

h.) Reports layout

- Creating (using relational and logical operator, local operators - AND OR, NOT)
- Modifying
- Sorting and grouping
- Labeling
- Printing

## Introduction

### Definition of Database

Collection of structured and related data items organized to produce a consistent and controlled access to the items.

### Challenges facing human way of managing databases (Manual)

1. Unnecessary duplication of data.
2. Burning and time wasting when searching for an item.
3. Misleading reports due to poor data entry and organization.
4. Poor update of records.

## Functions of Database Management System

1. Enables users to add or delete records.
2. Enables users to update or modify records.
3. Allows user to organize data for easy access, retrieval and manipulation.
4. Acts as an interface between database and other application programs.
5. Ensures security of data by safeguarding it against unauthorized access.
6. Keeps statistics of data items in a database.

NB: Database Management Software (DBMS) facilitates the creation, organizing and management of databases.

## Components of a Database System

1. **Hardware:** Storage disks, tapes and other associated devices like the CPU.
2. **Data:** Values physically recorded.
3. **Software:**
  - Data definition: Method of data definition and storage.
  - Data maintenance: Checks data in the fields.
  - Data manipulation: Inserting, updating and sorting data.
  - Data display: Viewing data.
  - Data integrity: Accuracy or completeness of data and information in a computer or received from an information system.
4. **User:**
  - a) Application programmer: Write programs that use databases.
  - b) End users: Interact with the database from a terminal.
  - c) Database administrator: Functions
    - Overall in charge of the system
    - Determine the information content of a database
    - Define unauthorized checks and validation procedures
    - Monitor performance and respond to changes in user requirement
    - Define a strategy for backup strategy

## Advantages of Computerized Databases

1. Reduces redundancy through the integration of files that have something in common.
2. Avoids inconsistency by safeguarding item duplication.
3. Data can be shared- data requirement can be satisfied even without necessary creation of a new file.
4. Offers security by restricting unauthorized access.
5. Data integrity is maintained- the accuracy of data.
6. Data independence: the immunity of the application to changes in storage and access strategy.

## Database Models

1. **Flat files:** They hold only one set of data and is not any different from the manual files.  
Example is the library catalog.
2. **Hierarchical models:** Arranged in hierarchical (text) form i.e. To access level two data one has to first access level one data items.
3. **Networking models:** Links or paths are used to express the relation between different data items forming a network of items.
4. **Relational model:** Related data items are stored together in structures called relations or tables.  
Relationships created between records of different tables.
5. **Object Oriented Model:** Database is a complete program built to hold a collection of objects which have both properties and behavior.

## Features of Database Management System

1. **Tables:** Hold related records.
2. **Queries:** A database tool used to search or question the database on specific data items. Types of queries-
  - Select query- Used to search and analyze data in one or more tables.
  - Action query- Used to make changes to many records once.
    - Task- a) Update: updates data in a table
    - b) Append: adds data in a table from one or more tables.
    - c) Make table: Creates a new table from a dynaset.
    - d) Delete: Deletes specified records from one or more tables.
3. **Forms:** Enables users to view and enter data in a table.
4. **Reports:** Provides users with means to specify output layout and what is to be printed.
5. **Macros:** A set of procedure to automatic frequently performed tasks.
6. **Programming module:** A powerful tool than macros to automate the database operations further.

## Data Organization in a Database

- Fields: Character or logical combination of characters.
- Records: Collection of related fields that represent a single entity.

- Tables:** A collection of related records.
- Database:** Highest in data records.

## Field Data Types

- Text:** Alphanumeric letters, numbers, space and functions.
- Number:** Numeric numbers can be manipulated mathematically.
- Memo:** Made of alphanumeric data up to 64000 characters.
- Date/ Time:** Identify a field as either a date or time.
- Currency:** Identify numeric values that are in decimal or fraction.
- Auto number:** Numeric value u wish MS-Access to automatically increment values in a field.
- Yes/ No:** Logical field where entry is either a yes or no using a check box.
- Object Linking and Embedding (OLE):** Used for graphical interface applications for inserting graphical objects.

## Field Properties

1. **Field size:** Allows user to set the number of characters in a field.
2. **Format:** Determines how information appears on screen and when printed.
3. **Decimal places:** Used for number or currency fields, and to specify the number of decimal places.
4. **Input Mask:** Automatically formats field entry into specified format.
5. **Caption:** A more descriptive name for a field to be used in a table.
6. **Default value:** A value that will automatically appear in datasheet if nothing is entered.
7. **Validation rule:** Logical expression that restricts the value to be entered in a field.
8. **Validation text:** Message that appears when the validation rule is violated.
9. **Required:** Determines if an entry must be made in a field before you proceed to the next field.
10. **Allow zero length:** Allows the users to proceed without making any entry in fields set as zero length.
11. **Indexed:** Facilitates the organization of records for easy search.
12. **Primary key:** Enforces uniqueness in a table so that one record isn't entered twice.
13. **Index:** Used to speed up search and sort operations in a table.
14. **Foreign Key:** A key in a child table which is a primary key in a parent table.

## Ways of Protecting Information System from Unauthorized Access

- Use of passwords
- User and group permission
- Data encryption
- User level security

## Data integrity Constraints

Rules governing entering, changing and deletion of data and records in a database.

1. **Entity integrity:** Rules governing the composition of primary key.

- Cannot contain a null value, it must be unique- No zero length
- No duplicate- indexed
- Input mask
- Caption

2. **Referential integrity:** Governs the nature of records in a one to many relationship between tables in the database.

-All foreign keys in child tables must have a matching field in a parent table.

- a) Restricted database- the system deletes or updates a parent record if there are no matching records. A parent record has a primary key and a child record has a foreign key of the relationship in the second table.
- b) Cascades database- deletes or updates all matching child records when the parent record is deleted or updated.

3. **Domain integrity:** Ensures no field takes on a value outside the range of valid values.

- Format
- Validation rule
- Validation text
- Indexed

## Terms used in Database

1. **Normalization:** This is the process of dividing information into independent tables to avoid repletion of data entries.
2. **Query language:** Special language used to write query statements.
3. **Data redundancy:** duplication of data.
4. **Data inconsistency:** When one piece of information in a record doesn't concur with the other piece in a different file.

## Types of Controls used in Database

1. **Bound Control:** One whose source of data is a field in a table or a query.
2. **Unbound Control:** A control that is not connected to any data source.

## Query Criteria

- Relational operations: >, <, <=, >=, <>, and =.
- Wildcards: \*(asterisk) and #.
- Logical operators: AND, OR and NOT.
- LIKE and BETWEEN: relate or display values within a range.

## Considerations for a Database Relationship

- Field of similar data types
- Field content
- Primary key

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

1. a) **Define a database.** (2mks)
- A collection of related files organized to provide consistent and controlled access to the data items.
  - A collection of related data elements stored together under one logical structure so as to provide a consistent & controlled access to the items.
  - A collection of information related to a particular subject or purpose
  - A common data pool, maintained to support the various activities taking place within the organization.
- b) **List four examples of database programs in the market today.** (2mks)
- Microsoft Access
  - Oracle
  - FoxPro
  - Dbase
2. **State the components of a Database hierarchy in ascending order.** (2mks)
- Character (alphabets, numbers and special characters)
  - Fields (Facts, attributes, set of related characters)
  - Records (Collection of fields)
  - File (Collection of records)
  - Database (Logical collection of files)
3. a) **Explain three types of database models.** (6 marks)
- i. **Flat file database:** It holds only one set of data
  - ii. **Relational database:** Related data items are stored or organized together in structures called relations or tables. Each table consists of rows and columns.
  - iii. **Hierarchical database:** The data items are organized in hierarchical (tree-like) structure. The records are stored in multiple levels, where units further down the system are subordinate to the ones above
  - iv. **Network database:** It allows a data element (or record) to be related to more than one other data element/record. Links are used to express the relationship between different data items forming a network of items.
- b) **Define the term sorting** (2mks)
- Sorting involves arranging of records in a logical order in the database. It can either be in Ascending or descending order.

**4. a) What are database management system software? (2mks)**

A collection of programs used to store & retrieve data, and manage files or records containing related information from a database.

**b) Give the two classes of database software. (2mks)**

PC-based database software:-Are usually designed for individual users or small businesses, e.g. Ms-Access, Dbase, Paradox, FoxPro

Corporate database software:-Are designed for big corporations that handle large amounts of data, e.g. Oracle, SQL Server, Sybase, etc

**5. State the use of the following objects in databases. (3mks)**

i) **Tables** To store related records

ii) **Forms** They act as screens for entering, changing & viewing data

in tables

iii) **Query** Searching for specific records/Data manipulation>Selecting

**6. a) Define the term normalization as used in database design. (2mks)**

Normalization is the process of trying to eliminate storage of duplicate values in a database.

**b) State three objectives of normalization. (3mks)**

- To relate different tables in a database
- To ease the retrieval of data from a relational database
- Breaking up multi theme tables into smaller workable tables

**7. Give three advantages of separating data from the applications that use the data in database design. (3mks)**

- You can retrieve recorded data easily
- You can do calculations in an easy way
- Creating of queries, forms, reports will be easy by using data separation.

**8. Differentiate between:****i) Primary key and relationship (2mks)**

**Primary key** is a field or a set of fields that can be used to uniquely identify each individual record in a table. It is used to relate a table to the foreign keys in other tables.

**ii) Tabular and columnar form layout. (2mks)**

**Tabular** – the records are displayed from left to right across the page, and the labels appear at the top of each column, with each row representing a new record.

**Columnar** – the fields for each record are displayed down a column, i.e. each value is displayed on a separate line with field labels to the left.

**9. State three types of relationships that can be used to link tables in databases. (3 mks)**

- One-to-One
- One-to-many
- Many –to-Many

**10. Explain how ‘parents’ and ‘child’ tables are related in relational database. (4mks)**

A parent table is the one that has the primary key of the relationship, while a child table is the one that has the foreign key of the relationship.

Parent and child tables are related through a common field that links the two tables. Records in a child table relate to one record in a parent table.

**11. a) Describe four major shortcomings of the conventional (paper )file structures that are being addressed by the database approach. (4mks)**

- Unnecessary duplication of data
- Boredom & time wastage especially when searching for a particular item
- In order to carry out any file processing task(s), all the related files have to be processed
- Misleading reports due to poor data entry and organization
- Difficulty in sorting, retrieving & updating records
- Security: no protection of files against unauthorized access and corruption
- Sharing of files is difficult
- Some information resulting from several files may not be available.

**b) List any two methods used to secure data in a database (2mks)**

- Password protection
- User and group permissions
- User-level security
- Data encryption

**12. The following car details are to be entered in a database: Make, Date-of-manufacture, colour, and cost.**

**a) Prepare a suitable database structure showing field names and their field data types (5 mks)**

Field name	Data type
ID (Primary key)	Auto Number
Make	text
Date of manufacture	Date/time
Colour	Text
Cost	Currency

**b) Explain how you index the data such that cars of the same make and colour are together. (2mks)**

Create a query to show same make and colour

**c) Write a statement that can be used to select cars of colour green. (2mks)**

Create a query. In the colour field, and in the Criteria row, write “green”

**d) Give an instruction that would:**

- i) Select cars whose cost is between 500,000/= and 1,000,000/= (3mks)

Create a query. In the cost field, and in the criteria row, write “>500000 and <1000000”

- ii) Determine the average cost of all cars. (3mks)

Create a query. Choose average of costs “Avg” option in the total section.



## Desktop publishing DTP

### Specific Objectives

By the end of the topic, the learner should be able to:

- a) Define desktop publishing;
- b) State the purpose of DTP;
- c) Identify types of DTP software;
- d) Design a publication;
- e) Edit a publication;
- f) Format a publication;
- g) Print a publication.

### Content

- a.) Definition of Desktop publishing
- b.) Purposes of DTP
  - Graphic design
  - Page layout design
  - Printing
- c.) Types of DTP software
  - Graphical based
  - Layout based
- d.) Designing a publication
  - Types of publications e.g. newsletters, cards, brochures, posters etc
  - Running the program
  - Screen layout
  - Setting up a publication
  - Manipulating text and graphics
- e.) Editing a publication
  - Editing tools
- f.) Formatting a Publication
  - Text
  - Graphics
- g.) Printing
  - Page set up
  - Print options

### Introduction

## Definition

This is the production of publication work within the computer framework of art and design

## Purpose of Desktop Publication

- Graphic design
- Page layout design
- Printing

## Application areas Desktop Publication

1. Designing text and images
2. Production of publication
3. Creating illustrations
4. Editing text and graphic
5. Composing templates

## Types of Desktop Publishing Software

### Graphical based software

They are used to develop, edit and format graphical objects. Examples of graphical based software are: Adobe Photoshop, Corel Draw, Harvard Graphics e.t.c

### Layout based software

Examples are Adobe PageMaker, MS-Publisher.

## PageMaker Screen Layout

1. **Pasteboard:** A large blank area where you place text and objects before arranging them on printable area.
2. **Printable area:** Area surrounded by margins on the pasteboard.
3. **Master Pages:** They are used to design the general layout that needs to be applied in all other pages of publication.
4. **Rules:** Help the user to manually create ruler guides which are non print extensions, and also to measure publication size.
5. **Control Palette:** Shortcut toolbar mainly having text and paragraph formatting command icons.
6. **Toolbox:** A set of buttons that contain various tools used to create and manipulate publications.

## The buttons are;

- Pointer- Used to select, move and resize text blocks and graphics.
- Hand- Used to scroll the page and preview it.
- Text- Used to type, select and edit text.
- Line- used to draw straight lines in any direction.
- Rotating- used to select and rotate objects.
- Constrained line- Used to draw horizontal and vertical lines.
- Cropping: Used to trim imported graphics.

- Rectangular frame- used to create a rectangular placeholder for text and graphics.
  - Zoom- used to magnify or reduce an area of a page.  
  - Ellipsis frame- used to create an oval or circular placeholder for text or graphics.
  - Polygon: used to draw basic polygons, triangles and stars.
  - Rectangle- Used to draw squares and rectangles.
  - Ellipsis- Used to draw circles and elipses.

## Terms used in Desktop Publishing

- Tracking: Changing the visual denseness or openness of characters in a line
  - Kerning: Fixing particular pairs of letters that are either too close or too far from each other.
  - Cropping: Trimming graphics.

## Non Printing Guides in PageMaker

1. **Ruler guides:** They are used to measure a publication size.
  2. **Column guides:** They help on to divide a page into columns that make the publication more organized.
  3. **Margin guides:** Used in the development of the printable area of your publication.

# Layering

The process of placing objects, text and graphical objects on one another.

# Importance of Layering

To have presentable levels

## Advantages of PageMaker over Word Processor

- The user has control over the desktop
  - Master pages are used to set a common layout which may be repeated on all the pages of the publication
  - There is a wide range of templates available e.g. brochures, posters e.t.c

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

# Solved KCSE Questions on the topic

The process of producing publications such as newspapers, books, newsletters, cards, etc by marking areas for text and graphical objects using specialized programs installed on a desktop computer.

**b) Give any three examples of desktop publishing software available in the market today. (3mks)**

- Adobe PageMaker
- Adobe Photoshop
- Adobe illustrator
- Ventura
- Microsoft Publisher
- CorelDraw
- Harvard graphics

**2. Identify four different types of publications that can be produced using desktop publishing software. (4mks)**

- Cards, e.g. for special occasions such as weddings, graduations, congratulations, etc
- Newsletters
- Newspapers
- Calendars
- Advertisements/Posters
- Magazines
- Certificates
- Notices
- Catalogues
- Pamphlets
- Books
- Brochures

3. **Differentiate between the following:**

- a) Pasteboard and printable page. (2mks)

Pasteboard is where text & objects are placed for editing before transferring them to the printable area; Printable page refers to the area enclosed in margin guides.

(2mks)

- b) **Margins and column guides.** (2mks)

Margins mark text areas on the page along the edges, while column guides divide the page into several fields. They are used to define the printable area.

- c) **Change case and drop cap.** (2mks)

Change case is changing text from upper to lower case, sentence, title, or toggle case, while drop cap refer to making the first character in a line bigger and drops down to occupy the space in the lines that follow.

- d) **Kerning and tracking.** (2mks)

Tracking refers to changing the visual denseness or openness of characters in aline, while Kerning is fixing particular pairs of letters that are too close or too far apart from each other.

- e) **Fill and stroke**

A stroke refers to a line style, while a fill refers to applying background pattern such as shading to a graphical object.

- 4 a) **What is layering as used in DTP** (1 mk)

Layering is the placing of text or objects on top of each other.

- b) **Why is layering very useful in a desktop publisher?** (1mk)

It may be used to create watermarks.

5. **What commands are used in place of portrait and landscape page orientation in PageMaker?** (1mk)

i. Portrait-tall;

ii. Landscape-wide

6. Give three methods that are used to transform an object. (3mks)

- i. Rotating
- ii. Skewing
- iii. Reflecting

7. a) what is text wrap? (1mk)

Text wrap is controlling the flow of text over or around a graphical object.

b) Give three ways you can wrap text on an object. (3mks)

- Make the text jump the object to the next page or column
- Allow to text to jump over the object and continue on the same page
- Create a rectangular text wrap around all the sides of the object.

8. Define the term object grouping (2mks)

- This refers to joining objects in order to manipulate them as one object.

## Internet and email

### Specific Objectives

By the end of the topic, the learner should be able to:

- a) Define internet;
- b) Explain the importance of internet;
- c) Describe internet connectivity;
- d) Identify internet services;
- e) Access internet;
- f) Use e-mail facilities;

g) State the moral, social and spiritual issues that may emerge through access to the internet.

### Content

- a.) Definition of internet
- b.) Development of internet
- c.) Importance of internet
- d.) Internet connectivity
  - Telecommunication facilities
  - Modems
  - Internet services providers (ISP)
  - Internet software
- e.) Internet services e.g.
  - World Wide Web (www)
  - Electronic mail (e-mail)
  - Electronic Commerce (e-commerce)
  - Electronic Learning (e-learning)
- f.) Accessing Internet
  - Log-in/sign-in
  - Surf/browse
  - Search engines and hyperlinks
  - Downloading/saving/printing
- g.) Electronic Mail (e-mail)
  - Definition
  - E-mail software
  - E-mail facilities
    - i. Mails (checking, composing, forwarding, sending, saving and printing)
    - ii. Fax
    - iii. File attachment
    - iv. On-line meetings
    - v. Telephone messages
    - vi. Contact management

**NB:** Emphasis is on the procedure and not necessarily on on-line connectivity

- h.) Use the internet to access information on emerging issues e.g.
  - HIV/AIDS
  - Drug abuse
  - Environmental issues
  - Moral integrity



## Introduction

### Definitions of Internet and Intranet

**Internet:** This is an interconnection of many large computer networks to enable different computers world wide to communicate.

**Intranet:** Interconnection of computers within an organization to form a network.

### Importance of Internet

- Research activities
- News and information dissemination
- Leisure
- Communication
- Business transactions

### Internet Connectivity Requirements

- Data terminal equipment: processor, host computer and transmit data on networks e.g. mobile phones, Personal Digital Assistant (PDA).
- Transmission media: physical (wired) or wireless pathway.
- Telecommunication lines: fiber optic cables.
- Wireless telecommunications like the GSM use GPRS.
- Satellite transmission
- Internet Service Providers (ISPs): Companies that offer internet services to end users at a fee.
- Software: Help to facilitate you access to internet- Internet Protocol (IP/ TCP), browsers (Mozilla, Opera, Internet Explorer), Email (Ms-Outlook, Express, Eudora, Yahoo Mail e.t.c)
- Modem: Special digital to analog interface card that changes digital data to analog so as to be transmitted and on receiving end the data is changed from analog to digital form for computer to understand

### Protocols

A set of rules that governs how two computers can send and receive data on the network.

Types of protocols are:

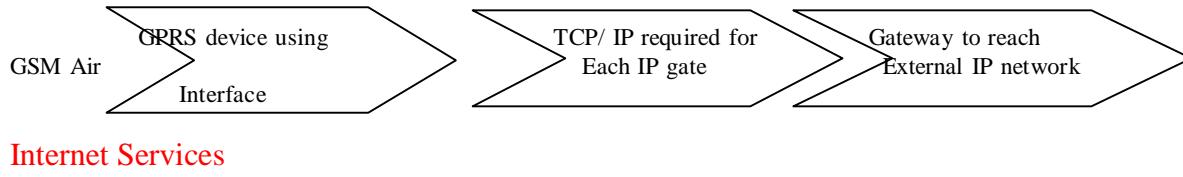
- Transmission Control Protocol (TCP): Governs how data is transferred from one computer to the next.
- Internet Protocol (IP): Determines the addressing system on the internet.

### Types of Internet Connection

1. Analog: ISP ancholes.
2. Integrated Service Digital Network (ISDN): Dial up faster than analog.
3. Broadband/ Asymmetrical Digital Subscriber Line (ADSL)/ Symmetrical Digital

Subscriber Line (SDSL): Faster than dial up.

## Internet Architecture



1. **E-mail:** Electronic exchange of letters, data and graphics on the internet.
2. **E-learning:** Learning through interacting with special programs on the computer.
3. **E-commerce:** Buying and selling of goods and services on the internet.
4. **Video conferencing:** Use of computer, digital camera and audio capturing equipment and communication network to enable people in different locations to talk to one another.
5. **Instant messaging:** Allow two or more people communicate directly e.g. Yahoo! Messenger, Google talk, IzzyTalk.
6. **News group**
7. **Searching:** Google, Opera Mini, Yahoo, Excite, Alta Vista.
8. **World Wide Web (www):** Vast virtual space on internet where information pages called websites is installed.

**Website:** Group of related web pages or other resources located on a web server.

**Web portal:** It offers specialized services like search, email, sports updates, financial news and links to selected websites.

**Blog:** Website containing information that can be easily updated. It acts as resume diary and may be used for business, advocacy and campaigns.

**Multimedia:** contains photos, movies, music, web TV, and internet radio.

## Terms used in accessing the internet

1. **Uniform Resource Locater (URL):** Address given to every resource on the internet which specifies the files or data and its location.
2. **Log in:**
3. **Sign up:**
4. **Surf/ browser:** Process of accessing internet resources.

5. **Hyperlinks:** Text or picture on an electronic document especially web pages that causes other web pages to open when link is clicked.
6. Search engine: program that searches document for specified keywords and returns a list of documents where keywords are found.
7. **Downloading:** Process of transferring information from host computer network to the local storage.
8. **Uploading:** Process of transferring information from a local storage to a remote computer on network.
9. **Computer Network:** This is a collection of independent entities that are arranged in such a manner so as to exchange data, information or resources all interconnected with a computer.

## E-mail Facilities

1. **Mails**
  - Checking
  - Compose
  - Send
  - Forward

2. File attachment
3. Online meeting
4. Telephone messaging
5. Contact management

## Advantages of Emails over Letters

- They are cheaper per individual message
- They are faster
- One can attach any kind of file
- More safer than a letter

## Precautions when setting an email system

- Install, use and regularly update antivirus software to reduce virus infection.
- Have a mail filtering system to track unsolicited mails.
- Install firewalls to block unauthorized internet traffic.
- Use passwords to allow only authorized users.

## Email Address Parts

- Example: josedeororah@ovi.com
- Josedeororah- Username
- @ - Separates username from host

- Ovi- Host computer on network
- .com- Identifies the type institution or domain.

## Web Address Parts

- Example: <http://www.pioneershomepage.com>
- http- protocol that transfers hypertext.
- www- Internet (web) server

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

**1. The first computer Network was set up by ARPA in the United States of America. What is the full meaning of the acronym ARPA (1mk)**

Advanced Research Projects Agency

**2. Your manager wishes to be connected to the Internet. He already has a powerful personal Computer (PC), a printer, and access to a Telephone line. However, he understands that he will need a Modem.**

**State why a modem is required to connect him to the internet. (2mks)**

A modem enables one to connect to the Internet and access information by transmitting data from one computer to another across telephone lines.

**3. The Internet connects millions of computers and telecommunication devices that have different hardware and software configurations. For these incompatible devices to be able to communicate, a protocols? (1mk)**

A protocol is a set of rules that govern how two computers can send and receive data on a network

Special communication rule that governs sending and receiving of messages by computers on a network

**b) Name the two most common protocols for the Internet, and state their functions. (3mks)**

**Transmission control Protocol (TCP);** - It governs how data is transferred from one place to another

**Internet Protocol (IP);** - It is used to provide routing from one network to another (i.e. it enables data to be sent & received by the different computers on a network)

- 4. a) Explain the following terms as used in internet:**

**i) Website**

(**1/2 mk**)

A collection /group of related Web pages belonging to an organization or individual

**ii) Browse/Surf the web.**

(**1/2 mk**)

Moving around and between the Web pages

- 5. a) What is meant by the term e-learning?**

(**1mk**)

This is learning through interaction with special programs on the computer.

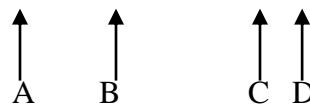
- b) A school intends to set-up an e-learning system. List three problems that are likely to be encountered.**

- Lack of capital
- Lack of skilled manpower (required technology to run & support the e-learning system)
- Spread of computer viruses
- Availability of pornographic material & literature to the students from the internet.

- 6. a) Identify the parts of the following e-mail address labelled A, B, C and D**

(**4mks**)

lat @africaonline . co.ke



A Name of the individual or organization

B Name of the host computer in the network on which the e-mail account is hosted

C Identifies the type of the organization or institution offering a particular service, i.e. commercial organization

D Name of the country where the site is located, i.e. Kenya.

- b) Mention two examples of e-mail software.**

(**2mks**)

- Microsoft Outlook
- Outlook express
- Microsoft exchange
- Eudora

- 7. Discuss four advantages and two disadvantages that electronic mails have over regular mails.**

(**6mks**)

**Advantages**

i) Cheap & economical: -It costs almost nothing to transmit and e-mail message over the network. There is no need for stamps, envelopes, etc

ii) Secure;-Access to a user's mailbox can be restricted by use of a password

- iii) Faster: - The delivery of an e-mail message normally takes seconds or minutes depending on the distance to the receiver.
- iv) Efficient:- A message prepared only once can be sent to several people
- v) Convenient: - with e-mail, one can send his/her messages when it is convenient for him/her & the recipients can respond at their convenient times.
- vi) Cheaper in preparing the message: - Most e-mail users accept less well-formatted messages and slight typing errors are overlooked, unlike in business letters which are expected to be error-free and formatted according to certain standards.

### Disadvantages

- the initial installation cost is higher
- Messages may be lost before they can be read due to virus infection
- Messages may not be kept for future reference due to the high cost of storage (2mks)

8. a) **What is a search engine?** (2mks)
- Google .com
  - Yahoo. Com
  - Hotmail.com
  - Excite.com
9. **Briefly describe four factors contributing to Internet access and growth in Kenya.** (6mks)
- i) Cost: - for effective use of internet, a powerful & costly computer is needed. The cost of installing internet services, telephone bills is also high hence discouraging internet growth.
  - ii) Illiteracy: - Many people are computer illiterate and therefore have no idea of computer internet services.
  - iii) Inadequate infrastructure: - Lack of infrastructures such as telephone services in rural areas also hinders growth of internet access. Lack of electricity discourages people from installing internets in their offices.
  - iv) lack of awareness of the existence of such services by the public.

## CHAPTER FIVE

### DATA SECURITY AND CONTROL

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Define the terms data security and privacy;
- b) Identify security threats on ICT and possible control measures;
- c) Identify types of computer crimes.

#### Content

a.) Definition of data security and privacy

b.) Security threats and control measures

• Threats e.g.

i) virus

ii) unauthored access

iii) computer errors and accidents

iv) theft

• Control measures e.g.

i) anti-virus software

ii) password

iii) user access levels

iv) backups

c.) Computer crimes e.g.

- i) trespass
- ii) hacking
- iii) tapping
- iv) cracking
- v) piracy
- vi) fraud
- vii) sabotage
- viii) alteration

• Detection and Protection e.g.

- i) audit trail
- ii) data encryption
- iii) log files
- iv) firewalls

d.) Laws governing protection of information systems

## Introduction

### Data and Information Security involves

- Protection of data and information against unauthorized access.
- Denial of data and information to unauthorized access.
- Provision of data and information to authorized users.

### Data Security Core Principles

1. Confidentiality
2. Integrity
3. Availability

CIA

## Security Threats and Control Measures

### 1. Virus

Destructive program that installs itself in the computer

#### Types of Viruses

1. Boot sector: It destroys the booting information on storage devices.
2. File: It attaches themselves to files.
3. Hoax: They are spread through e-mails.
4. Trojan: It performs undesirable activities in the background.
5. Worms: They stick in the computer memory.
6. Backdoors: Trojan/ worm that allow hidden access to computer files.

#### Sources of Viruses

- Contacts with contaminated system
- Pirated software
- Infected proprietary software
- Freeware and shareware
- Updates of software distributed

#### Symptoms of viruses

- Quizzical messages appearing on the screen
- Unfamiliar graphics
- Keys on keyboard changing
- Program taking longer to load
- File access taking longer to load
- Less memory available is unusual
- File programs disappearing mysteriously.
- Disk access seem extensive for simple tasks

#### Control Measures against viruses

- Install the latest version of antivirus
- Avoid foreign disks
- Scanning mails before opening

### 2. Unauthorized Access

### Types

1. Eavesdropping: Tapping into communication channels to get information.
2. Surveillance: Gathering information and use it for illegal purpose
3. Espionage: Spying to get information to use it to counter or finish another computer.

### Control Measures against Unauthorized Access

- Data encryption during transmission
- Reinforce check access points
- Enforce network security measures
- Keep the computer room closed when nobody is using it
- Fingerprint identification strategies

### 3. Computer Error and Accidental Access

Occur as a result of people experimenting with features which they're not familiar with or make a mistake by printing sensitive reports and unsuspecting give them to unauthorized person.

### Control Measures

- Give various file access privileges
- Set up comprehensive error recovery strategy in the organization

### 4. Theft

#### Control measures

- Employ guards
- Burglar proofing
- Reinforce weak access points
- Install backup storages preferably out of the computer room

### 5. Computer Crimes

1. Trespass: Gaining access to information without permission.
2. Cracking: Guess work till one discovers weakness in security.
3. Hacking: Intentional breaking of codes and passwords to gain access.
4. Tapping: Sending an intelligent program to the host computer to get information.
5. Piracy: Making illegal copies of copyrighted software.
6. Fraud: Use of computers to cheat people with the intention of gaining money or information.
7. Sabotage: Illegal destruction of data and information with the aim of crippling service delivery or causing great loss to an organization.
8. Alteration: Illegal changing of data and information without permission with the aim of gaining or misinforming the authorized users.

## Control measures against piracy

- Make software cheap enough to increase affordability.
- User license and certificates to identify originals.
- Set installation passwords to deter illegal installation.

## Detection and Protection against Computer Crimes

- a) **Audit trial:** Careful study of an information system in order to establish or find out all weakness in the system that could lead to security threats and weak access points.
- b) **Data encryption:** Transforming data in a way that only the sender and receiver can understand.
- c) **Log files:** Special system files that keep records of events on the use of the computer and resources in the information system.
- d) **Firewalls:** Software that filters data and information exchanged between different networks by enforcing the host network access control policy.

## Rules in selection of a good password

- A good password should be at least six characters long, including both letters and numbers.
- It should not be easy for somebody to know.
- It should be easy to remember.

## Reason for Information System failure

1. Hardware failure due to improper use.
2. Unstable power supply as a result of brownout or blackout and vandalism
3. Network breakdown
4. Natural disasters like floods, etc.
5. Program failure or crash

## Difficulties in detection and prevention of computer crimes

- Crime right be complex
- It's not easy to find clear trail of evidence leading to the guilty party e.g. no fingerprints.
- There are no witnesses.
- Few people in management and law enforcement know enough about to prevent crimes.

## Causes of Data Loss

- Attack by malicious programs like viruses
- Data manipulation- alteration and deleting ( sabotage)
- Piracy: illegal copying of copyright protected data and information

## Data Protection Measures

- Encryption
- Enforcing data and information access control policies on all employees and outsiders
- Reinforce computer room security
- Assign user accounts in a networked environment
- Install firewalls: They act as security buffers or wall between private network and other networks
- Install security and antivirus software, which should be updated regularly to protect the computer against malicious programs.
- Put in place disaster recovery plan
- Avoid downloading programs, games, screen savers and themes you are not sure of
- Enable write protection on removable disks.
- Protect the computer against brownouts or blackouts which may cause physical damage or data loss by using surge protectors and UPS.

## Concerns related to collection and use of private and confidential data are:

- Spreading information without the owners consent or awareness
- Spreading inaccurate information
- Eavesdropping and taping of information from a communication line
- Secretly recording and reporting user activities by using normal recording devices, spyware and copiers

## Laws governing Piracy and Confidentiality

1. No secret databases e.g. in government or private organizations
2. Right to individual access
3. Right of consent- information for one purpose cannot be used for other purpose without owners consent.
4. Right to correct- individual corrects or amends records of his or her information.
5. Assurance of reliability and proper use- Data must be reliable.

## Laws governing protection of Information

1. Data and information should be kept secure against loss or exposure.
2. Data and information should not be longer than necessary.

3. Data and information should be accurate and up to date.
4. Data and information should not be transferred to other counties without owners' permission.
5. Data and information should be collected and kept for specified lawful process.

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

**1. Differentiate between data security and data integrity. (2mks)**

Data security – the protection of data & information from accidental or intentional disclosure to unauthorized person or from unauthorized modification.

Data integrity-the accuracy & completeness of data entered in a computer.

Define integrity – the accuracy & completeness of data entered in a computer.

**2. a) Define the term Computer crime (2mks)**

- The use of computer hardware or software for illegal activities, e.g., stealing, forgery defrauding, etc.
- A deliberate theft or criminal destruction of computerized data
- Committing of illegal acts using a computer or against a computer system.

**b) Explain the meaning of each of the following with reference to computer crimes. (7mks)**

- i) Cracking – use of guesswork over and over again trying to look for

- weak access points in software in order to get access to data & information
- ii) Hacking – Breaking of security codes and passwords to gain unauthorized access to a computer system.
  - iii) Tapping - Listening to a transmission line to gain a copy of the message being transmitted.
  - iv) Piracy – Making illegal copies of copyrighted software, data, or information (i.e. copying of software illegally).
  - v) Data alteration – Illegal changing of stored data & information without permission with the aim of gaining or misinforming the authorized users. Alteration changes the information inferences from the data.
  - vi) Fraud- use of computers to conceal information or cheat other people with the intention of gaining money or information
  - vii) Trespass-illegal physical entry to restricted places where computer hardware, software & backed up data is kept.

### 3. Outline four ways of preventing piracy with regard to data and information.

(4mks)

- Enact & enforce copyright laws and other regulatory frameworks that
- protect the owners of data & information against piracy
- make software cheap enough to increase affordability
- use licenses and certificates of authenticity to identify originals
- Set installation passwords that prevent illegal installation of software.

### 4. a) What is a Computer virus? (2mks)

This is a program intentionally written to destroy data, information or the

working of other programs in a computer system

**b) i) State two ways through which computer viruses may be controlled.**

(2 mks)

Running antivirus software programs regularly

Controlling the movement of storage media (e.g. floppy disks, flash disk, etc)  
in and out of the computer room

Disabling the floppy disk drives

**ii) Explain how each of the two ways listed in b (i) above assist in controlling computer viruses.** (2mks)

Antivirus software helps to detect and remove the viruses from the  
computer controlling the movement of floppy disks ensures that infected  
disks are not inserted into computers.

**5. Computer systems need maximum security to prevent unauthorized access.**

**State six precautions that you would expect an organization to take to prevent illegal access to its computer-based systems.** (6mks)

- Lock the doors, (i.e. keep the computers in a strong room, which should remain firmly locked when nobody is using it).
- Avoid welcoming strangers into the computer room
- Use of personal identification cards
- Use of fingerprint identification
- Install security alarms at strategic access points so as to alert the security personnel in case of a break in.

- Use of special voice recorders that would be able to analyse the voice of a trespasser & check against the database containing the voice patterns of valid users
- Enforce data & information access control policies on all employees to control access to data
- Use file passwords to prevent any person from getting access to the electronic files
- Enforce network security measures, e.g. use of firewalls
- Encrypt the data & information during transmission
- Perform frequent audit trails to identify threats to data & information.

**6. Give four rules that must be observed in order to keep within the law when working with data and information. (4mks)**

- It should be kept secure against loss or exposure
- Should not be kept longer than necessary
- Should be accurate and up-to-date
- Should be collected, used & kept for specified lawful purposes (e.g., data should not be used for unlawful gain)
- The owner of the data has a right to know what data is held by the person or organization having it.
- Data should not be transferred to other countries without the owner's permission
- Do not collect irrelevant and overly too much information for a purpose.

**7. An individual has a right to demand guarantee to privacy of personal information stored on a computer. Give three such types of information. (3 mks)**

- Name

- Date of birth
- ID. Number
- Residence
- Address
- Phone number

## CHAPTER SIX

### DATA REPRESENTATION IN A COMPUTER

Specific Objectives

By the end of the topic the learner should be able to:

- a) Explain concepts and reasons for data representation in a computer
- b) Define the terms bit, byte, nibble and word
- c) Explain types of data representation in the computer
- d) Perform binary arithmetic operations.

## Content

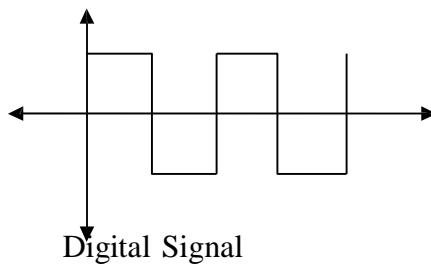
- a.) Concepts and Reasons of data representation
- b.) Definition of terms: bit, byte, nibble and word
- c.) Types of data representation.
- Number Systems and their representation of integral values
  - i) Decimal
  - ii) Binary
  - iii) Octal
  - iv) Hexadecimal
- 'A
- Symbolic representation
  - i) Binary Coded Decimal Code (BCD)
  - ii) Extended Binary Coded Decimal Interchange Code (EBCDIC)
  - iii) American Standard Code for Information Interchange Code (ASCII)
- d.) Conversion between binary and decimal
- e.) Binary arithmetic operations
  - Binary addition
  - Binary subtraction
  - (i) ones complement
  - (ii) twos complement

## Introduction

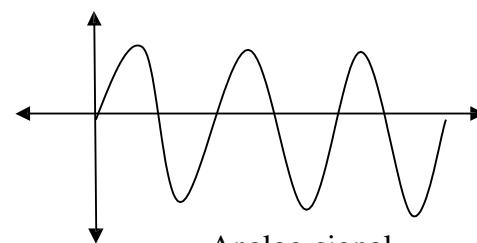
In this topic we will focus on the classification of computers according to their functionality:

1. Analog
2. Digital
3. Analog

In digital computers, the user input is first converted then transmitted as electrical pulses called periodic that can be represented by two distinct states ON and OFF. The ON state may be represented by a “1” and OFF state by a “0”. The sequence of the two states results to an electrical signal that the computer can understand.



Digital Signal



Analog signal

In order for data to be exchanged via network the data is first converted to analog signals during transmission (modulation) then the analog signals are converted to digital (demodulation).

## Three Signal parameters in a periodic

- Amplitude (A): The maximum value attained by a pulse in a wave.
- Frequency (f): Number of cycles made by the wave in one second.
- Periodic time (T): Time taken by signal to complete one cycle

## Concept of data representation

### Data representation in electric circuits

High voltage (ON) is represented as “1” while a low voltage (OFF) is interpreted as “0”.

### Data representation in magnetic media

The presence of magnetic field in one direction is (1) while absence of magnetic field is (0).

### Data representation in optical media

The presence of light is (1) while absence is interpreted as (0)

## Reasons for use of binary digital technology

1. It is the only language the computer can understand.
2. Devices that use binary technology use less energy, are more reliable and are small in size than analog devices

## Bits, bytes, nibble, word, word length

- Bit: Binary unit/ Basic unit of data and information in a digital computer.
- Byte: A collection of eight bits.
- Nibble: four bits or half a byte.
- Word: Combination of logical characters.
- Word length: Number of bits of in each word of a computer.

## Types of Data Representation

Number system and their representation

### Decimal number system

Consists of 10 digit ranging from 0 – 9. It is written as base10. In decimal number system the magnitude of a number is evaluated using three parameters:

- Absolute value- magnitude of a digit in a number line
- Place value/ position value-
- Base value

### Binary number system

Use two digits “0 and 1”. It is written as base2.

### Octal number system

It consists of eight digits ranging from 0 to 7. It is written as base8.

### Hexadecimal number system

It consists of sixteen digits ranging from 0 to 9 then letters A to F. A= 10,B= 11 and so on.

## Reasons for using Octal and Hexadecimal number system

- A single octal/ hexadecimal digit encodes more than one binary digit. This is automatic data compression, hence saves space on storage media.
- Instead of transacting long digits of 0's and 1's between devices, the data can be encoded sa octal or hexadecimal to improve transmission efficiency.

## Base Conversion

### Decimal to binary

Divide by 2 noting the remainder from bottom. For fractional part multiply by 2 while noting the remainder from top.

#### Example

Convert the decimal number  $7.5625_{10}$  into its binary equivalent

#### Solution

Convert the two parts separately

Integral part

2 | 7  
 2 | 3 R 1  
 2 | 1 R 1  
 0 R 1

7 is equivalent to 111<sub>2</sub>

Fractional part

Read this digits



$$0.5625 \times 2 = 1.125$$

$$0.125 \times 2 = 0.250$$

$$0.250 \times 2 = 0.500$$

$$0.500 \times 2 = 1.000$$

Since the product of the last step of the fractional part is zero. We stop here.

$$0.5625 \times 2 = 0.10012$$

$$7.5625 = 111.10012$$

## Binary to decimal:

The integral part

First write the place values starting from the right hand side. Write each digit under its place value.

Multiply each digit under its corresponding place value i.e.  $2^0$  (from 0, 1). Add up the products. The answer will be the decimal number in base 10. The fractional part

Multiply each digit under its corresponding place value i.e.  $2^{-1}$  (from -1).

## Decimal to octal

Divide by 8 noting the remainder from bottom. For fractional part multiply by 8 while noting the remainder from top. The answer is to base 8.

## Octal to decimal

The method is similar to converting binary to decimal but using 8 instead of 2.

## Binary to octal

Divide the binary numbers in pairs of three from the right side. Then multiply each digit by its place value i.e.  $2^0$ . The answer is to base 8.

## Octal to Binary

Divide each digit by 2.

Decimal to Hexadecimal

Just like the process done in converting decimal to binary but using 16. The answer is to base 16.

## Hexadecimal to decimal

Like binary to decimal conversion but using  $16^0$ . The answer is to Base 10.

## Binary to Hexadecimal

Divide into four parts, then multiply each digit by the place value of  $2^0$ , answer to base 16.

## Hexadecimal to Binary

Divide each digit by 2. Answer to base 2.

## Symbolic Representation using Coding Schemes

### Binary Coded Decimal (BCD)

This is a 4 bit code scheme applied in calculators and microwaves because it makes it easier to process and display individual numbers on the LCD screen. Standard BCD is an enhanced BCD in an 8 bit representation scheme and can represent non-numeric characters.

Only 64 or  $(2^4)$  characters can be represented.

### American Standard Code for Information Interchange (ASCII)

A 7 bit code scheme that only represents 128 characters ( $2^7$ ).

**Extended Binary Coded Decimal Interchange Code (EBCDIC)**

An 8 bit digit character coding scheme used primarily in IBM systems. A total of 256 or  $(2^8)$  characters can be represented.

## Binary Arithmetic Operations

Arithmetic and Logic Unit (ALU) performs subtraction by process called (complementation). For multiplication and division the ALU uses a method called (shifting) before adding the bits. Representation of signed binary numbers Both positive and negative numbers can be represented in the computer memory during processing.

Various methods are used to represent negative numbers in the computer:

### 1. One's Complement (1c Method)

The binary bits representing the negative number are negated that in the number are changed to 0's and vice versa. Example; -17<sub>10</sub>

-17 can be represented in binary as a negative as follows

Solution

$$17_{10} \longrightarrow 10001_2 \\ \text{Therefore } -17 \longrightarrow 01110_2 \quad (\text{One's Complement})$$

### 2. Two's Complement (2c Method)

The negative number is represented into binary, then complemented as in 1c method but a (1) is added to the least significant digit of the complement value. Example; -17<sub>10</sub>

Solution

$$17_{10} \longrightarrow 10001_2 \\ \text{Therefore } -17_{10} \longrightarrow \begin{array}{r} 01110 \\ + \quad 1 \\ \hline 01111_2 \end{array}$$

### 3. Signed Magnitude

In decimal numbers, signed number has a prefix “+” for a positive number and (-) for negative number may be represented by prefixing a digit ‘1’ to the number while a positive number may be represented by prefixing a ‘0’ ie.

$$17_{10} \longrightarrow 10001_2 \text{ (unsigned)}$$

-17<sub>10</sub>  To indicate it's a negative number we add an extra bit (1) 10001<sub>2</sub>

+17<sub>10</sub>  To indicate the positive number we add an extra bit (0) 10001<sub>2</sub>

## Advantages of Two's Complement

There are no two ways of representing a zero as in 1c method and signed magnitude. Effective addition and subtraction can be done even with numbers that are represented with a sign bit.

## Binary Arithmetic

### Binary Addition

Binary addition rules

A+B	SUM	CARR
-----	-----	------

0+0	0	Y
-----	---	---

0+1	1	0
-----	---	---

$$\begin{array}{r}
 1+0 \\
 1+1 \\
 1+1+1
 \end{array}
 \begin{array}{c}
 1 \\
 0 \\
 1
 \end{array}
 \begin{array}{c}
 0 \\
 1 \\
 1
 \end{array}$$

## Binary Subtractions

Rules

A-B	DIFFERENCE	BORROW
0-0	0	0

$$\begin{array}{r}
 0-1 \\
 1-1 \\
 1-1
 \end{array}
 \begin{array}{c}
 1 \\
 1 \\
 0
 \end{array}
 \begin{array}{c}
 1 \\
 0 \\
 0
 \end{array}$$

## Subtracting Using One's Complement

Question: Get the difference in 7-4 using Ones complement.

Solution

Rewrite the problem as  $7 + (-4)$

Convert the absolute value of 4 to 8 bit equivalent ie.

$$\begin{array}{r}
 2|4.0 \\
 2|4|0 \\
 \hline
 1|1
 \end{array}
 \quad 00000001_2$$

Take the one's complement of  $00000001_2$  ie  $11111110_2$  which is the binary representation of -

$410$

Add the binary equivalent of 7 to 1c of 4 ie.

$$\begin{array}{r}
 R \\
 \begin{array}{r}
 2|7|1 \\
 2|3|1 \\
 \hline
 1|00000111
 \end{array} \\
 +11111110 \\
 \hline
 (1)00000101_2
 \end{array}$$

Looking at the difference of two binary numbers, you will observe that

1. Has an overflow bit
2. The results shows that the difference between the two numbers is  $00000101_2$ .

This isn't true! We know it should be  $00000110_2$ .

$00000101$

$$\begin{array}{r}
 1 \\
 \hline
 00000110_2
 \end{array}$$

## Subtracting using Two's Complement

Question: Using  $2^7$ c Method work out  $710 - 410$  in binary form.

Solution

Convert  $410$  to binary equivalent ie.  $00000001_2$

One's complement of  $00000001_2$  is  $11111110_2$

Two's complement of  $11111110_2 + 1 = 11111111_2$

Add the 2'c to the binary equivalent of 710

$$\begin{array}{r}
 11111111 \\
 +00000111 \\
 \hline
 (1)000001102
 \end{array}$$

→ 00000110<sub>2</sub>

**End of topic**

Did you understand everything?

If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

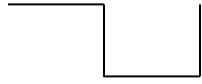
## Solved KCSE Questions on the topic

1. **With the aid of a diagram, explain the difference between a digital signal and an analogue signal.** (2mks)

An analogue signal is continuous in nature, while a digital signal is in discrete form.



Analogue signal- sine wave



Digital signal – rectangular shaped

2. **Explain the role of a modem in communication.** (2mks)

A modem converts (modulates) data from digital to analogue form to be transmitted

over the telephone line. At the receiving end, the modem attached to the receiving computer converts (demodulates) the analogue signal back to the original digital form.

**3. Explain each of the following computer terminologies as used in data representation.**

(4mks)

- i) bit - The smallest binary unit, ‘0’ or ‘1’
- ii) Byte - A group/collection of 8 bits used to represent a character.
- iii) Nibble - a group of four binary digits usually representing a numeric value.
- iv) word - The total number of bits that a single register of a particular machine can hold

**4. State two reasons for using binary in digital technology. (2mks)**

- It is easier to develop devices that understand binary language
- Devices designed using binary logic are simple, more reliable & consume less energy.

**5. Distinguish between Binary and Octal number systems, and give an example of each.**

(2mks)

Binary (base 2) system has just two states usually called “ON” and “OFF” or “0” and “1”, Octal (base 8) system has eight different characters, I.e, 01234567.

**6. Perform the following computer arithmetic. In each case, show how you arrive at your answer.**



a) Convert the following Decimal numbers to their Binary equivalent.

i)  $45_{10}$  (2mks)

2	45	Rem
2	22	1
2	11	0
2	5	1
2	2	1
2	1	0
	1	1



$$45_{10} = 101101_2$$


---

ii)  $4.75$  (1mk)

2	4	Rem
2	2	0
2	1	0
	1	1

$$=0.11_2$$

$$0.75 \times 2 = 1.50 \rightarrow 1$$

$$0.50 \times 2 = 1.00 \rightarrow 1$$

$$= 100_2 \qquad \qquad = 100.11_2$$

**b) Convert  $77_8$  to Binary. (2mks)**

Step 1: Convert the octal number given to decimal

$$(7 \times 8^1) + (7 \times 8^0)$$

$$56 + 7 = 63_{10}$$

Step 2: Convert the resulting decimal number to binary

2	63	Rem
2	31	1
2	31	1
2	15	1
2	7	1
2	3	1
	1	1

$$= 111111_2$$

**c) Use binary addition to solve the following:  $4_{10} + 3_{10}$  (2mks)**

Step 1: Convert the decimal numbers to binary.

2	4	Rem
2	2	0

2	1	0
	1	1

$$4_{10} = 100_2$$

Step 2: Add binary notations

$$100_2$$

$$11_2 +$$

$$\begin{array}{r} 111_2 \\ \underline{111_2} \\ \hline \end{array}$$

	3	Rem
2	1	1
	1	1

$$3_{10} = 11_2$$

- d) Convert **10100000001111111<sub>2</sub>** to its Hexadecimal equivalent. (2mks)

$2^0$	$2^3 2^2 2^1 2^0$	$2^3 2^2 2^1 2^0$	$2^3 2+2^1 2^{0+}$	$2^3 2^2 2^1 2^0$
1	0100	0000	0111	1111

$$= [1] + [4] + [0] + [4+2+1] + [8+4+2+1]$$

$$=[1] + [4] + [0] + [7] + [15]$$

$$= 1407F_{16}$$

7. a) State one use of hexadecimal notation in a computer. (1mk)

- Helps to manage long binary digit properly
- Helps to improve the processing speed and optimize memory usage.

**b) Convert  $767_8$  to hexadecimal equivalent. (2 mks)**

Step 1: Convert  $767_8$  to decimal

$8^2$	$8^1$	$8^0$
7	6	7

$$7 \times 8^2 + 6 \times 8^1 + 7 \times 8^0$$

$$448 + 48 + 7 = 503_{10}$$

Step 2: Convert  $503_{10}$  to hexadecimal

	503	Rem
16	31	7
16	1	15
	1	1

$$767_8 = 1 F7_{16}$$



**8. Use One's compliment to solve the following the following sum: -  $5_{10}$  (2mks)**

2	5	Rem
2	2	1
2	1	0
	1	1

**9. Perform the following conversions:** (3mks)

(a).  **$34_{10}$  to Binary.**

2	34	Rem
2	17	0
2	8	1
2	4	0
2	2	0
2	1	0
	1	1



$$34_{10} = 100010_2$$

(2mks)

b)  **$7.125_{10}$  to binary** (2mks)

2	7	Rem
2	3	1
2	1	1
	1	1



$$= 111_2$$

$$0.12 \times 2 = 0.250 \rightarrow 0$$

$$0.20 \times 2 = 0.500 \rightarrow 0$$



$$\begin{aligned}
 0.500 \times 2 &= 1.000 \rightarrow 1 \\
 &= 0.001_2 \\
 &= 111.001_2 \quad (1\text{mks})
 \end{aligned}$$

c) **101101<sub>2</sub> to a base 10 number.**

$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$
1	0	1	1	0	1

$$\begin{aligned}
 &= (1 \times 2^5) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^0) \\
 &= 32 + 8 + 4 + 1 \\
 &= 45_{10}
 \end{aligned}$$

d) **10.11<sub>2</sub> to decimal** (2mks)

$$\begin{aligned}
 &= (1 \times 2^1) + (0 \times 2^0) (1 \times 2^{-1}) + (1 \times 2^{-2}) \quad \checkmark 1 \\
 &= 2 + 0 \frac{1}{2} + \frac{1}{4} \\
 &= 2. \{0.5 + 0.25\} \quad = 2.75_{10} \checkmark 1 \quad (3\text{mks})
 \end{aligned}$$

e) **20.2<sub>16</sub> to decimal** (2mks)

$16^1$	$16^1$		$16^0$
7	0		2

$$= [2 \times 16^1] + [0 \times 16^0] [2 \times (1/16)]$$

$$= 32. [0.125]$$

$$= 32.123_{10}$$

f) **7AB<sub>16</sub> to decimal** (2mks)

$16^2$	$16^1$	$16^0$
7	A	B

$$= [7 \times 16^2] + [10 \times 16^1] + [11 \times 16^0]$$

$$= 1792 + 160 + 11 = 1963_{10}$$

=====

g) **0.111011.010<sub>2</sub> to Octal** (2mks)

	$2^2 \ 2^1 \ 2^0$	$2^1 \ 2^0$		$2^1$
000	1 1 1	0 1 1	.	0 1 0

$$= \{4+2+1\} \ \{2+1\} \ \{2+1\} \ \{2\}$$

$$= 73.2_8$$

10. **Convert 57.4<sub>10</sub> to its Octal equivalent** (2mks)

8	57	Rem
8	7	1
8	7	1

2	7	7	
---	---	---	--

$$0.4 \times 8 = 3.2 \rightarrow 3$$

$$0.2 \times 8 = 1.6 \rightarrow 1 = 0.31_8$$

$$= 71_8$$

$$71.31_8$$

**11. a) Perform the following Binary arithmetic:**

i)  **$11100111 + 00101110$**  (1mk)

$$\begin{array}{r} 11100111 \\ 00101110 + \\ \hline (1) 00010101 \end{array} = 100010101_2$$

(1 mk)

ii)  **$10101_2 - 110+2$**  (1mk)

$$\begin{array}{r} 10101_2 \\ 110_2 \\ \hline 1111_2 \end{array}$$

b) **Use Two's compliment to subtract 101 from 1000:** (2mks)

Step 1: change the values to 8 binary digits.

$$00001000_2 - 00000101_2$$

Step 2: Add the binary equivalent of the first value to the Two's complement of the second value

00001000

11111011 +

\_\_\_\_\_

(1)00000011

\_\_\_\_\_

=100000011<sub>2</sub>

(2mks)

\_\_\_\_\_

**12. Convert 7AE<sub>16</sub> to a decimal number.**

(2mks)

Step 1

$16^{2+}$	$16^1$	$16^0$
7	A	E

$$= [7 \times 16^2] + [12 \times 16^1] + [1 \times 16^0]$$

$$= 3840 + 192 + 1 = 4033_{10}$$

\_\_\_\_\_

Step 2

2	4033	Rem
2	2016	1
2	1008	0
2	504	0
2	252	0
2	126	0
2	63	0
2	31	1
2	15	1
2	7	1
2	3	1



2	1	1
	1	1

$$4033_{10} = 111111000001_2$$

**14. Write the following abbreviations in full: (4mks)**

- i) BIT -Binary digit
- ii) BCD -Binary Coded Decimal
- iii) ASCII -American Standard Code for information Interchange
- iv) EBCDIC -Extended Binary Coded decimal Interchange Code

## CHAPTER SEVEN

### DATA PROCESSING

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Define the terms data, information and data processing;
- b) Describe data processing cycle;
- c) Explain types of errors in data processing;
- d) Explain the various methods of data processing;
- e) Describe data integrity;
- f) Describe a computer file;
- g) Describe types of computer files;
- h) Describe file organization methods;
- i) Describe the various data processing modes.

#### Content

- a.) Definition of the terms data, information and data processing
- b.) Data processing cycle
  - **Data collection**
    - i) stages of data collection
    - ii) methods of data collection
  - **Data input**
  - Processing
  - Output

c.) Description of errors in data processing e.g.

- Transcription errors
- Transposition

d.) Data processing methods

- Manual/conventional
- Mechanical
- Electronic

e.) Data Integrity

- Accuracy
- Timeless
- Relevance

f.) Computer files

- Elements of computer file
- Logical and physical files

g.) Types of computer processing files e.g.

- Master
- Transaction
- Report
- Sort
- Backup
- Reference

h.) File organization methods

- Sequential
- Random/direct
- Serial

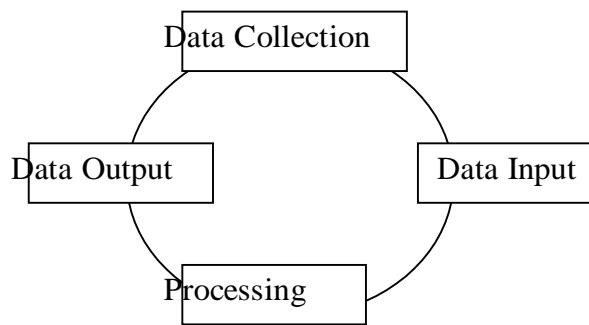
- Indexed sequential
  - i.) Electronic Data processing modes
- On-line
- Distributed
- Time-sharing
- Batch processing
- Multi-processing
- Multi programming/multi-tasking
- Interactive processing
- Real-time

## Introduction

### Definition

This is the process of transforming data into a meaningful output i.e. information.

### Data Processing Cycle



### Data collection/ Information gathering/ Fact Finding

Methods involved in data collection are; interviews, questionnaires, observation or direct data capture. Stages involved

- i. Data creation: the process of putting together facts in an organized format.
- ii. Data transmission: converting the collected data to something meaningful.
- iii. Data preparation: conversion of data from source document to machine readable form.
- iv. Media conversion:
- v. Input validation: check and remove errors
- vi. Sorting: arranging data in an organized format.

### Data Input

This is the process where the collected data is converted from human readable form to machine readable form.

### Data Processing

This is the actual transformation of input data by the control processing unit (CPU) to a more meaningful output or information.

### Data Output

This is the final activity of data processing cycle which produces the information. Ways of data dissemination

- Electronic presentation over media or television
- Distribution of hard copies

- Broadcasting the message over the internet
- Mobile phones

## Description of Errors in Data Processing

### Types of Data Processing Errors

#### Transcription errors

Errors that are made during data entry. Types of transcription errors are;

- a) **Misreading errors**-Occur as a result of incorrect reading of source document by the user like typing S instead of 5.
- b) **Transposition errors**- Occurs as a result of incorrect arrangement of characters or incorrect order of characters. Example, instead of typing 567, typing 576.

#### Computational errors

Result from an arithmetic operation that doesn't produce the required output. Types;

- a) **Overflow errors**- Occur from a calculation that is too large to be stored in allocated memory space.
- b) **Truncation errors**- result from real number that has a long fractional part which cannot fit in the allocated memory. Example  $0.75535322 \longrightarrow 0.755$  (truncated to four digits)
- c) **Rounding errors**- from raising or lowering a digit in a real number to the required rounded number. Example  $\overline{7.56} \quad 7.6$

#### Algorithm or Logical errors

Result from logarithmic design.

## Data Integrity

The accuracy and completeness of data intended in a computer or received from the information system. Data integrity is determined by;

1. Accuracy: whether the data is true or false.
2. Timeliness: This relays the availability of data in time or whether it is already outdated.
3. Relevance: Consider whether the expected output meets the processing cycle requirements, the daily operations and the decision making.
4. Audibility (Verifiability): Ability of the user to check the accuracy and completeness of information.

## Minimizing threats to data integrity

- Using error detection and correction software when transmitting data.
- Using devices that capture data directly from source e.g. cameras
- Controlling the access to data by enforcing security measures.
- Back-up data preferably on external storage media.
- Design user interface that minimize chances of invalid data entry.

## Data Processing Methods

1. Manual data processing
2. Mechanical data processing

### 3. Electronic data processing

## Factors determining the Methods of Data Processing

- Size and type of business
- Timing aspects
- Link between applications

## Computer Files

Definition: A collection of related records that give a complete set of information about a certain data item.

### Advantages of a computer files

- Information takes less time than manual system
- Enhances integrity and reduces item duplication
- Offers faster data access and retrieval
- It's much easier to update and modify easier

### Elements of a Computer File

- Character- any single entry
- Field- a single character or a collection of character that represent a single piece of data
- Records- A collection of related fields that represent a single entity
- File

## Ways of viewing a file

1. **Logical:** the file is viewed in terms of its content and the processing to be carried upon.
2. **Physical:** the file is viewed in terms of its appearance and how processing is made possible.

## Types of Computer Files

1. **Master:** Main permanent or semi permanent file containing record of particular item.
2. **Transaction:** Input output file holding incoming and outgoing data and also updates master file.
3. **Reference:** Permanent or semi-permanent used for look up purposes and it contains static records.
4. **Sort:** File created from existing transaction/ master file.
5. **Back up:** Duplicate existing files to supplement the operational files incase of any loss reason.
6. **Report:** They contain extracted records from master file.

## File Processing Methods

- Updating:** Changing data in master file to reflect the current status.
- Reference:** Happens when it is made to particular records to ascertain what is contained there in but doesn't alter the content.
- Sorting:** Entails arranging of file contents into a predetermined sequence of the key field which occupy the same position.
- Merging:** Process of combining the contents of master file from a file.

- Matching:** Input files records are matched or compared to ensure that records exist in both files.
- Summarizing:** Records of interest from the file are accumulated to form a record in an output file.
- Searching:** Entails looking for the record of interest from the file.

## File Updating

- Hit rate:** Used to describe the rate of processing of a master file in terms of its active records
- Volatility:** Frequency with which records are added to the file or deleted from. If the frequency is high then the file is said to be “volatile” otherwise “static”.
- Size:** Refers to the amount of data stored in the file. Its expressed in terms of the total number of records in the file.

## File Organization Methods

### Sequential file organization

Records are stored and accessed in a particular order sorted using a key field. The key field is used to search for particular record. Searching commences from the beginning of file and proceed to the tail of the file till the record is reached e.g. in magnetic tapes.

#### Advantages

- Simple to understand the approach
- Easy to organize, maintain and understand
- In expensive input output media and devices are used

#### Disadvantages

- Entire file must be accessed even when the activity rate is very low.
- Random enquiries are impossible to handle.
- Data redundancy is typically high.

## Random or direct file organization

Records are stored randomly but accessed directly. A record key is issued to determine where the record is stored on storage media e.g. in magnetic and optical disks.

#### Advantages

- Records are quickly accessed
- File update is easily achieved

#### Disadvantages

- Data may be accidentally erased or overwritten unless precaution taken
- Expensive hardware and software resources are required
- Relative complexity of programming
- System design around is complex and costly

## Serial file organization

Records are laid out contiguously one after the other in no particular sequence. The records are stored one after another in the same order they come into the file and there exists no relationship between contiguous records e.g. magnetic tapes.

## Indexed sequential file organization

It is similar to sequential method only that an index is used to enable the computer to locate individual records on the storage media e.g. magnetic disks.

### Advantages

- Resources can be accessed sequentially or randomly
- Records are not duplicated
- Accessing of records can be fast if done randomly

### Disadvantages

- Storage media is rather expensive
- Accessing records sequentially is time consuming
- Processing records sequentially introduce redundancy

## Elements of Data Processing Modes

1. **Online:** Data is processed immediately received. The computer is connected to data input unit via communication link and stores the results.

### Application

- Banking
- Stock exchange
- Stock control
- Water/electricity  
billing

### Advantages

- Files are maintained up to date.
- Information is readily available for current decisions.
- Files enquiries are possible through terminals (workstations).

### Disadvantages

- Systems are complex to develop.
- Costly in terms of hardware, software, storage media e.t.c.

2. **Real-time:** Process incoming data as soon it occurs, updating transaction file and giving immediate results.

### Application

- Air reservation

- Hotel reservation
- Chemical plant processing

#### Advantages

- Information is readily available for instant decision making.
- Provides immediate control.
- Fast and reliable information.

#### Disadvantages

- Requires complex and expensive operating system.
- Aren't easy to develop.
- Require Front End Processors (FEPs) to relieve the central processor.

3. **Distributed:** Divides processing task to two or more computers on separate sites connected by data transmission media.

#### Application

Banks where customers can be served from different branches but information is updated at head branch.

#### Advantages

- Less risk to system breakdown.
- In case of data loss, only a small portion of data is lost.
- Reduces the load on the host computer hence faster processing.

#### Disadvantages

- Requires more expensive CPUs.
- Operating system is complex and more difficult to operate.

4. **Timesharing:** Terminals are connected to the central computer are given access to the CPU apparently the same time.

#### Application

- Bureau
- Companies
- Learning institutions

#### Advantages

- Better services to users, for information/ output are fast.
- File enquiries possible since files are held online.
- User interaction possible through terminals.

#### Disadvantages

- User has no control over the central computer.
- Not reliable with regard to data security.

Response time is slow when there are many tasks.

5. **Batch:** Data is accumulated as a group (batch) over a specified period of time then processed

#### Application

- Payroll processing

### Advantages

- Simple to develop
- Timing reports is not a necessity

- Unit cost of processing is low

#### Disadvantages

- Time lag between origination of transaction and the information available
- Late information is not suitable in situations when instant decisions are required.
- Difficult to provide the desire priority schedule

6. **Multiprocessing:** Different processors are connected to the main processor like in banks to update transactions made.

7. **Multitasking/ multiprogramming:** Capable of handling more than one task but the processes one at a time.

#### Advantages

- Increase productivity of computer reducing CPU idle time
- Reduces incidence of peripheral bound operations

#### Disadvantages

- Requires more expensive CPUs
- More sophisticated software is required to maintain data integrity.

8. **Interactive:** Continuous communication between the user and the computer.

#### Advantages of Electronic Processing

1. Quick processing especially where all required data is available
2. Availability of data and information digitally
3. Distance between entities that are processing data is made non-significant
4. Support for information sharing and collaboration

#### Disadvantages of Electronic information Processing

1. Security of data can be compromised during storage or while in transit on networks if appropriate measures are not taken
2. Lack of legal framework in many countries that should support electronic processing activities
3. Lack of ICT skills among many knowledge workers to support electronic data processing

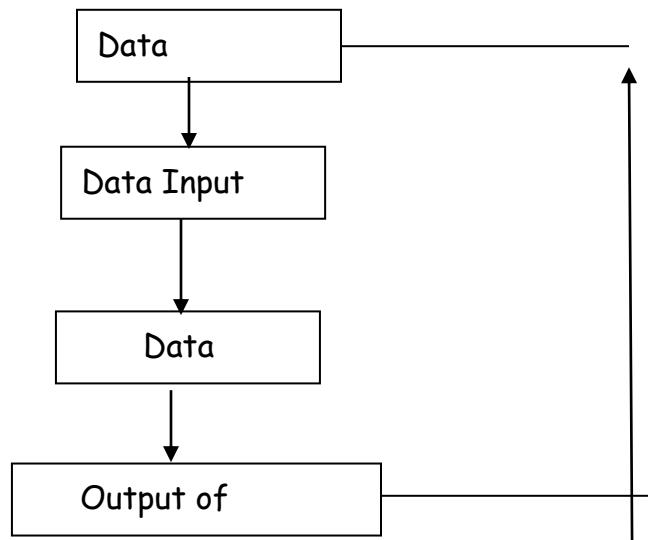
End of topic

Did you understand everything?

If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

Solved KCSE Questions on the topic

1. With an aid of a diagram, explain the stages of the data processing cycle.  
(6mks)



- Data collection involves getting the data/facts needed for processing from the point of its origin to the computer
- Data Input- the collected data is converted into machine-readable form by an input device, and send into the machine.
- Processing is the transformation of the input data to a more meaningful form (information) in the CPU
- Output is the production of the required information, which may be input in future.

**2. Clearly differentiate between data collection and data capture. (2mks)**

- Data capture is the process of obtaining data in a computer-sensible form for at the point of origin (the source document itself is prepared in a machine-sensible form for input)
- Data collection involves getting the original data to the ‘processing centre’, transcribing it, converting it from one medium to another, and finally getting it into the computer.

**3. Outline the 5 stages of data collection. (3mks)**

- Data creation
- Data transmission
- Data preparation
- Media conversion (i.e, conversion of data from one medium to another)
- Input validation
- Sorting

**4. a) Explain the relevance of the term garbage in garbage out (GIGO) in reference to errors in data processing. (1mk)**

The accuracy of the data entered in the computer directly determines the accuracy of the information given out.

**b) Give and explain two transcription and two computational errors committed during data processing. (8mks)**

- Misreading errors: -they occur when the user reads source document incorrectly, thus entering wrong values, e.g. a user may confuse 5 in the number 586 with S, and type S86 instead.
- Transposition errors: - they result from incorrect arrangement of characters (i.e., putting characters in the wrong order especially when keying data onto a diskette), e.g. the user may enter 396 instead of 369 computational errors

- Overflow errors: -An overflow occurs if the result from a calculation is too large to fit in the allocated memory space, e.g., if the allocated memory space is able to store an 8-bit character, then an overflow will occur if the result of the calculation gives a 9-bit number.

**5. a) Define the term data integrity. (2mks)**

Data integrity refers to the dependability, timeliness, availability, relevance, accuracy & completeness of data/information

**b) State three ways of minimizing threats to data integrity. (3mks)**

- Backing up the data on external storage media
- Enforcing security measures to control access to data
- Using error detection & correction software when transmitting data
- Designing user interfaces that minimize chances of invalid data being entered.

**6. a) briefly explain real-time processing. (2mks)**

- Airline reservation systems
- Theatre (cinema) booking
- Hotel reservations
- Banking systems
- Police enquiry systems
- Chemical processing plants
- Hospitals to monitor the progress of a patient
- Missile control systems

c) Give three advantages and two disadvantages of a real-time system. (5mks)

### Advantages

- Provides up-to-date information
- The information is readily available for instant decision-making
- Provides better services to users/customers.
- Fast & reliable
- Reduces circulation of hardcopies.

### Disadvantages

- Require complex Os & are very expensive
- Not easy to develop
- Real time systems usually use 2 or more processors to share the workloads, which is expensive.
- Require large communication equipment.

7. Differentiate between CPU bound jobs and I/O bound jobs. (2mks)

*CPU bound jobs* require more of the CPU time to process these jobs. Most of the work the I/O devices perform is on the Input; and Output; hence, they require very little CPU time.

8. Most companies are now shifting from the use of geographically distributed personal computers. This method of data processing is known as **Distributed Data Processing (DDP)**

#### *Required:*

i) Name any threes computing resources that can be distributed. (3mks)

-CPU (Processors) time

-Files

-Application software

- Data/information/messages
- Computer processing power
- Memory (computer storage)
- Input/Output devices, e.g. printers
- communication devices/communication ports

**ii) Name four examples of industries and business organizations that extensively use distributed processing systems. (4mks)**

- Banks
- Computerized retail stores, e.g. supermarkets
- Learning institutions with many departmental offices
- Bureaus or communication cyber cafes
- Airline reservation systems

**iii) List down two benefits and three risks that might be associated with the distributed data processing system. (5mks)**

#### ***Benefits***

- The load on the host computer is greatly reduced
- The use of low cost minicomputers minimizes the cost in data processing
- Delays in data processing are reduced
- Provides better services to the customers
- There is less risk in case of system breakdown
- The design & implementation of the system is less complex due to decentralization
- The level of expertise required is less.

#### ***Risks***

- Data duplication is very common
- Programming problems occur with microcomputers & minicomputers
- Security threats, i.e. the data & information sent one the network from one place to another can be tapped, or listened to by unauthorized parties
- More training is needed for the users involved
- It is expensive due to the extra cost of communication equipment.

**9. a) Explain the concept of multi-programming (2mks)**

A Multi-programming system allows the user to run 2 or more programs, all of which are in the computer's main memory, at the same time.

**b) Give two benefits that are derived from multi-programming (2mks)**

- It increases productivity of a computer
- Reduces the CPU's idle time
- Reduces the incidence of peripheral bound operation

**10. State at least four advantages of storing data in computer files over the manual filing system (4mks)**

- Stored information takes up less space
- Easier to update and modify
- Provides faster access and retrieval of data
- Reduces duplication of data or stored records
- Cheaper

- Enhances data integrity (i.e. accuracy and completeness)

**11. Distinguish between logical and physical computer files. (2mks)**

- A logical file is viewed in terms of what data items it contains and what processing operations may be performed on the data
- A physical file is viewed in terms of how the data items found in a file are arranged on the storage media and how they can be processed.

**12. Arrange the following components of the information system data hierarchy in ascending order of complexity:****Field, Database, Byte, Record, Bit, and file (4mks)**

Bit → Byte → Field → Record → File → Database

**13. In a computer based information system, state the purpose of the following files, and give one example where such a file may be required in a school. (8mks)**

i) Report file- It contains a set of relatively permanent records extracted from the data in a master file.

They are used to prepare reports, which can be printed at a later date, e.g. report on student's class performance in the term, extract of students who have not cleared their school fees, report on absentees.

ii) Backup file- Used to backup data or to hold duplicate copies of data/information from the computer's fixed storage or main file for security purposes e.g. a copy of all the students admitted in a school fees, report on absentees

iii) Reference file - Used for reference purposes. It contains records that are fairly permanent or semi-permanent, e.g. Deductions in caution money, wage rates, tax deductions, employees address, price lists etc.

iv) Sort file – used to sort/rank data according to a given order, e.g. ranking position in a class of students.

**14. a) What is file organization?**

It is the way records are arranged (laid out) within a particular file or any secondary storage device in a computer

**b) Differentiate between the following file organization methods: (4mks)**

**i) Sequential and serial**

*In sequential file organization*, records are stored in a sorted order using a key field, while in *serial*; the records are stored in the order they come into the file, and are not sorted in any way.

**ii) Random and indexed-sequential**

In *random file organization*, records are stored in the file randomly and accessed directly, while in *indexed –sequential*, the records are stored sequentially but accessed directly using an index.

## CHAPTER EIGHT

### ELEMENTARY PROGRAMMING PRINCIPLES

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Define Programming;
- b) Describe the various levels of programming languages;
- c) State the advantages and disadvantages of each level of the programming language;
- d) Define the terms assembler, compiler, interpreter, source program and object program;
- e) Describe the stages of program development;
- f) Describe the program control structures;
- g) Define and develop algorithm, pseudo-code and flowchart.

#### Content

- a.) Definition of Programming
- b.) Levels of programming languages
  - Low level language
    - i) Machine
    - ii) Assembly
  - High Level languages
    - i) Third Generation Languages (3GLS)
    - ii) Four Generation Languages (4 GLs)
    - iii) Object Oriented Programming (OOPs)
    - iv) Internet (scripting) Programming Languages
      - c.) Advantages and disadvantages of low and high level languages
      - d.) Description of terms
  - i) assembler
  - ii) compiler
  - iii) interpreter
  - iv) source program
  - v) object program
  - e.) Program development
    - problem recognition
    - problem definition

- program design
- program coding
- program testing
- implementation
  - f. ) Program Control Structure
- Sequence
- Selection
- Iteration (looping)
  - g. ) Definition and development of Algorithm
- Pseudo-code
- Flow chart

## Introduction

**Program:** A set of instructions

**Programming:** The process of developing computer instructions used to solve a particular task.

**Programming language:** Special list of symbols that can be translated into machine readable form by a computer when in a particular sequence or order.

## Terms used in Programming

**Source program:** Program code that programmers enter in the program editor window that is not yet translated into machine readable.

**Object code:** Program code that is in machine readable form

**Translator:** Language processor that converts source program into object code.

**Assembler:** Translates assembly language into machine language that computer can understand.

**Interpreter:** Translates source program line by line allowing CPU to execute one line before translating

**Compiler:** Translates the entire source program into object code.

**Encapsulation:** Process of having data and functions that operate on the data within an object.

Interpreter	Compiler
Translates source program one statement at a time	Translate entire source code at once for execution
Translates program code each time it is run hence slower than the interpreter	Object code can be saved on a storage media and run as required hence executed faster

## Levels of Programming

### Low Level

They were easy, understandable and hardware oriented hence not portable.

1. **First Generation Language (1<sup>st</sup> GLs)/ Machine Language:** they are written using binary logic.
2. **Second Generation Language (2<sup>nd</sup> GLs)/ Assembly Language:** used MNEMONICS (symbolic operation codes, shortened two or three words)

### High Level

They are very close to human language and are machine independent, hence they are portable

1. **3<sup>rd</sup> GLs (Structured procedural):** Pascal, Formula Translator (Fortran), COBOL, BASIC, Ada.
2. **4<sup>th</sup> GLs:** They present programmers with programming tools. Examples; Visual Basic, Visual Delphi, Visual COBOL.
3. **5<sup>th</sup> GLs:** They depict human like intelligence- PROLOG, MERCURY, LISP and

OCCAM.

4. Object Oriented Programs (OOP): Simula, C++, Java and Small Talk.
5. Web scripting: Java, php (hypertext preprocessor), Visual Basic Script.

## Advantages and Disadvantages of Low and High Level

### Advantages and Disadvantages of Low Level

#### Advantages

1. Easily understood by the CPU
2. Processed faster
3. Stable and hard to crash

#### Disadvantages

1. Difficult and cumbersome to use and learn
2. Require highly trained personnel
3. Debugging is difficult
4. Machine dependent

## Advantages and Disadvantages of High Level

#### Advantages

1. They are portable
2. Friendly and easy to use and learn
3. Flexible enhancing the creativity of programmers
4. Debugging is easier

#### Disadvantages

1. Easily crash

## Program Development Stages

1. Problem recognition
2. Problem definition
3. Program design
4. Program coding
5. Program testing and debugging
6. Implementation and maintenance

## Problem recognition

Reasons for development of a computerized program:

- Problem or undesirable situation that prevents an individual from achieving their goals.
- Opportunity to improve the current system.

- A new directive, given by the management requiring a change in status quo.

## Problem analysis

Determining or defining the likely input, processing activities and the expected output.

## Program Design

Actual development of program's processing or problem solving logic called the algorithm.

## Program Coding

Process of converting a designed model into its equivalent program using programming language.

## Program Testing and Debugging

Correcting errors in the program being developed and making sure it meets the requirements.

### Types of errors:

- a) **Syntax errors:** Arise from the improper use of language rules e.g. punctuation and spelling.
- b) **Logic errors:** They are not detectable by translator but halt the program when running it.

## Method of Error Detection

1. Desk checking (dry run): correction is done on papers.
2. Debugging utilities: errors are corrected before execution.
3. Test data: trial runs by programmers.

## Reasons for testing the system before implementation

1. Ensure that all the system programs are error free

2. Guarantee that the end user can successfully interact with the system
3. Establish whether components of the system interface correctly
4. Determine the ruggedness of the system
5. Ensure that operations group has adequate group has documentation and instructions to operate the system properly

## Implementation and Maintenance

**Implementation:** Actual delivery and installation of the new program ready for use. Review and maintenance

## Program Documentation

Writing of support materials explaining how program can be used by users, installed by experts by operations and modified by programmers:

1. User oriented- enables the user to use the program easily and quickly.
2. Operator oriented: help to install and maintain the program.
3. Programmer oriented: provide necessary technical information for future modification of programmers.

## Benefits of program documentation

- Help during future modification of a program
- Help other programmers to understand the code statement
- User learns how to use the program quickly
- Help in installing and maintaining the program.

## Algorithm Development

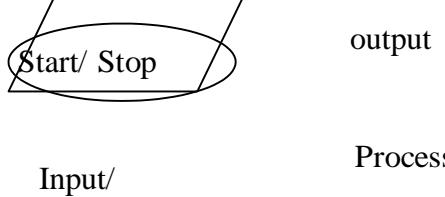
### Pseudocode

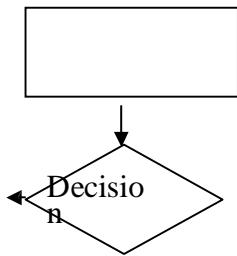
#### Guidelines for designing a good Pseudocode

1. The statement must be short, clear and reliable
2. The statements must not have more than one meaning i.e. should be unambiguous
3. The Pseudocode lines should be clearly outlined and indented clearly
4. A Pseudocode should show clearly the start and stop of executable statements and the control structures (to be discussed later in the section).
5. The input, output and processing statements should be clearly stated using keywords like PRINT, READ, INPUT etc.

### Program Flowcharts

Common symbols used in drawing program flowcharts are:

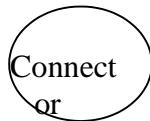




Ellipse: denotes the beginning and end of the program algorithm. Parallelogram: used to denote an input or output operation.

Rectangle: Indicates that a processing or data transformation is taking place.

Rhombus: Used to specify a condition. A condition must evaluate to a Boolean value (True or false) for the program to execute the next instructions.



Connector: Used as a connecting point or interface for arrows coming from different directions



Arrow: Used to indicate the direction of flow of the program logic.

### Advantages of Flowcharts

- Gives programmer good visual reference of program function.
- Serves as a program or system document.
- It is easy to trace through from the start to find the action resulting

### Program Control Structure

Blocks of statement that determines how statements are to be executed; sequence, selection and iteration.

#### Sequence

Computer read instructions from a program file stretching from the first top lines and proceeding document one-by-one to the end- sequential program execution.

#### Selection

Execution of statement depends on a condition that returns true or false. There are four types

##### IF...THEN

Only one IF option is available. All others are ignored during program execution.

General format: IF <condition> THEN

Statement;

**END IF**

##### IF...THEN...ELSE

Only two Ifs are the available option. The general

format: IF <condition> THEN

Statement;

**ELSE**

Statement;

**END IF**

#### Nested IF selection

There two or more If options and statements to be conditioned to make a selection.

General format; IF <condition> THEN

Statement

**ELSE**

**IF**           <condition>

**THEN** Statement

```
ELSE
    Statement
END IF
END IF
```

## Case Selection

An alteration to Nested If especially where there are several options to choose from. The flowchart not different from Nested IF.

### CASE X OF

Label 1: statement 1

Label 2: statement 2

Label 3: statement 3

.

.

.

Label n: statement n- 1

ELSE Statement

n

END CASE

### Iteration/ Looping

Repetition designed to execute the same block of code again and again till a certain condition if fulfilled.

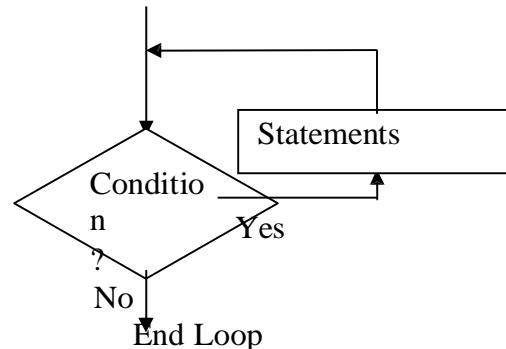
#### The WHILE...DO loop

General format

Pseudocode

```
While    <condition>
Do
    Statement
End while
```

Flowchart



#### The REPEAT...UNTIL loop

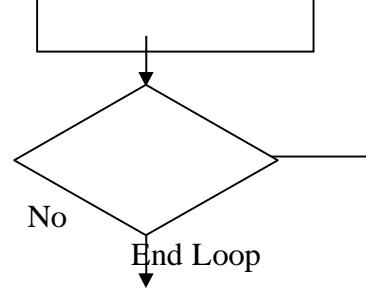
General format

Pseudocode

```
Repeat
    Statement
Until <condition>
```

Flowchart





## The FOR loop

General Format

- Format for the FOR loop that counts from the lower limit

FOR loop variable= Lower limit To Upper limit

    DO Statements

End FOR

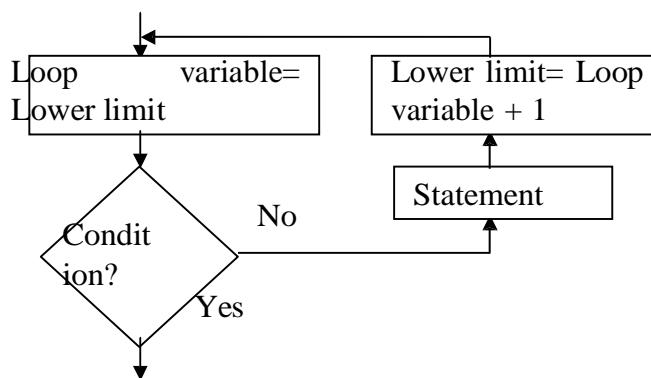
- Format for the FOR loop that counts from the upper limit down to the lower limit

FOR loop variable= Lower limit Down to Lower limit Do

    Statements

End For

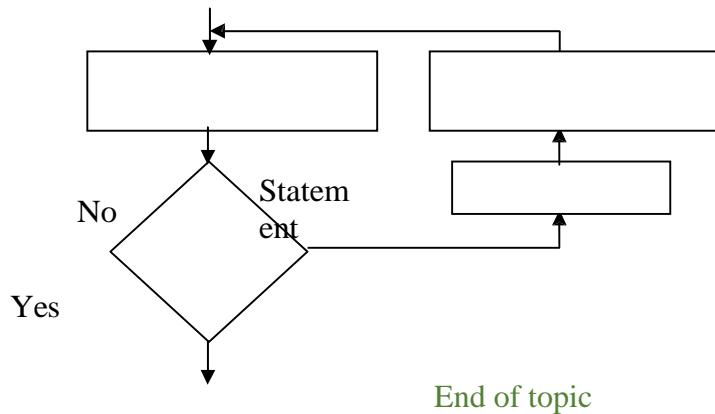
## Flowchart extract for a FOR loop that counts upwards



## Flowchart extract for a FOR loop that counts downwards

Loop variable=      Upper Limit= Loop  
 Upper Limit                  variable + 1

C                      ondition?



Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

### 1. Define the following terms: (3mks)

#### i) Computer Program

A *computer program* is a set of instructions that directs a computer on how to process a particular task.

#### ii) Programming

*Programming* is the process of designing a set of instructions which can be used to perform a particular task or solve a specific problem.

#### iii) Programming language

A *programming language* is a language (set of instructions) used in writing of computer programs. The language must be understood by the computer for it to execute.

### 2. Explain the meaning of the following as used in computer programming. (2mks)

i) **Syntax**-these are rules that govern the arrangement of commands in a particular language

ii) **Semantic** - the meaning attached to every command in a particular language.

### 3. a) What are low-level languages? Give their features. (4mks)

These are the basic programming languages, which can easily be understood by the computer directly, or which require little effort to be translated into computer understandable form.

#### Features:

- They are machine hardware-oriented
- They are not portable, i.e., a program written for one computer cannot be installed and used on another computer of a different family
- They use Mnemonic codes
- They frequently used symbolic addresses.

**b) Give three advantages of high-level languages as opposed to low-level languages (3mks)**

- Easier to learn, understand and use
- Easily portable, i.e. they can be transferred between computers of different families and run with little or no modification
- The programs are short & take shorter time to be translated
- More flexible, hence they enhance the creativity of the programmer and increase his/her productivity in the workplace
- Easier to debug (correct errors)& maintain
- Easy to modify
- They are user-friendly & problem –oriented, hence can be used to solve problems arising from the real world.

**4 a) Examine two features of fourth generation languages (4GLS) (2mks)**

- Have programming tools such as command buttons, forms, textboxes, etc
- Use of mouse pointer to drag an object on a form
- Use application generators to generate program codes
- Can enquire & access data stored in database systems

**b) List three examples of fourth generation programming languages. (3mks)**

- Visual Basic
- Delphi Pascal
- Cobol
- Access Basic

**5. Describe 5 factors to be considered while choosing a programming language. (5mks)**

- i) The availability of the relevant translator
- ii) Whether the programmer is familiar with the language
- iii) Ease of learning and use
- iv) Purpose of the program, i.e. application areas such as education, business, scientific, etc.
- v) Execution time: High –level languages are easy to read, understand & develop; hence, they require less development time. Machine code & Assembly languages are relatively difficult to read, understand and develop; hence, they are time-consuming.
- vii) Popularity: - the language selected should be suitable and /or successful in the market with respect to the problems to be solved.
- viii) Documentation: - It should have accompanying documentation (descriptions on how to use the language or maintain the programs written in the language
- ix) Availability of skilled programmers: - The language selected should have a pool of readily available programmers to ease the programming activity, and reduce development

time.

**6. Differentiate between the following as used in programming:**

a) **A source program** is a program that is not yet translated;

**Object code** is a program that is in machine readable form obtained from a source program by use of a translator

**b) Flowchart and pseudo code. (2mks)**

A flowchart is a graphical representation of step-by-step processing logic of a program, while pseudo code is a set of structured English like statements that describe the processing steps to be followed to solve a given problem.

**7 What do the following abbreviations stand for: (2mks)**

- i) FORTRAN - formula Translator
- ii) COBOL - Common business oriented language
- iii) OOP - Object Oriented Programming

**8 a) Define a Language translator (1mk)**

This is a language processor such as an assembler, interpreter, or compiler that converts the source program into object code.

**b) Give two advantages of compiling a program rather than interpreting it. (2mks)**

- Interpreters translate the source program one statement/line at a time, Compilers translate the entire source code at once before execution.
- Interpreters translate the program each time it runs, hence slower than compiling. Compiled programs can be saved on a storage media. It does not require any further translation any time the program is run, hence executes faster than interpreted programs.
- Interpreter translation takes less memory, while compiled programs require more memory as the object code files are larger.

**9. Name the stages of a program development in their logical sequence. (31/2)**

- Problem recognition
- Problem definition
- Program design
- Program coding
- Program testing and debugging
- Program implementation and maintenance
- Program documentation

**10. (a) Give two reasons why it is necessary to have a program design. (2mks)**

- It identifies the exact order in which the processing tasks will be carried out so as to solve the problem
- It provides for easy maintenance & modification

**b) State two requirements during computer program testing. (2mks)**

Compilation to check the whole program if there are any errors

Debugging the program

**11. a) State any four rules/guidelines that should be followed when drawing program flowcharts. (4mks)**

- A flowchart should have only one entry (starting point) and one exit point
- The flowchart should be clear, neat and easy to follow
- Use the correct symbol at each stage in the flowchart
- The flowchart should not be open to more than one interpretation
- Avoid overlapping the lines used' to show the flow of logic as this can create confusion in the flowchart
- Make comparison instructions simple, i.e , capable of Yes/No answers
- The logical flow should be clearly shown using arrows
- Ensure that the flowchart is logically correct & complete

**b) Give one advantage of pseudo codes over flowcharts (1mk)**

- Pseudo codes are easier to write and understand
- They are convenient especially for long algorithms which span over several pages.

**12. Explain the following types of computer program errors:****a) Syntax error (2mks)**

These are programming errors/mistakes that occur due to incorrect/improper use of the grammatical rules of a particular language

E.g., Punctuation mistakes, (i.e. omitting a comma or a semicolon), improper naming of variables, wrong spellings of user defined and reserved words.

**b) Logical Errors**

These are errors that occur as a result of bad program design

Logical errors relate to the logic of processing followed in the program to get the desired results e.g. they may occur as a result of misuse of logical operators.

**c) Run-time (execution) error. (2mks)**

Run-time (execution) errors. They occur when the programmer develops statements, which are not projecting towards the desired goal. Such statements will create deviations from the desired objectives

**13. Explain four error detecting methods in program development (4mks)**

i) Dry running (desk checking); - checking a program for errors by making the corrections on a paper before entering it in the program editor.

ii) Translator system checking: - It involves the running of a translator program (e.g., compiler or Interpreter) after entering the set of coded instructions in order to detect any syntax errors.

iii) Use of debugging utilities: - It involves supplying data values to the program for which the answer is known. If the program does not give the correct answers, it shows that it contains some errors.

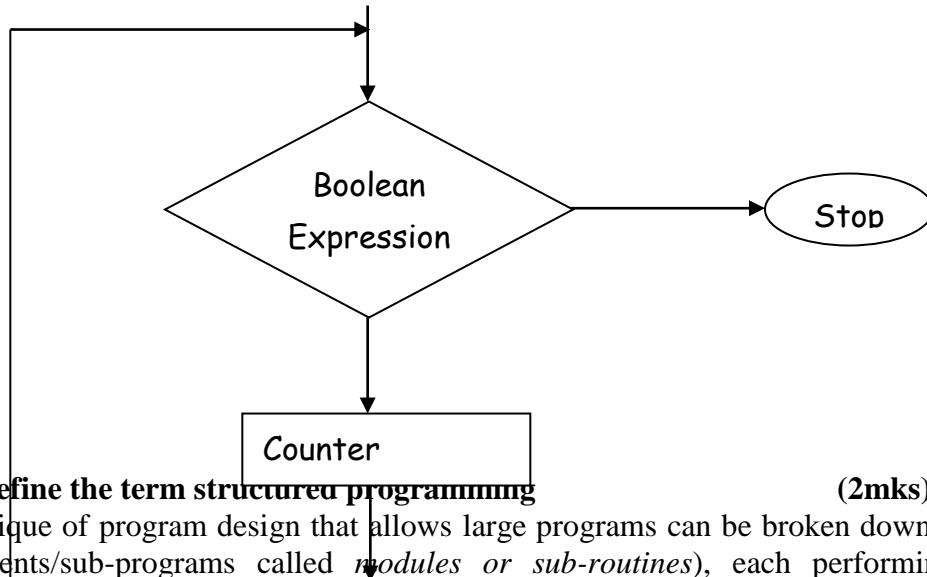
**14. Describe three types of program documentation in reference to programming (6mks)**

- i) User-oriented documentation: - It is a manual that enables the user to learn how to install and use the program
- ii) Operator –oriented documentation: - It is a manual that enables the user to learn how to install and use the program.
- iii) Programmer-oriented documentation: - This is a detailed documentation written for skilled programmers. It provides the necessary technical information to help the programmer in future modification of the program.

**15. a) State three types of control structures use in programming. (3mks)**

- Sequence
- Selection/decision
- Iteration/looping

**b) Draw a simple flowchart diagram to illustrate the FOR-DO structure. (3mks)**



**16. a) Define the term structured programming. (2mks)**

This is the technique of program design that allows large programs can be broken down into smaller components/sub-programs called *modules or sub-routines*, each performing a particular task.

**b) List any two characteristics of Structured programming. (2mks)**

- Modules or sub-routines
- Use of control structures in problems solving

**c) Give two benefits of structured programming. (2mks)**

- Breaks (splits) a large program into smaller sub-programs (modules) each able to solve a particular/specific problem
- Structured programs are easier to read
- They are easy to code and run
- Programs are easy to modify because; a programmer can change the details of a section without affecting the rest of the program
- Modules are easy to test & debug (i.e correct mistakes/errors). This is because; each module can be designed, coded & tested independently
- It is easier to document specific tasks.
- Use of modules can be named in such a way that, they are consistent & easy to find in documentation
- It is flexible.

**17. a) Define the term selection to program control structures. (1mk)**

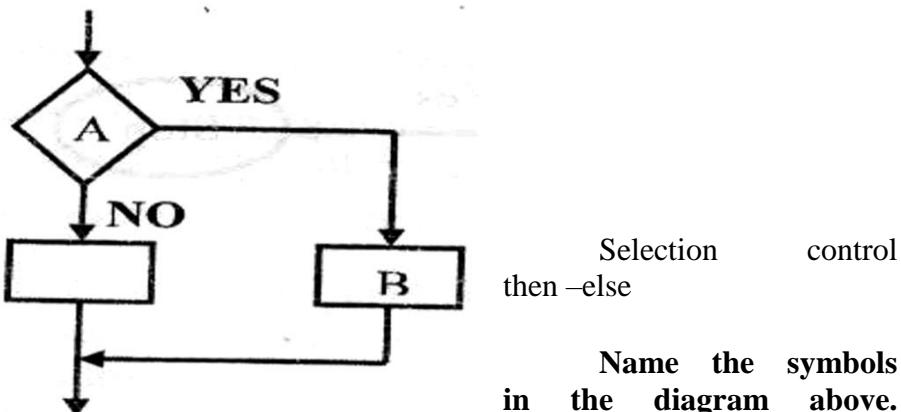
*Selection* refers to a situation where further program execution depends on making a decision from two or more alternatives.

**b) List four selection control structures used in writing a program(4mks)**

- IF...THEN
- IF...THEN...ELSE
- Nested IF
- CASE ...OFF

**18. a) Name the control structure depicted by the following diagram (2mks)**

structure, e.g. If –



**b)**  
**labeled A and b (2mks)**

A-Decision box

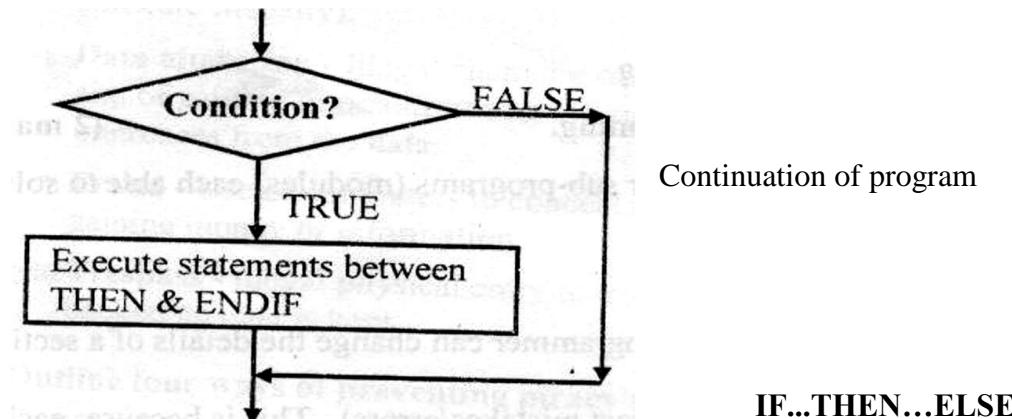
B- Process symbol

**19. Define the term ARRAY as used in computer programming. (1mk)**

An array is a data structure that stores several data items of the same type.

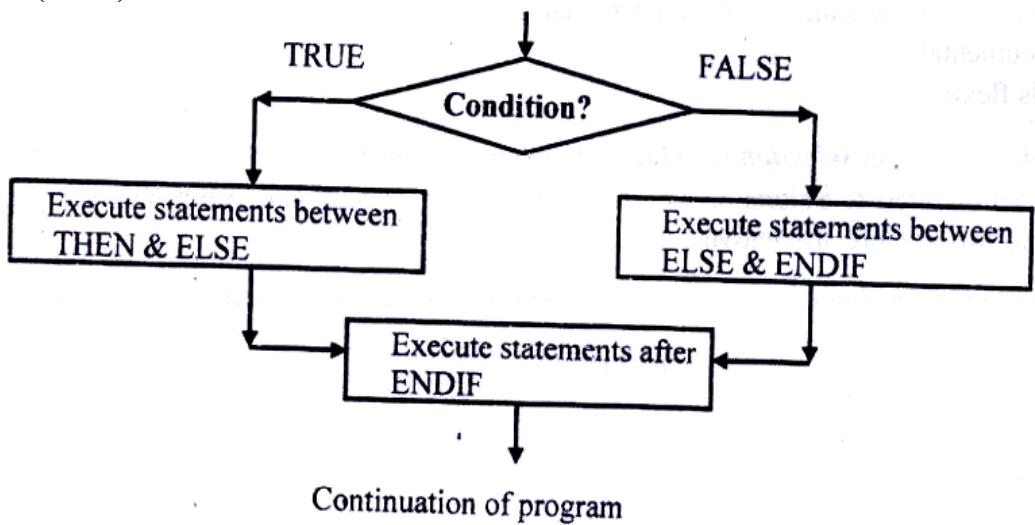
**20. Draw a simple flowchart diagram showing: (2mks)**

a) IF....THEN.... selection



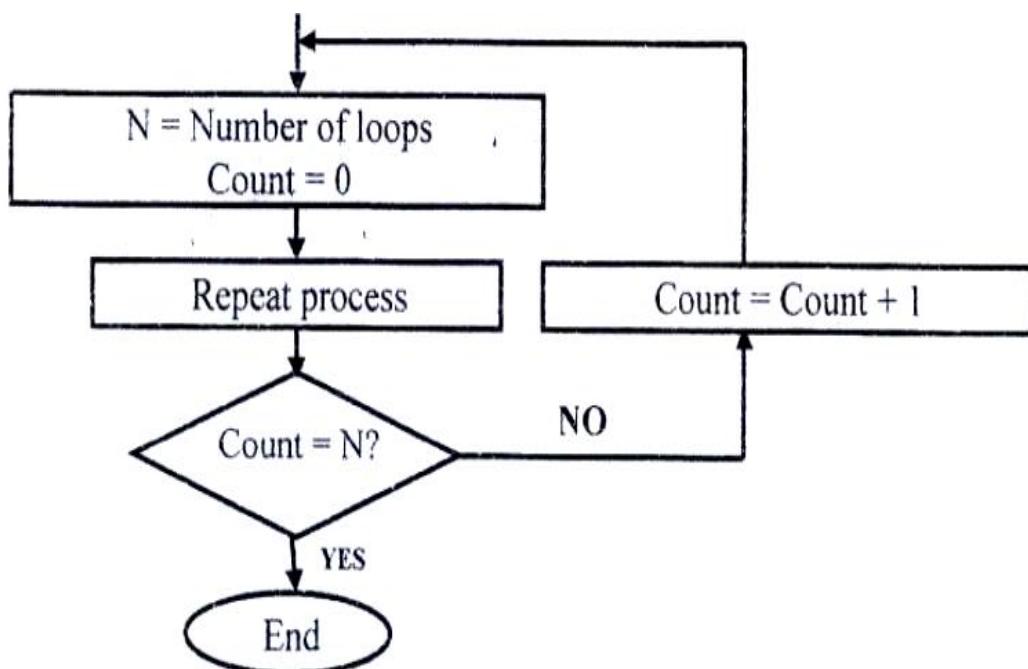
b)  
selection

(2mks)



c) REPEAT...UNTIL loop

(4mks)



21.

a) With aid of a pseudo code and a flowchart, design an algorithm that would:

- Prompt the user to enter two numbers X and Y
- Divide X by Y. However, if the value of Y is 0, the program should display an error message "Error: Division by zero".

**START**

PRINT ("Enter two numbers, X and Y") Input X, Y

**IF** Y=0 **THEN**

    PRINT 'Error: division by zero'

**ELSE**

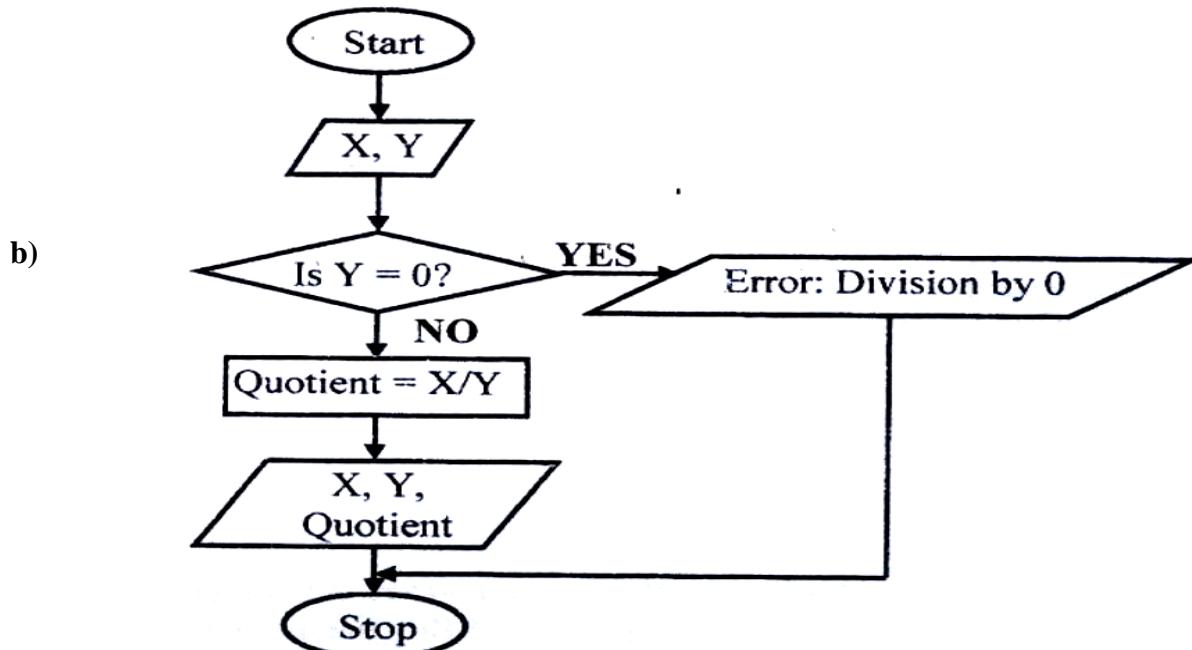
    Quotient = X/Y

    PRINT X, Y, Quotient

**ENDIF**

**STOP**

Flowchart

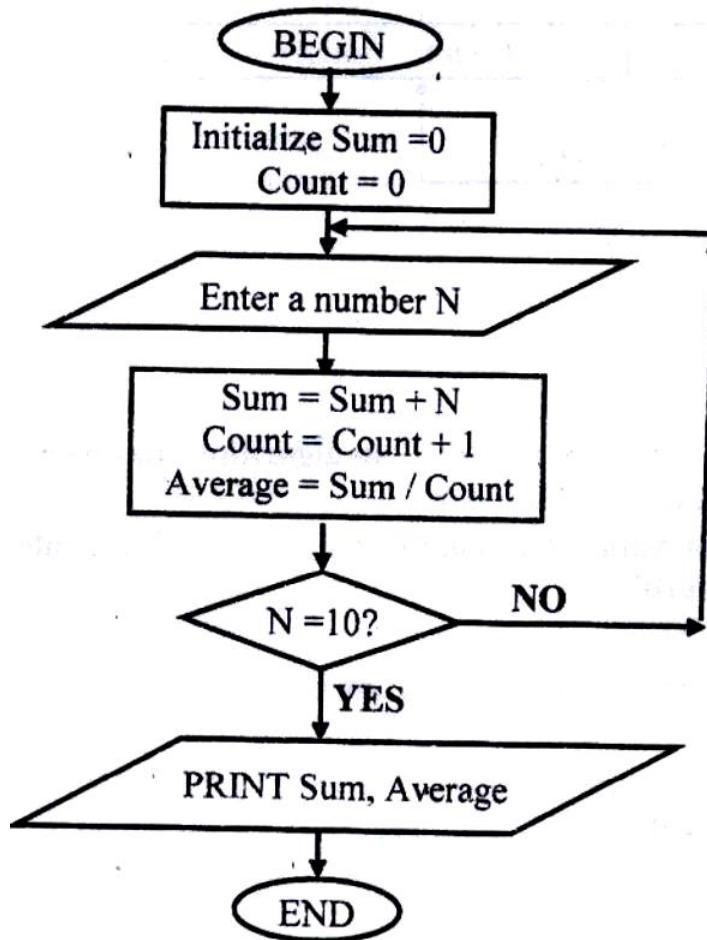


Write down the assignment statement used in the algorithm above. (2mks)

Quotient=x/Y

c) Which program control structure is depicted in the algorithm? (1mk)  
If ...then...Else

22. Draw a flowchart for a program that is to prompt for N numbers, accumulate the sum and then find the average. The output is the accumulated totals and the average.



23. Write a pseudo code  
 that reads temperature for each day in a week, in degree Celsius, converts the celcius into Fahrenheit and then calculate the average weekly temperatures. The program should output the calculated average in degrees Fahrenheit.

```

START
INPUT temperature in  $^{\circ}\text{C}$ 
SET Initial day to 0
WHILE Initial day <= 6 DO
  F =  $32 + (9c/5)$ 
  INPUT temperature in  $^{\circ}\text{C}$ 
  Initial day = Initial day + 1
  Cumulative = Cumulative +  $^{\circ}\text{F}$ 
END WHILE
Average = Cumulative/7
PRINT average
Stop
  
```

24. Michael deposits 1,000 in a bank at an interest rate of 10% per year. At the end of each year, the interest earned is added to the amount on deposit and this becomes the new deposit for the next year.

Develop a pseudo code to determine the year in which the amount accumulated first exceeds 2,000. Also for each year, print the year (starting from 1), the deposit, the Interest earned, and the total accumulated at the end of the year.

**START**

    Input initial deposit, Interest rate, and Target deposit

    Set Deposit to 1000

    Set Year to 0

**REPEAT**

    Year = Year + 1

    Interest = Deposit x 10%

    Total = Deposit + Interest

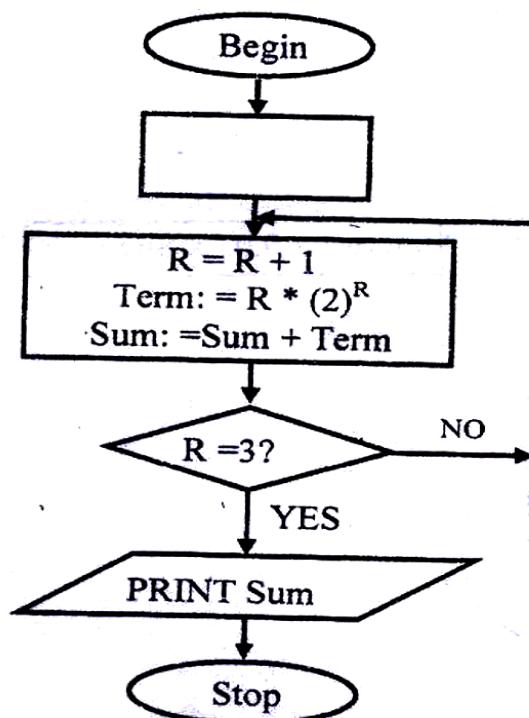
    Deposit = total

**UNTIL** Deposit > 2000

    PRINT Deposit, Year

    STOP

25. Study the flowchart diagram below and answer the questions that follow:



- a) What will be the value of the

**sum when printed? Show how you arrive at your answer.  
(5mks)**

R	Term	Sum
0	$0 \times 2^0$	$0 + 0 = 0$
1	$1 \times 2^1 = 2$	$0 + 2 = 2$
2	$2 \times 2^2 = 8$	$2 + 8 = 10$
3	$3 \times 2^3 = 24$	$10 + 24 = 34$

The value of Sum = 34

**26. Mwalimu savings society (MSS) Pays 5% interest on shares exceeding 100,000 shillings and 3% on shares that do not meet this target. However, no interest is paid on deposits in the member's MSS bank account**

**a) Design a pseudo code for a program that would:**

- i) Prompt the user for shares and deposit of particular members
- ii) Calculate the interest and total savings
- iii) Display the interest and total savings on the screen for particular members of the society. (7mks)

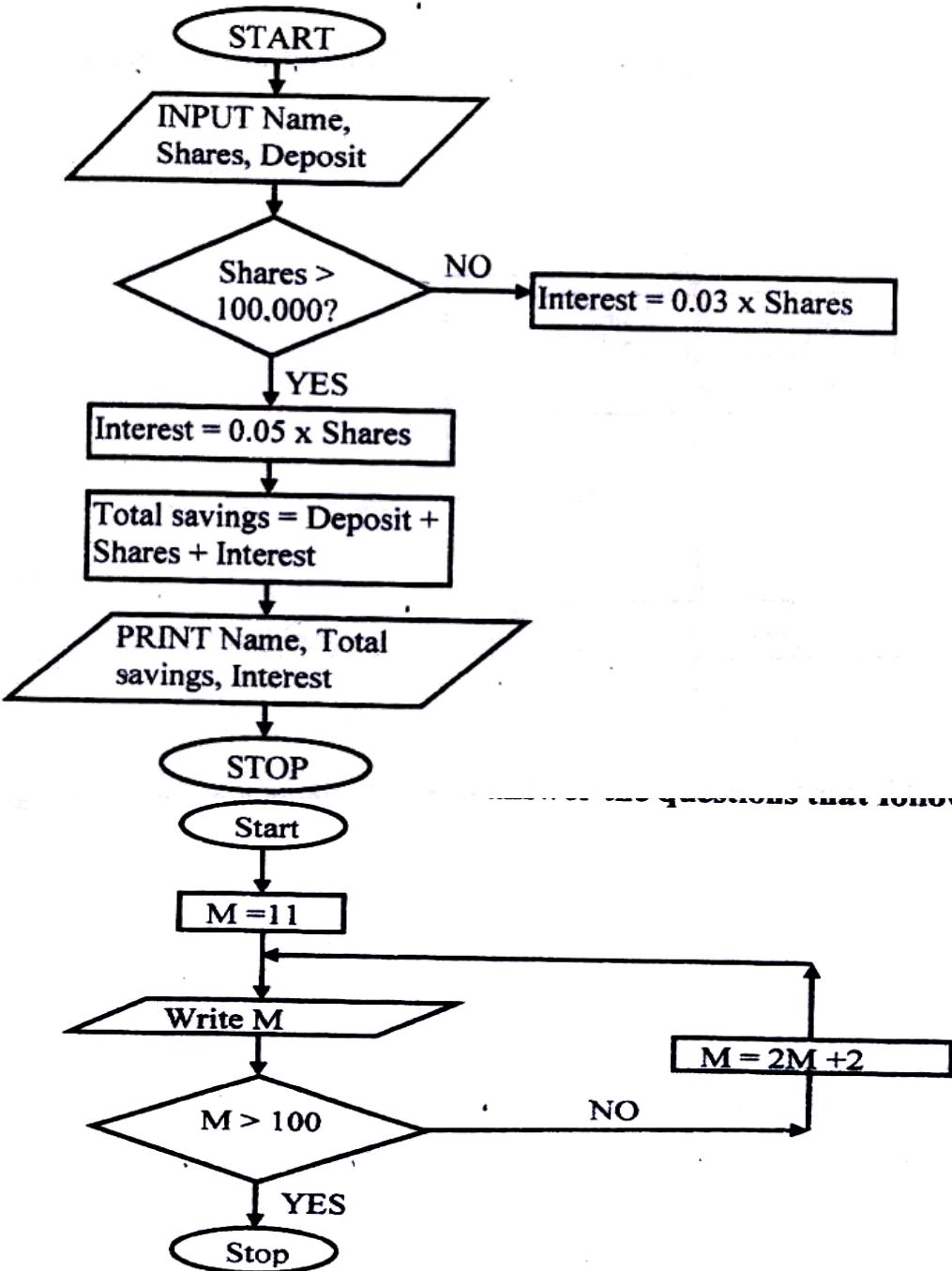
```

START
PRINT "Enter member Name, share and Deposit"
INPUT Name, Shares, Deposit
IF shares > 100,000 THEN
Interest = 0.05 x Shares
ELSE
Interest = 0.03 x Shares
ENDIF
Total savings = Deposit + shares + Interest
PRINT Name, Total savings, Interest
STOP

```

**b) Draw a flowchart for the above pseudo code. (8mks)**

27.



- a) Study the flowchart below and answer the questions that follow:

a) List all the outputs from the flowchart. (3mks)

24, 50, 102 (any correct 3)

b) What will be the output if the statement in the decision box is changed to? (3mks)

i)  $M \leq 100$

Only one value, 11 will be printed ✓ 1

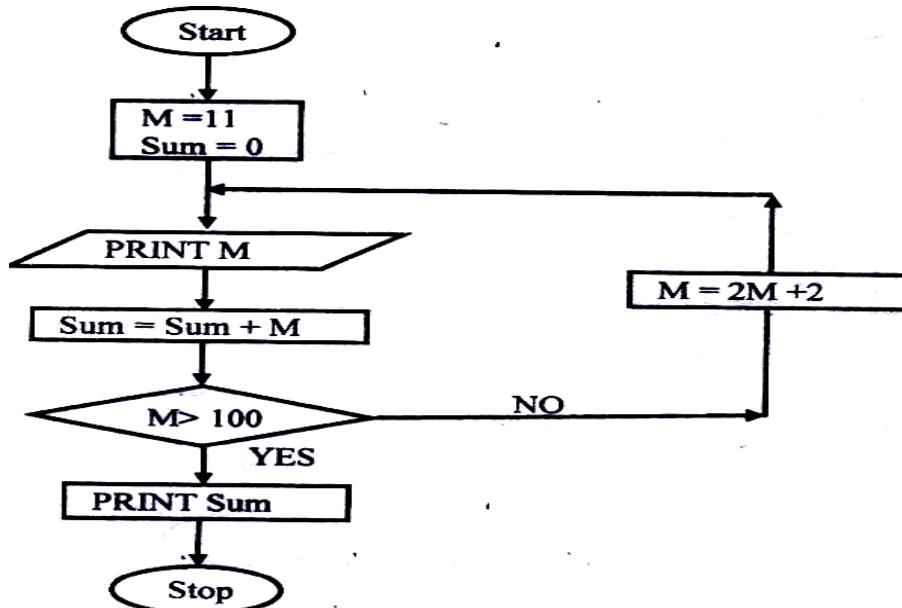
ii)  $M < 100$

Only one value, 11 will be printed ✓ 1

iii)  $M = 100$

values starting with 11 to infinity, i.e., 11, 22, 44,..... ✓ 1

c) Modify the flowchart to print the sum of all the outputs. (9mks)



28.

of

Mutson Chemist is based on the Basic and additional benefits. Employees with more than 10 year's experience get an additional pay of 10% of their basic salary. Bonuses are given as per employees' sales of the month as:

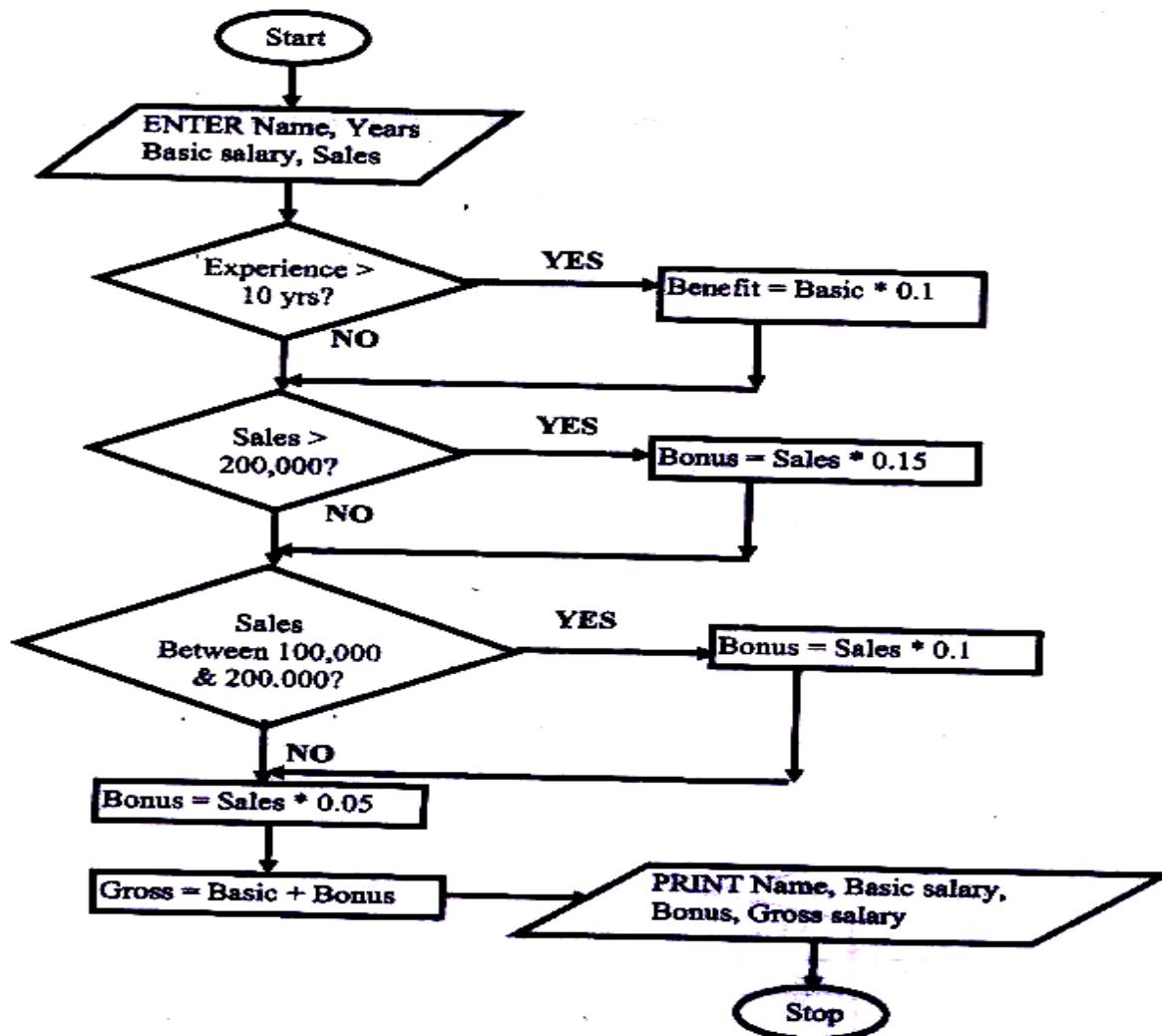
>200,000

15%

The  
gross salary  
employees of

100,000 – 200,000	10%
Below 100,000	5%

Draw a flowchart for the program that will calculate Gross salary and output each employee's Basic salary, gross salary and all benefits. (15 mks)



## ELEMENTARY PROGRAMMING PRINCIPLES

### Specific Objectives

By the end of the topic the learner should be able to:

- a) Describe a system;
- b) Define an information system;
- c) State the purpose of an information system;
- d) Identify the stages of system development;
- e) Develop a system using a case study;
- f) Write a report on the case study.

### Content

- a.) Description o f a system
- b.) Definition of an Information System
- c.) Purpose of an Information System
- d.) Stages of system development
  - Problem recognition and definition
  - Information gathering eg
    - i) investigation .
    - ii) observation
    - iii) interviews
    - iv) questionnaires
  - Requirement specification for the new system
  - System design
  - System construction
  - System implementation
  - System review and maintenance

(\*A number of theories exist on system development. The above is a general guide to the stages)

#### 9.2.5 System Documentation

- Reports on fact finding/information gathering
- 436
  - System flowchart
  - Table/file structure/descriptions
  - Sample data
  - Output reports
  - User manual



## Introduction

### Definition of System Development

Organization of components which interact in a given environment and within a specified boundary to achieve collective goals and objectives that are emergent.

### Description of a system

A system is described as either hard or soft system

#### Soft System

- Their boundaries may be fluid or keep on changing.
- Their goals and objectives usually conflict and may not be captured clearly because they are human based.
- It is difficult to precisely define exact measure of performance for them. Examples: sales tracking and predicting systems, political system,

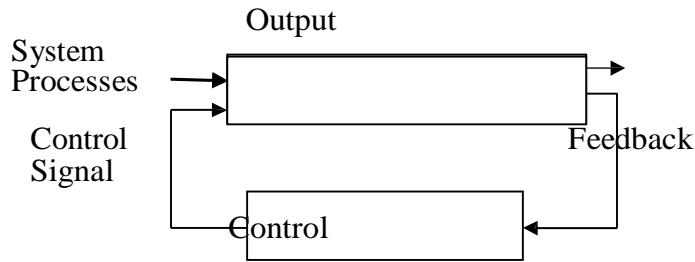
#### Hard systems

They are systems whose goals and objectives are clearly defined and the outcome from the system process are predictable and can be modeled accurately.

### Characteristics of Systems

1. **Holistic thinking:** Combination of various components to create a complex whole.
2. **Subsystems:** A system doesn't exist in solitude but may be a component of a large system.
3. **Boundary and environment:** An external element whose changes in attitudes, behavior and property affect respectively.
4. **Processor:** Transform or processes data from one state to another.
5. **System entropy:** The decaying or becoming useless because of the improvement in technology, new management policies or the change in user requirements.
6. **Inputs and outputs:** The system communicates to its environment by receiving inputs and giving outputs.
7. **Open and Close:** The open system receives input from and gives output to the environment while the closed system uses input as its own benefit thus building itself from the output.
8. **Purpose:** The objectives that a system is supposed to achieve enable system developers to measure the performance of a system during its operation.
9. **Control:** This is the method by which the system adapts to changes in the environment in order to give the expected output or to perform to the expected level.

Input



## Information System

An arrangement of people, data processes and information that works together to support and improve the day to day operation in a business and decision making. Purpose:

- Supporting information processing task e.g. data collection, processing and communication.
- Helping in decision making by collecting operational data, analyzing it and generating reports to be used in supporting decision making process i.e. online analytic process.
- Enable information sharing

## Reasons to develop a new system

- New opportunities to improve quality of internal processes and service delivery in an organization.
- Problems that prevent an organization from meeting its goals.
- Directives or new requirements by the government, management or an external influence.

## The Role of an Information System Analyst

1. Responsible for identifying an organization's needs and problems.
2. Reviewing the existing system and making recommendations on how to improve or implement an alternative system.
3. Working hand in hand with programmers to construct a computerized system.
4. Coordinating training of the new system users and owners.

## Theories of system development

1. **Traditional approach:** Relies mostly on the skills and experience of individual staff members carrying out the project.
2. **Rapid Application Development (RAD):** Quick implementation of the new information system.
3. **Structured approach:** System developers define a set of procedures to be followed when developing a system.

## Stages of System Development

### 1. Problem recognition and definition (Problem analysis)

The system analyst needs to carry out a special study to establish the cost and benefits of a new system i.e. a feasibility study. The feasibility of a system is assessed in four ways:

1. Operational feasibility: Establishes the extent to which the users are comfortable with the proposed system.
2. Schedule feasibility: Whether development of proposed system will be accomplished within the available time.
3. Technical feasibility: Whether the available technology is sufficient or can be upgraded.

4. Economical feasibility: The effective cost i.e. cost and benefit of proposed system.

## 2. Information Gathering/ Fact finding

Studying available documentation

### Advantages

- One has the necessary material.

### Disadvantages

- Slow method
- If wrong data was entered wrong information will be collected.

## Interviews

### Guidelines:

- Interviewee must be informed in good time and the topic of discussion communicated before to allow for adequate preparation.
- Avoid personal biases in your questions.
- Be careful about body language and proxemics.

### Types of Interviews

- Structured:** Questions have been already organized or prepared and spaces for the answers/responses.
- Unstructured:** Questions are not written or prepared.

### Advantages

- Non-verbal communication can be used.
- Questions can be rephrased instantly for clarification and to probe the interviewee further.
- Gives adequate opportunity for the interviewer.
- Interviewer is accessible to first hand information.

### Disadvantages

- It is difficult to organize interviews and they are time consuming.
- Interviewee may not fully open up on some issues that may be personal or sensitive.
- They are expensive to conduct.

### Automated Methods

The uses of data capture devices like cameras, scanners and camcorders.

### Advantages

- The method is accurate.
- Fast.

### Disadvantages

- Expensive equipment required.

### Questionnaire

It is a special purpose document that allows a person to collect information and opinions from the people who receive and respond to it.

#### Application

- When limited amount of information is required from a large number of people.
- People you need to gather information from are vastly dispersed.

#### Advantages

- Since they are filled and returned in primary more sincere responses are possible.

- Respondent can fill the questionnaire at their own pace.

#### Disadvantages

- Good ones are difficult to prepare.
- The respondent may not fully understand the questions because of ambiguity of language hence giving erroneous responses.
- Time consuming in analyzing.

## Observation

#### Advantages

- Difficult concept for non-technical staff to explain can be observed.
- Helps analysts become acquainted with the operational personnel.
- Helps the analyst acquire know how needed to assist that have been recommended.
- Can correct “hazy” understanding/ erroneous impressions.

#### Disadvantages

- The person being interviewed can alter behavior leading to wrong requirement being observed.
- The need to be on-site consumes a lot of time.
- The method cannot give information about past activities and problems.

## 3. System Classification

- Deterministic system:** system whose output is precisely known by their inputs like the computer system.
- Probabilistic system:** Output can only be predicted but not precise like in business and economics.
- Cybernetics system:** Self system which adapts to the environment and regulate their own behavior by accessing the feedback e.g. in human beings, plants.

## 4. Requirement Specification

### Output Specification

Activities that entail generation of reports used to facilitate decision making. Factors to consider;

- Target audience.
- Frequency of report generation.
- Quality and format of output.

**Input Specification**

- Content and volume of input.
- Mode and device of input selection.
- Layout and information sequence

**File / data store specification**

- The key attribute/ field
- Type of data
- Length of each field
- Back up and recovery strategies

**Hardware and software specification**

- Economic factors e.g. prices
- Operational factors e.g. reliability, upgradability, compatibility with existing resources
- User-friendliness

**5. System Construction**

The coding, installing and testing modules and their components e.g. Input, output by

- Using high-level structure language like PASCAL, COBOL e.t.c.
- Fourth Generation languages- Visual Basic, Visual COBOL, Visual Delphi e.t.c.
- Customizing the standard packages.
- Testing

**6. System Design**

Development of flowcharts, data flow diagrams, structured charts e.tc.

**7. System Implementation**

The activities involved during this stage are: Installing the system, testing, converting from old system to the new system and training the users.

File creation and convention: Setting up of master files to be used to support the new system.

Training the staff

- Convert staff of user department on the effectiveness of the new system
- Remove fear of change from them
- Enabling staff cope with processing task of the new system

Methods used in training: documentations, film shows, manual reference, group discussions and visits

## Changeover

The process of changing over from old system to the new system.

**1. Direct Changeover:** The new system commences live operations and immediately the old system is abandoned.

### Advantages

- Cheap method

### Disadvantages

- Places the organization in a do or die situation
- Extremely risky

**2. Parallel Changeover:** Operations of the old system and the new system are run alongside each other

### Advantages

- Provides a method of training in the new system
- Personnel become familiar with the new system

### Disadvantages

- Costly to run two systems
- Cross checking is difficult
- Requires more staff hence more training is required

**3. Phased Changeover:** Implementation is done only on part of the new system at one time or step by step.

### Advantages

- Allows the system to be implemented quickly
- Less costly
- Failure of the new system is limited
- Cause minimal disruption

### Disadvantages

- Problems on assuming that the final sphere is implemented and converted

## 8. System Review and Maintenance

Adjustment and enhancement or correction of errors after the system has been implemented. Reviewing includes going through the specification and testing the system after implementation to find out whether it still meets the original specifications.

### System Documentation

1. Reports on fact-finding
2. Requirement specification
3. System and module flowcharts
4. Table/ file structure description
5. Sample test data and expected output
6. Output reports.

## CHAPTER TEN

### INTRODUCTION TO NETWORKING AND DATA

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Define computer networking TERMS;
- b) State the purpose of computer networks;
- c) Describe the elements of a network;
- d) Describe various types of networks;

e) Describe various types of network topologies.

- i) Resource sharing
- ii) Remote communication
- iii) Distributed processing facilities
- iv) cost effectiveness
- v) reliability

- Limitations

f.) Elements of Networking

a) Data communication media

- Communication with cables

i) twisted pair cables

ii) coaxial cables

iii) fibre-optic cables

- Communication without cables (wireless) e.g.

i) Microwave

ii) satellite

iii) radio transmission

b) Data Signal

- Analog
- Digital

c) Communication Devices e.g.

- Modems
- Network cards
- Hubs

## Content

a.) Definition of terms

- i) computer networks
- ii) data communication

Purpose and Limitations of networking

- Purpose
  - b.) Network software
- Operating systems
- Protocols
  - c.) Types of Networks
- Local Area Network (LAN)
- Metropolitan area Network (MAN)
- Wide Area Network (WAN)

d.) Types of Network topologies e.g.

- Ring
- Star
- Bus

## Introduction

**Computer Network:** Collection of computers linked together using transmission media for the purpose of communication and resource sharing.

## Terms used in Networking

1. Data signal- Voltage level in the circuit which represent flow of data.
2. Multiplexing- Process of sending multiple signals over same media.
3. Demultiplexing- Process of separating multiple signals at receiving point.
4. Bandwidth- Maximum amount of data a transmission medium can carry at one time.
5. Baseband signal- Analog signal send over transmission medium using a particular frequency.
6. Baseband width- Digital signal generated and applied to transmission medium directly without modulation.
7. Attenuation- Decrease in magnitude and energy as signal progressively moves along a transmission medium.
8. Repeater station- Receive signals, clean, amplify them for transmission.

## Modes of Communication

1. Simplex- Communication in only one direction e.g. television and radio broadcasting
2. Half duplex- Communication in both directions, one at a time e.g. Walkie Talkie
3. Full duplex- Communication in both directions simultaneously.

## Types of Computer Network

1. **Local Area Network (LAN)**- Network that spans a relatively small geographical area e.g. a building, a school etc.
2. **Metropolitan Area Network (MAN)** - Covers a metropolitan area like a town or a city of typically a radius of between 5 to 50Km or MAN is made up of many LAN's in a metropolitan area.
3. **Wide Area Network (WAN)** – Covers a large geographical area like continent or the world.

**Server:** This is computer dedicated to serving requests for resources from other computers(workstations) on network.

### Advantages of LAN

1. Enables many users share expensive resources like printers and data.
2. Enables communication- sending messages and open chat sessions.
3. Capable of transmitting data very fast.

## Purpose of Networking

**1 Resource sharing-** File sharing, mail exchange, sending faxes, schedule meetings and print documents leading to less wastage of time and enhances greater productivity.

**2 Remote communication-** faster data transmission from different geographical site. Problems that faced workers.

Roaming of officers who by virtue of their work cover long distance away from their work place.

Time wastages in accessing organization information.

Remote communication is the process of transmission of data signals between communications devices located at different geographical locations. Components of remote communication are:

Remote Client- Computer that tries to access resources from another computer on network.

Remote host- Computer being accessed on network

**3. Distributed processing facilities-** Def. Process of running databases or programs on different computers which are on the same network. The advantages:

(i) Failure of central computer doesn't affect the operations of the other terminals.

(ii) Processing load shared is equally distributed hence no wastage.

**4. Cost effectiveness-** Although the initial installation cost is high it cuts down most expenses and adds value to service delivery.

### Advantages

- (i) Daily communication- paperless communication environment.
- (ii) Reduces transport cost for executive meetings.
- (iii) Resource sharing e.g. printers, fax machine, optical drives, files and applications.

### 5. Reliability

- (i) Transfer of data with minimum errors from destination
- (ii) Easy recovery incase of computer breakdown.

## Limitations of Networking

1. Security issues- Data is prone to more illegal access threat in the network
2. High initial cost for software and hardware.
3. Moral and cultural effect- chartrooms and pornography.
4. Spread of terrorism and drug trafficking.
5. Overreliance on network thus network failure may halt the system or bring down the organization.

## Elements of Networking

### A. Data Communication Media

#### 1. Bounded (cabled) Media

##### **Two line open cable**

Insulator between the two wire help reduce interline interference. They capture environmental frequencies e.g. radio waves hence causing noise in the transmission medium/pathway.

Insulator



##### **Twisted pair cable-**

Wires are in a double helix manner. They transmit both voice and signal data. Types

- (i) Unshielded Twisted Pair (UTP) cables- Don't have a shied that prevents electromagnetic interference (EMI) or "electronoise" from the environment.
- (ii) Shielded Twisted Pair (STP) cables

#### **Advantages**

- Used in the telephone systems
- Cheap installation equipments
- Cheap due to mass production of telephone

#### **Disadvantages**

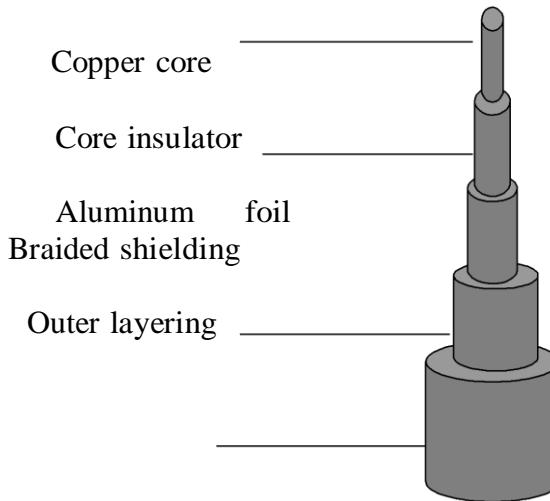
- Suffer a high attenuation rate.
- Sensitive to EMI and eavesdropping
- Low data transmission but more than two line

## Coaxial cables

Has a central copper core surrounded by a dielectric material (insulator) that is then surrounded by a hollow mesh conductor covered by a shield. The braid (mesh conductor) is made of copper/ aluminum and serves as the ground for the carrier wire. The braid protects radio and electromagnetic interference. The thinner the conductor determines the attenuation rate. Thinner have a high attenuation rate. Used in network blockade- A link

that connects two separate LAN's

- (ii) Thin coaxial cables (Thinnet)- has no dielectric insulator
- (iii) Thick coaxial cables (Thicknet)- has two dielectric insulators.



### **(b) Thicknet**

#### **Advantages**

- Stable even under high loads
- Large bandwidth than twisted pair
- Carry voice, data and video signals simultaneously
- Resistant to radio and EMI than twisted pair cables.

#### **Disadvantages**

- Thicknet is hard to work with
- Are relatively expensive to buy and install compared to twisted pair

## Fiber optic cable

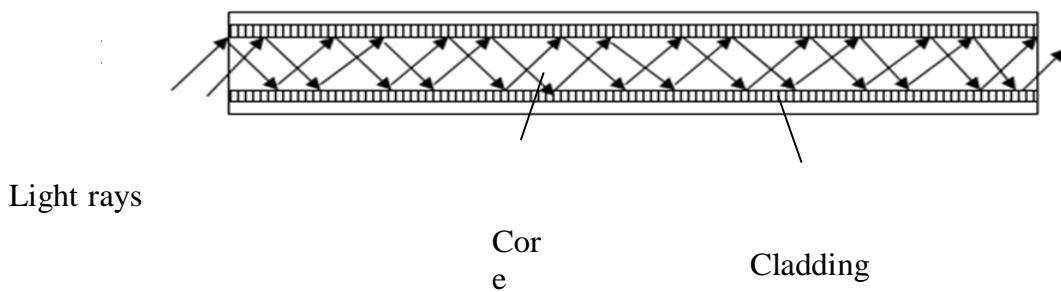
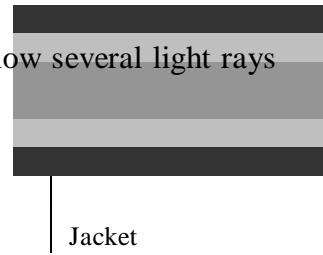
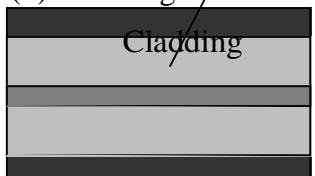
Electronic signals from source are converted to light signals the propagated along the fiber cable by a Light Emitting Diode (LED) at the transmitter then at the receiving end a photosensitive device used to convert light signals back to electric signals. Components:

- (i) Core- Central part and is made of a hollow transparent plastic glass.
- (ii) Cladding- Single protection layer surrounding the core.
- (iv) Buffer- Surrounds the cladding, strengthening the cable.
- (v) Jacket- Outer casing

## Types of optical fiber cables:

- (i) Multimode: Has a very narrow center core hence have low attenuation rate as light takes only one path in its suitable for long distance

- (ii) Single mode: Has a thicker core hence allow several light rays



### Advantages

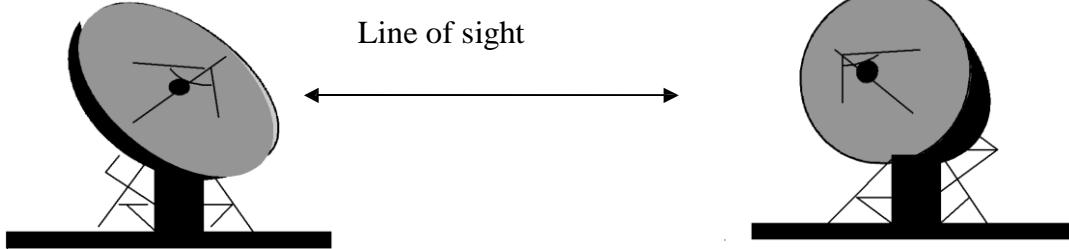
- Immune to EMI and eavesdropping.
- Fast and support high bandwidth.
- Large distance can be covered- low attenuation
- Used in hazardous places- Don't generate electric signals.
- Smaller and lighter than copper- Ideal for space limited situation

### Disadvantages

- Difficult installation since it must be carefully be handled
- Expensive connectivity devices and media are required
- Relatively complex to configure
- Difficult and expensive to repair

## A. Unbounded (Wireless) Media

### Microwave Transmission



Have a high frequency of 3 GHz to 4 GHz. It suitable for point to point transmission (line of sight): Signal is directed through a focused beam from transmitter to receiver.

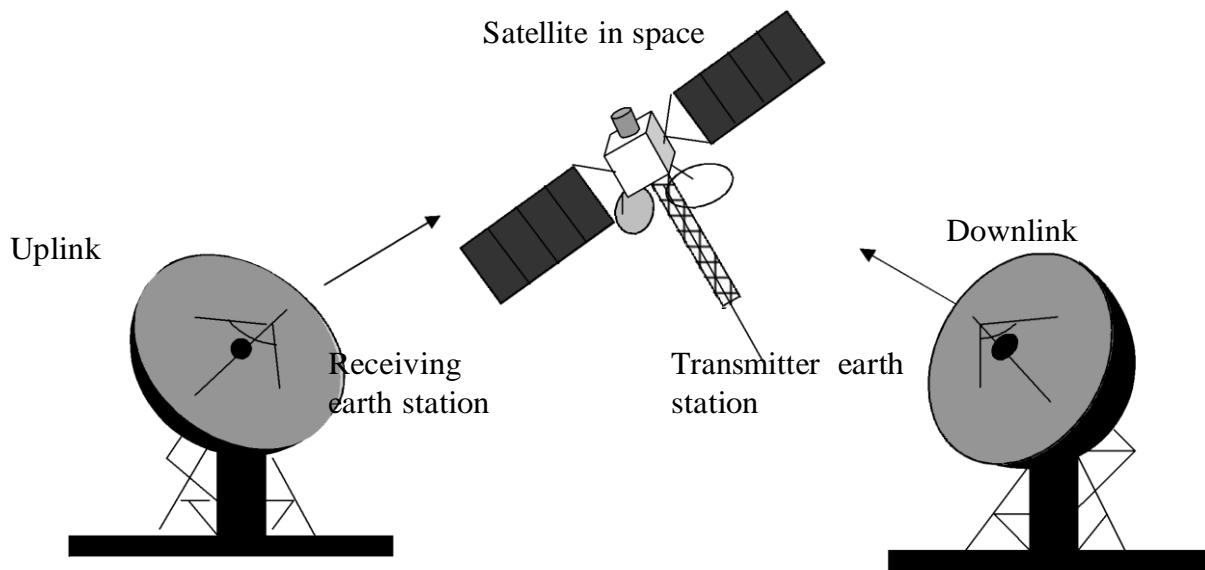
### Advantages

- It is less prone to transmission errors.
- It is capable of operating on both digital and analog data
- Operates at a high speed.

### Disadvantages

- Signals affected by atmospheric conductors e.g. lightening
- Additional numbers of repeaters are added after every few kilometers.

## Satellite Transmission



A satellite transmission system has three main components:

1. The transmitter earth station- sets up an uplink in order to transmit data.
2. A satellite (geostationary) - receives, amplifies and transmits the signal to receiving earth station via a downlink frequency.
3. Receiving earth station- receives signals on the other side of the globe from the satellite

**Satellite footprint:** Area on earth where line of site can easily be located. Transmission of signals to many recipients' earth stations forms a point to multipoint transmission.

**Very Small Aperture Terminal (VSAT):** This technology refers to very small satellite dish used in radio, data and TV communications. It enables direct access to satellite communication instead of having to go through satellite owned or licensed satellite gateway.

### Advantages

- Has a high band width.
- Earth station can be installed on a customer property than layering extensive cables.
- Cheap since cost is not dependent on the distance.

### Disadvantages

- Expensive to install ground stations.
- Heavy rains or bad weather increases loss of signals.
- Any station can receive the signals.

## Radio Communication

- (i) **High Frequency (HF)** - Propagated by directing it to ionosphere on

earth. Then the ionosphere will reflect back to earth surface and the receiver will pick it up.

- (ii) **Very High Frequency (VHF)** - Transmitted over the earth's surface. Stationaries are placed strategically to maintain the line of sight from one another.
- (iii) **Ultra-High Frequency (UHF)**- It is the same as VHF but require smaller aerial because they can be made to follow even narrow and direct path to the receiver than VHF
- (iv) **Bluetooth**- Enables people to use hand-held communication devices e.g. phones PDA's to access the internet. Network Bluetooth enabled devices is called a wireless personal area network (WPAN) or piconet.

## Infrared Transmission

Infrared transceivers must be within the line of sight in the same room because unlike radio signals they cannot penetrate objects.

### Advantages of Wireless Media

- Flexible in operations compared to wired.
- Span a large geographical area.
- Can take place in satellite even in remote areas.

### Disadvantages of wireless Media

- Relatively difficult to establish or configure.
- High initial cost.

## Communication Devices for Bounded (Wired) Media

1. **Network Interface Card (NIC):** Creates a physical link between computer and transmission media.
2. **Modems and Codec:** Modem (Modular demodulator) is a device that converts digital to analog signals when sending data over a transmission media then converts the analog signals to digital at the receiving point. Codec converts analog signals to digital form for transmission via a digital medium.
3. **Hubs (Concentrators):** Connects computers on the network and relay signals from one computer to another on the same network using protocols.
4. **Bridge:** Determines selectively the appropriate network segment for which a message is meant for delivery through address filtering thus dividing a busy network into segments reducing network traffics.
5. **Repeaters:** Receive signals from one segment of the network, cleans it to remove any distortion then send it to another segment.
6. **Routers:** Interconnects different networks and directs transfer of data

packets from source to destination depending on the network address.

7. **Router:** Communication device that combines the functionality of a bridge and a router.
8. **Gateway:** Any device that can be configured to provide access to a Wide Area Network (WAN) or the internet.
9. **Switches:** Unlike the hub, a switch forwards a packet directly to the address node without broadcasting

NB Node- Data terminal equipment e.g. workstation.

## Wireless (Unbounded) Communication Devices

1. **Access points (AP):** Entry point into a bounded network for people who have wireless network devices like PDAs, laptops and computers with wireless links.
2. **Wireless antennae:** Detects signals in the surroundings.
3. **Personal computer memory card international association (PCMCIA):** Add-on card inserted in devices e.g. PDA or laptops in order to enable wireless communication between devices and wired network server. Mostly used in LAN connection.

## Network Software

### Classifications of Network Software

- a) Network operating system
- b) Network protocols

### Network operating system

Network operating system is specially designed to optimize the network computer ability to respond to services request. Its functions are:

- (i.) Provide access to network resources e.g. printers and folders.
- (ii.) Enables nodes on network to communicate with each other more efficiently.
- (iii.) Support interprocess communication i.e. enables various processes on the network to communicate.
- (iv.) Respond to requests from application programs running on one network.
- (v.) Support network services e.g. network cards, drivers and protocols.
- (vi.) Implementing network security features.

## Functions of network Administrators

- (i.) Secure the network against unauthorized access
- (ii.) Track network usage and keeps a log of all people who have used the network.
- (iii.) Ensures inter-operability between various systems on the network.
- (iv.) Performance monitoring to ensure maximum throughput on the network. Examples of networking operating systems are:
  - Windows NT/2000 /2003

- UNIX
- Linux
- Novell Netware.

## Network Protocols

They are a set of rules and procedures that govern communication between two different two devices or people.

### Concept behind network protocols

In order to transmit data over the network it has to be broken into discrete systematic steps. Each step has its own rule and procedures i.e. protocols that must be coordinated so that there are no conflicts or incomplete operations. Achieved through protocol layering .Network protocols are designed after the Open System Interprocess (OSI) model. The open system interconnection model is not a protocol as such but is meant to help designers to come up with high quality layered protocols.

	Layer	Function
7.	Application layer	User application run here and generate request for data transmission or open received files.
6.	Presentation layer	Adds formatting, display and encryption on information to data
5.	Session layer	Sets up data transmission session between two communication
4.	Transport layer	Manages data transfer over the network to ensure
3.	Network layer	Address information is added to the data packet and routed to
2.	Data link layer	Adds error checking information and prepares data for going into
1.	Physical layer	Data packets are finally transmitted via the network and through

## Network Topologies

This refers to the way in which computers or devices have been arranged or how data is passed from one computer to another in the network.

### Classifications of Network Topologies

1. Logical topology
2. Physical topology

#### Logical / Signal Topology

Mainly concerned with the way data passes from one device to the next on the computer network.. Examples of signal topology are *Ethernet* and *Token ring* topologies.

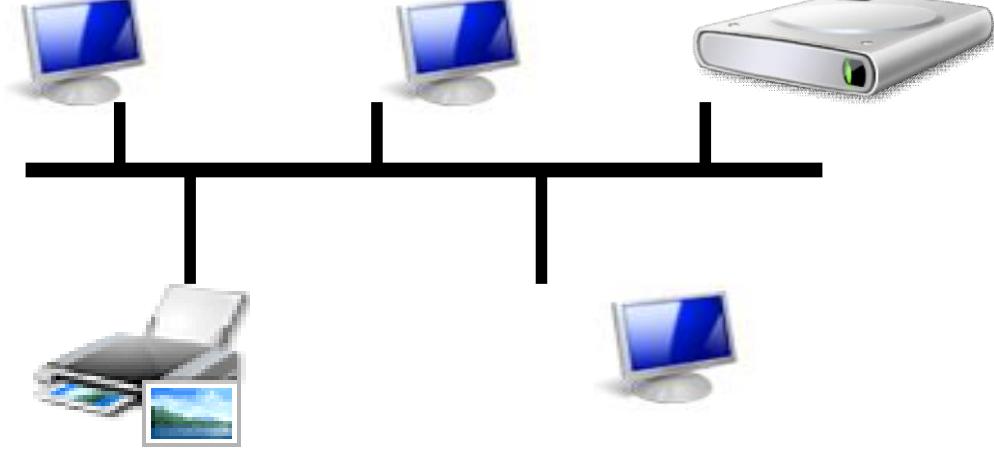
- a) Ethernet topology: All the workstations or computers adhere to the network media and can only send data when none of the others are sending data.
- b) Token ring: There is a special package for data called a token that goes around the network and only the computer whose address is on the data held in the token will take up the token to read the data then release the token.

## Physical Topology

### Bus Topology.

All the devices on the network are connected to a central cable called the bus or the backbone. Each

end of the cable is connected to a terminator to avoid signal from bouncing back and fourth on the cable causing signal distortion. The network address of computers on the network is called the *medium access control (MAC)* address



Advantages of bus topology are:

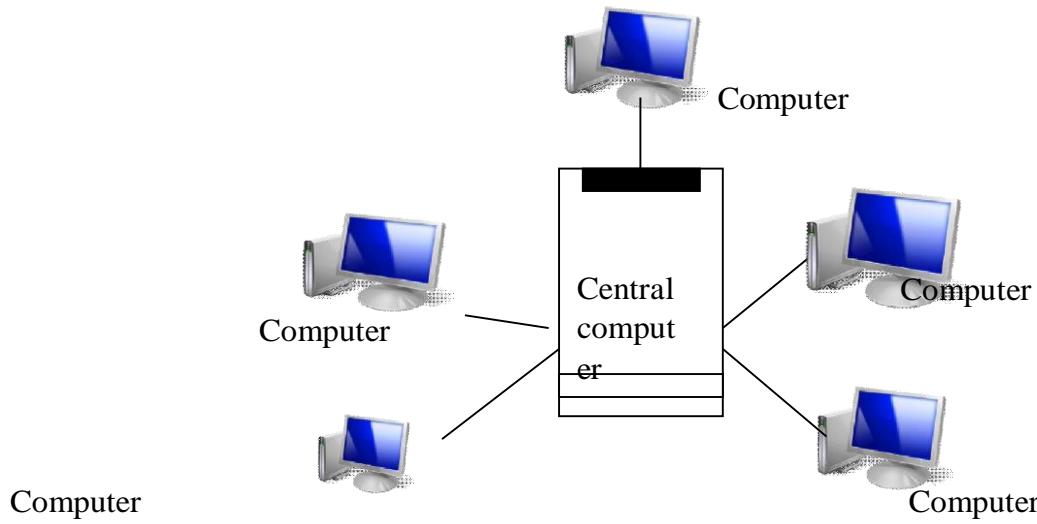
- It is easy to install.
- It is less costly because it doesn't require a complete cable length per computer.

The disadvantages of bus topologies are:

- Failure of central cable brings the whole network down.
- Only one node can transmit message at a time.
- Difficult to troubleshoot

## Star Topology

All the devices are connected to the central hub (concentrator).

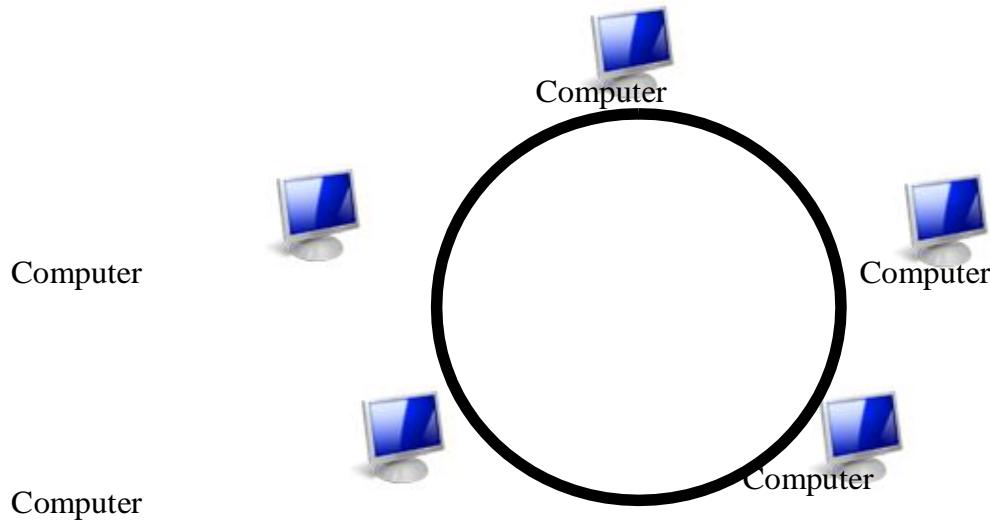


### Advantages of Star topology

- Easy to configure.
- If one node fails it doesn't affect the other nodes.
- It is easy to expand this topology.
- Allows the centralization of key network resources.

### Disadvantages

- It requires more cables to install hence it is more expensive.
- Failure of the central hub puts the entire network at a stand still.
- Installing this type of network is time consuming.



## Advantages of Ring topology

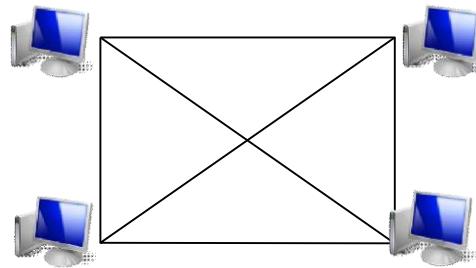
- Data transmission is fast.
- They use a short length cable.
- Ring topology is simple to install.

## Disadvantages of the ring topology

- Modification may be difficult because adding or removing a device can disrupt the entire network
- Troubleshooting can be difficult.
- If one site fails it affects the entire network.

## Mesh Topology

Device in this topology are connected with repeating (redundant) cables between the workstations. Each node is connected to one another.



## Advantages of Mesh Topology

- It is easier to troubleshoot.

## Disadvantages

- Expensive: Costly to provide the redundant cables.
- Difficult to install and maintain.

## Tree/Hierarchical Topology

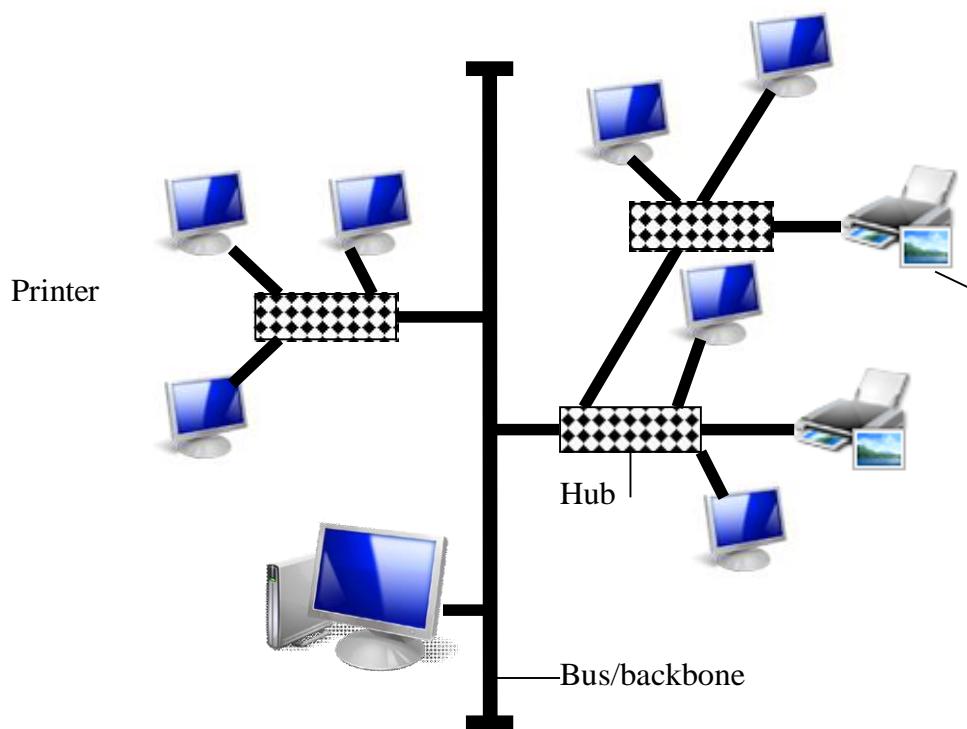
All the nodes are connected in form of a tree with nodes as leaves and links as branches. The branches are connected to one another by the means of devices called hubs.

## Advantages of Hierarchical topology

- If the node below the main node fails, the network does not fail.

## Disadvantages

- If the top node fails the entire network fails because it controls the other nodes.
- Expensive to install since it is complex.



## Network Security

### Classification of Network Security

- (i.) Share level security
- (ii.) User level security

### Share level Security

Mostly the share level security is used in peer-to-peer networks. It is used to decide which resources to share. It is provided by most desktop operating systems like Windows 9X.

### User level Security

Applied in server-based networks. A network administrator assigns accounts to users, so each user must provide a unique name and password to access the network resources. It is found in Microsoft Windows NT, 4.0/2000/2003, UNIX, Novell Netware, Linux Fedora, etc.

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

### 1. Define the following terms:

(2mks)

#### (i) Computer network

(2mks)

- A collection 2 or more computers connected together using transmission media (e.g., telephone cables, or Satellites) for the purpose of communication and sharing of resources.

#### (ii) Data transmission

(2mks)

- Passing information from one terminal to another in a computer network through telecommunication channels

#### (b) Differentiate between a modern and a multiplexer.

(2mks)

- A Multiplexer enables sending of multiple data signals over the same medium, either simultaneously or at different times.
- A Modern converts a digital signal to analogue form, so that it can be transmitted over analogue telephone lines.

### 3. State three advantages and three disadvantages of computer networking.

(6mks)

#### Advantages

- Sharing of resources between the computers
- Sharing of risks.
- Provides cheaper and efficient communication.
- Running cost is low because of the minimal hardware required.
- Reliable and error-free.
- Enhances faster communication
- It is not time-consuming.

#### Disadvantages of networking

- High initial installation cost (i.e., expensive to install).
- Security threats e.g., hacking, which posses a great danger to loss of information
- Moral and cultural effects.
- Spread of terrorism, drug-trafficking and viruses.
- Over reliance on networks.

### 4. (a) What is a distributed system?

(2mks)

- This is a system in which data is manipulated in different processors/computers, which are on the same network but placed in separate locations.

(b) State any two advantages of distributed systems. (2mks)

- There is sharing of data & other resources.
- Relieves the central computer of the burden of processing data
- Failure of the central computer does not affect the operations of the other terminals
- Processing load is shared equally; hence no time wastage
- There is faster processing of data since each machine can process & store its data
- It doesn't need powerful & expensive servers for data storage
- It can accommodate users with variety of needs
- Creation of employment at the remote centers.

5. Distinguish between bounded and unbounded transmission media, giving two examples in each.

- In *bounded media*, data signals are transmitted from the source to the destination through a restricted pathway, e.g., two open wire cables, twisted pair cables, Coaxial cables, fiber optic cables.
- *Unbounded media* transmits data without physical connections, e.g. microwave, satellite, radio, infrared communication.

6. State what is meant by each of the following data transmission media, and give two advantages and three disadvantages for each.

i) Twisted pair cables. (3mks)

A twisted pair cable is made up of 2 insulated copper wires twisted around each other in a spiral pattern. This prevents electromagnetic fields from developing around the two wires as they transmit data.

#### Advantages

- Has high data transfer rates of up to 100 Mbps
- It is cheap because of mass production for telephone use.

#### Disadvantage

- They suffer from high attenuation
- affected by electromagnetic fields
- It has low data transmission rates as compared to other cables

ii) Coaxial cables

Coaxial cables consist of two conductors which are insulated and shielded to provide high noise immunity & also more resistant to electromagnetic interference.

#### Advantages

- They have a large bandwidth (up to 1 Gbps) compared to twisted pair cables
- They can carry voice, data and video signals simultaneously
- They are more resistant to radio and electromagnetic interference than twisted pair cables

#### Disadvantages

- They are hard to work with

- They are expensive to buy & install

iii) Fibre optic cables is made of transparent glass and uses light to transmit data signals from one point to another on the network.

#### Advantages

- It is immune to electromagnetic interference, and eavesdropping.
- It is fast and supports high bandwidth
- It has low attenuation; hence, a long distance can be covered
- It is small & light.

#### Disadvantages

- Difficult & expensive to install
- Once broken, it is difficult & expensive to repair.

iv) Wireless/microwave/radio transmission. (3mks)

- In wireless transmission, no physical connections are used to transmit data from one point to another. Instead a transmitting antenna & a receiver aerial are used to facilitate the communication

#### Advantages

- wireless networks can span large geographical areas easily
- Can be used in very remote areas that do not have high cost physical infrastructure like telephone lines
- Flexible.

#### Disadvantages

- The initial cost is very high
- It is relatively difficult to establish or configure.

7. Explain the function of the following network devices:

i) Network interface card (NIC)

NIC creates a physical link between the computer and the transmission media.

ii) Gateway

Gateways provide access to the Wide area networks & the Internet.

iii) Bridge

This is a network device that selectively determines the appropriate network segment for which a message is meant to be delivered.

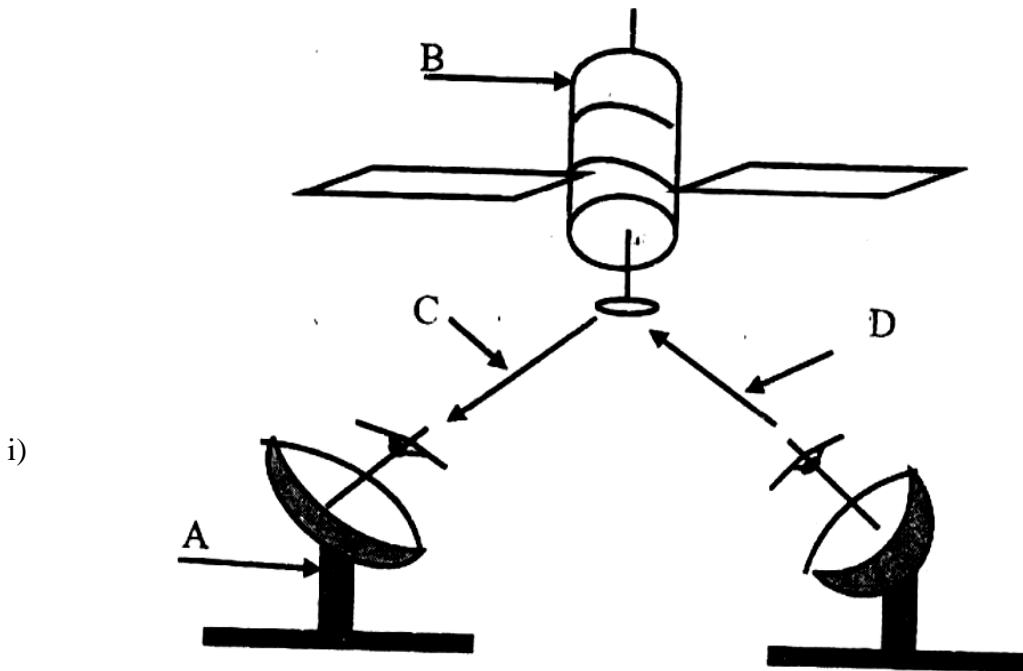
iv) Repeater

A repeater receives a weak signal on the network, cleans and amplifies it for transmission over the next portion of the network. Signals become weak due to attenuation

8. List two advantages of cell phones over fixed lines. (2mks)

- Are cheaper than fixed lines
- Less prone to transmission errors
- Can be used even where there are no telephone lines
- Portable, i.e. can be carried around

**9. a) Study the diagram below and answer the questions that follow:**



**Name the communication media depicted in the above diagram. (1mk)**  
 Satellite communication

**ii) Name the parts labelled A, B, C, and D.**

**(4 mks)**

- A -Receiving earth station
- B -Satellite in space
- C -Down link
- D -Up link

**iii) List three advantages of the above communication media.**

**(3mks)**

- It is fast
- It is convenient because; it provides a large constant line of sight to each station  
 Hence, there is no need to keep on moving the parabolic dish so as to track the line of sight
- Can be in very remote areas that do not have high cost physical infrastructure like telephone lines.

**(2mks)**

**10. a) Define the term network topology.**

**(2mks)**

Network topology refers to the arrangement of the computers, printers and other equipment connected on the network.

**b) Distinguish between logical and physical network topology. (2mks)**

- Logical (signal) topology deals with the way data passes from one device to the

- next on the network
- Physical topology refers to the physical arrangement (layer out) of devices on the network.

## CHAPTER ELEVEN

### APPLICATION AREAS OF ICT

#### Specific Objectives

By the end of the topic the learner should be able to:

Describe the use of computers in different application areas.

## Content

### Application Areas of Information and Communication Technology

- **Financial Systems**

- a) accounting
- b) banking
- c) payroll

- **Retail Systems**

- i) point of sale systems
- ii) stock control
- **Reservations Systems**
- i) hotels
- ii) air-lines

- **Communication Systems**

- i) Fax and telex
- ii.) radio
- iii.) television
- iv.) video conferencing
- v.) e-mail
- vi.) telecommuting
- vii.) internet

- **Education**

- i) Computer Aided Learning (CAL)
- ii) e-learning
- iii) computer based simulation

- **Industrial systems**

- i) simulation
- ii) process control
- iii) CAD (Computer Aided Design)/CAM (Computer Aided Manufacture)

- **Scientific and Research Systems**

- i) Weather forecasting
- ii) Medical research
- iii) military/space exploration

- **Transportation Systems**

- i) air-traffic control
- ii) Shipping control

iii) Automobile traffic control

- Entertainment Systems

i) Computers and movies

ii) Multi-media

- Virtual reality

i) Uses of virtual reality

ii) visor

- Library Systems

Library lending system

- Home use

- Health

- Expert systems

- Offices

Expert systems

- Offices

Expert systems

- Marketing

i) e-commerce

ii) business

Field work Report

## Application areas of Information and Communication

### Technology Retail systems Stock control

Computers enables the user to manage his or her stock more efficiently by helping to track what is in stock and what needs recording.

#### **Transaction handling at the electronic point of sale terminal (EPOS)**

EPOS is a computer terminal that is used in retail stores to input and output data at the point where sales are transacted e.g. supermarkets and wholesales. Other additional equipments required are: The barcode reader (wand): passed over items mar code.

Monitor: Enables the user to interact with the system

Receipt printer: Produces the receipt based on the customers purchase.

#### **Advantages of EPOS are:**

Accuracy: Correct prices are used at the check out counter.

Faster: Since data entry is not manual

#### **Financial Systems**

## Payroll systems

This system helps an organization to process accurately information of employees including gross pay and deductions and getting their net pay.

## Accounting systems

- (i.) **Customer order entry and billing:** Subsystem records incoming customer orders authorizes delivery of items or services and produce invoice for customers who don't pay in advance
- (ii.) **Inventory management:** Keeps track of items in stock and help the management to determine which item to reorder.
- (iii.) **General ledger account:** Keep track of how much a business makes and its worthiness by summarizing the financial transactions producing a report called balance sheet.
- (iv.) **Accounts payable:** Keeps track of the amount the business owes other organizations like the tax organizations, suppliers and transporters.
- (v.) **Accounts receivable:** Keeps track or records the amount owed by the customers.

## Banking Systems

- (i.) **Processing customers' transactions:** Computers are used in banks to record deposits, withdraws and calculating interest on savings and loans.
- (ii.) **Cheque clearing and processing:** The use of magnetic Ink-Character Recognition (MICR) details of the cheque is automatically entered into the computer for the cheque process. The special characters on the cheques includes the bank in which the cheque is drawn from, the customer accounts number the cheque number and the cheque amount.
- (iii.) **The electronic fund transfer:** Use of Information Communication Technology to move money. Used especially with credit cards and the ATM cards.

## Reservation systems

These systems are also called *online enquiries*. The concept used in reservation systems is the application of distributed network systems. Applications of reservation systems:

- (i.) **Hotel booking:** Booking and reservations rooms in a hotel are made from a remote terminal connected to a centralized computer database or via the internet using the hotels website.
- (ii.) **Airline booking:** All the flights and passenger records are stored in a centralized database. Travel agents from all over the world can access each data via communication lines. Likewise the agents book in clients where tickets have not been bought.
- (iii.) **Car rentals**

## Education Systems

1. **Computer Aided Instruction (CAI):** The process of using computers to learn, drill and practice particular education principles.
2. **Computer Aided Learning (CAL):** This is meant to drill the learner and present particular education materials the way a teacher does in class.
3. **E-learning:** Lessons and lectures are presented from a central site like a website the transacted to remote conference terminals or displayed on television screens.
4. **Computer Aided Simulation:** It refers to the science of representing behavior of a real life situation by using computerized models.

## Communication Systems

- (i) **Fax:** During the process of sending the fax the document is scanned then converted into analog form then transmitted. The receiver fax converts it into the original softcopy the it prints the document.
- (ii) **Radio communication:** Computers are used to:
  - Record and manage radio programmes for broadcasting.
  - Manage radio transmission and took performance.
  - Create slides, simulated objects and sound effects when preparing

- electronic and printed media advertisements.
  - Downloading information from the internet like international news.
- (iii) **Television sets**
- Ceefax (teletext)**: This refers to the computerized service where news and other information are provided on television screens to subscribers using an add-on card. It involves simplex transmission
  - Videotext (view data)**
- (iv) **Video conferencing**: Use of computers, digital camera (camcorder), audio capturing equipments and communication network to enable people from different locations to see and talk to one another.
- (v) **Telecommuting**: Situation where an employee work at home using a computer connected to workplace network.

### Advantages

- Reduces transport cost.
- Gives people the option of flex time.
- Saves costs.
- Reduces pollution and congestions inroads.

### Disadvantages

- Lack of discipline.
- Work quality may suffer.
- Few opportunities for brainstorming with colleagues.
- Disappear of direct supervision.

### (vi) Internet

- World Wide Web: This is the collection of webpages, which may be made of text, images, animations, sounds and video held on web servers.
- E-mail: Electronic sending and receiving of messages, data, files or graphics in the internet.

## Industrial systems

### (i) CAM and CAD

- Computer Aided Design (CAD): Refers to the integration of computers and graphics to aid in the design and drafting process. Examples of software are: Softpan, Autocad and Archicad.
- Computer Aided Manufacturing (CAM): It refers to the use of computers to control machines in the manufacturing process e.g. Delta.

### (ii) Industrial simulation:

Allows activities that would otherwise be expensive and dangerous to real life situation to be put under test. The Non Destructive Testing (NDT) can be used to test motors and other machines with the use of computers.

### (iii) Process control:

Computers are used to control ongoing physical process like regulating temperature, pressure and fluid flow.

## Scientific and Research Systems

(i) **Weather forecasting:** Analyzing, predicting, processing weather patterns through the use of Geographical Information System (GIS) and Geographical Positioning System (GPS).

(ii) **Medical research:** Diagnosing, Keeping of patients' records, inventory control. Expert systems that emulate the reasoning of a human expert in a narrow field of

specialization.

- (iii) **Military and space exploration** e.g. the National Aeronautics and Space Administration (NASA).

### Library Systems

- (i) **Lending system:** Information system that manages the issuance and the return of the borrowed reading materials.
- (ii) **Inventory control:** Manages the stock by checking for books currently in the shelves and those on high demands for purpose of adding more.
- (iii) **Cataloging:** A catalog refers to the collection of cards with information about each book or reference materials found in the library. Electronic cataloging is updated constantly when new reference materials are required.

### Entertainment Systems

- (i) **Games:** Games are now found on the Digital video disks (DVDs) and three-dimensional (3D) games are now possible on personal computers.
- (ii) **Music and video:** Video compact disks (VCDs) and Digital versatile disks (DVDs) have become a common feature in the music industry. In music industry computers are used in recording, synthesizing, editing and adding special effects on music. In video industry, computers are used to produce high simulated and animated movies, generate scenes and actors.

### Transportation Systems

- (i) **Automobile traffic control:** controlling traffic lights in road junctions.
- (ii) **Air traffic control:** Computers are used to monitor air traffic movement, take off and landing of aircrafts.
- (iii) **Shipping control:** Controlling and guiding paths taken by spaceships and water vessels as they travel to distant land using the Global Positioning System (GPS).

### Home Use

- (i) Preparing domestic budgets.
- (ii) Entertainment.
- (iii) Research.
- (iv) Education.

### Office Expert System

This is a system capable of simulating decisions making process and intelligent problems solution just like a human expert.

### Marketing

- (i) Electronic commerce (e-commerce): Transactions are carried out directly without physical interaction between the buyer and the seller.
- (ii) Electronic presentation
- (iii) Advertising

## Virtual/ Artificial Reality/ Cyberspace/ Virtual Works/ Virtual Environment

Condition in which a person is psychologically immersed in an artificial environment generated by a computer system: Requirements

- Head mounted display (HMD)/ Headgear: made up of two tiny display screens and sound systems that channel images and sound from the source to the eye and early presenting a stereo three dimensional (3D) sound effect in the virtual world.
- Gloves: Allows the user to navigate through the virtual world and interact with virtual objects. They have sensors that collect data about the movement of the hands and relays the data into the system
- Body suit: Worn during virtual reality session and it is made of conductive material
- VR software

### Applications

- (i) Training in medicine, military education
- (ii) Entertainment
- (iii) Simulation
- (iv) Study of human anatomy
- (v) Exploring landscape, underneath
- (vi) Crime scene reconstruction

### Law Enforcement

- Biometric analysis: fingerprints and facial identification.
- Use of video camera e.g. in banks
- Development of strong military bases which have international coordination by use of a computer radar system
- Jet fighters are computerized with correct control centers.

### Teleworking

A situation where an employee works usually at home using a computer connected to work place.

### Advantages

- Reduces travel expenses due to reduction of unnecessary travel to work.
- Gives people the option of flexitime giving them the option of working long hours part time.
- Saves cost if people work from home.
- Reduces pollution and congestion as a result of fewer people commuting to work.

### Disadvantages

- People who lack discipline may not do work, whereas others may overwork.
- Work quality may suffer if employees take the attitude "no one sees me doing the job so it doesn't matter."
- Fewer opportunities of brain storming with colleagues.
- Direct supervision disappears when people work from home.

## Application of computers in radio communications

- Record and manage radio programs
- Automate running of selected programs

- Create slides, simulate objects and sound effects to prepare adverts

End of topic

Did you understand everything?  
If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

- 1. Write in full hence, explain the term ICT. (2mks)**
  - ICT- Information and Communication Technology
  - ICT- refers to the integration of computers and telecommunication facilities for the purpose of communication.
- 2. State four areas where computers are used today. (4mks)**
  - i) Financial systems, e.g. accounting, stock exchange, payroll, banking, etc,
  - ii) Transport systems, e.g. air traffic control, shipping control, automobile traffic control
  - iii) Entertainment systems, e.g. used in showing movies, playing music, & computer games.
  - iv) Scientific research, i.e. weather forecasting, medical research, military & space exploration.
- 3. State two ways in which a computer may be used in efficient running of a hospital.**
  - Keeping records of incoming and outgoing patients
  - In electro-cardiogram screening and monitoring, analyzing the sickness & checking for damages, e.g. X-ray
    - A computer controls life supporting machines
    - For inventory control
    - To access foreign expertise or labour, i.e. to get in touch with consultants or surgeons in another country, thereby reducing traveling of patients & professionals.
- 4. a) Name the type of processing that would be required by a payroll system. (1mk)**

Batch processing
- b) Identify two benefits of using computers in accounting systems. (2mks)**
  - They make the processing of financial records easier
  - Error checking procedures can be established to ensure accuracy & security of data
  - Used to store volumes of financial records

- Ensure fast & easy production of financial reports
- They are cheaper than manual systems

**5. a) Write down all the input and output devices of an ATM machine of Pesapoint in Kenya.**

- Keyboard
- The ATM card
- Screen (Visual display)
- Printer

**b) List down three advantages of ATM cards. (3mks)**

- Offer 24 hour service to customers
- Ensure more flexibility in cash deposits and withdrawals
- It is secure because; it requires a personal identification number (Pin), which is only known by the card holder
- There is no need for human bank clerks.

**6. a) State four components of an electronic Point-of-sale terminal. (4mks)**

- Terminal, e.g. Console, which is connected to the main computer
- Monitor
- Printer

**b) Give two advantages of using electronic point-of sale terminals as opposed to manual entry at a supermarket checkout counter. (2mks)**

- Fewer errors made by employees, i.e. correct prices are used at the point of entry
- It ensures faster entry of data, since the attendant does not have to enter details manually.
- Ensures good stock management procedure.

**7. Define the following terms:**

**a) Biometric analysis**

This is the study, measurement & analysis of human biological characteristics. It uses a computer and a biometric device to recognize & analyze features of human body parts such as fingerprints, lips, voice iris colour, etc

**b) Telecommuting**

A situation where an employee works in a location that is remote from the normal place of work either on full-time or part-time basis.

**8. Outline four devices required in order to conduct a video conference. (4mks)**

- A computer
- A digital video camera (camcorder) attached to a computer
- Network software for video conferencing
- A microphone

- Speakers

**9. a) Define the term E-commerce (2mks)**

E-commerce is a way of doing business where the transactions are carried out electronically without the seller and buyer interacting physically.

**b) List down two advantages of e-commerce as used in modern business environment (2mks)**

- Reduces traveling, hence saves money and time
- A company can access customers all over the world, and is not limited by space & wagons
- Reduces operating costs of small business as they can establish websites where they can auction their good & services. This also increases their sales.

**10. Describe how computing has been applied to each of the following areas:**

**i) Transportation systems. (2mks)**

- Used by railway corporations to coordinate the movement of their goods & wagons
- Used in airline industry for air traffic control, surveillance of airspace using radar equipment
- Used in shipping control
- Used in automobile traffic control in busy towns, i.e. to simulate the timing of traffic lights.

**vi) Reservation systems. (2mks)**

- To keep record of reservation
- For online reservation (i.e. provide online remote services)
- Paperless transaction (Paying via credit cards)
- Easy to check for vacant positions

**vii) Law enforcement (2mks)**

- For keeping record on fingerprints
- Biometric analysis in crime detection so as to provide immediate & accurate information
- Scene monitoring & analysis to help the police in arresting traffic offenders and criminals.

**viii) Library management systems (2mks)**

- Keeping book records and stock management
- Tracking overdue books

**11. Suggest how computers may in future be made more user-friendly for persons that are:**

**a) Blind (1mk)**

- Development of Braille keyboards, or engraved keyboards
- Computers can be installed with talking software, i.e., can store voice patterns of the user

**b) Without hands**

- Use of voice-activated commands.
- Computers can be installed with powerful multimedia system & speech recognition devices.

**12. Give at least four reasons why a firm may decide to computerize its operations**

- Handling of errors easily
- Easy storage and retrieval of information
- Increased efficiency
- Higher quality work
- Reduced cost.

## CHAPTER TWELVE

### IMPACT OF ICT ON SOCIETY

#### Specific Objectives

By the end of the topic the learner should be able to:

- a) Identify issues resulting from the use of ICT;
- b) Discuss future trends in ICT.

#### Content

##### Issues resulting from use of ICT

- a) Effects on employment

- job creation
- job replacement
- job displacement

- b) Automated production

- pros & cons

- c) Issues of workers health

- d) Breakthroughs

- Health care
- Education
- Communication
- Research
- Commerce
- Arts
- Entertainment
- Transport

e) Cultural effects

- Computer crimes
- Moral effects

Evolution of computer systems

- Possible future trends in capabilities, physical size, price, software etc
- Artificial intelligence

i) expert systems

ii) natural language processing

ii) artificial neural networks

iii) robotics

## Introduction

### Issues Resulting from the use of ICT

#### Effects on employment

1. **Job creation:** New opportunities; computers operators, programmers, network administration, information technology and information science managers, database administrators, software developers, system analyst etc.
2. **Job replacement:** Clerical and repetitive tasks that require a large number of employees have been made redundant. Computer illiterate are replaced.
3. **Displacement:** Loosing job, displacement of employees from another place or department when computer skills are required.

## Automated Production

#### Advantages

- Increases efficiency due to balancing of workload and production capacity.
- Improved customer service: Adequate and high quality goods are produced in time.
- Efficient utilization of resources

#### Disadvantages

- High initial cost of setting up automated systems

- Automated production may lead to unemployment

## Issues of Workers Health

1. Repetitive Strain Injuries (RSI): Injuries resulting from wrist, hand, arm, mode strain,tendonitis and neck strains due to forced repetitive movement. The cure for RSI is by resting, sitting in a relaxed position and changing typing techniques.
2. Eyestrains and headaches: Computer Vision Syndrome (CVS) is characterized by eyestrains, headaches, double vision and other problems caused by improper use of monitors. The solution for this is good resolution, antiglare filters, adjusting brightness.
3. Stress
4. Isolation
5. Electromagnetic emissions: Computer users are advised to use low emission device to avoid expressing thermals to excess emission.
6. Radiation from the VDU causes birth defects, blindness, cancer, miscarriage and sterility.
7. Computer chip toxin: workers are exposed to toxic chemicals in chip manufacturing industries that may pose health problems similar to those from the VDU.

**Environment pollution:** Huge garbage dumps of dead computer parts, printers, ink, tonner cartridges, monitors and other computer accessories are disposed in landfills causing environmental pollution. Nickel-cadmium laptop batteries that contain toxic cadmium which when buried in a landfill can leak into underground water tables and attachment areas.

### Cultural Effects

1. Flaming: writing online messages that use derogatory, obscene or dirty language.
2. Pornographic material
3. Computer crimes: hacking, eavesdropping, piracy etc.
4. ICT have erased people's integrity by using computers as a tool to accomplish their vices e.g. forge certificates, passports and other documents.
- 5.

### Breakthrough in ICT

It has changed lifestyles in health care, education, communication, research, commerce, art and design, entertainment, transport etc.

## Evolution of Computer Systems

### 1. Rapid evolution in computer hardware and software.

- Computers will become more intelligent
- Software will be more versatile and easier to use
- Cheaper and more powerful computers which will have faster processor
- Industries will become more automated
- More application software will be available because of high speed, large available memory for programs
- Education will have to gear itself to training students to computer assisted services rather than teaching them physically
- Smaller size in computers
- Operating systems that will handle real time data analysis and objects oriented will be developed
- Will have improved user interface that offers user easier and more intrusive access to information.

### 2. Artificial Intelligence (AI):

This is a branch of computer science that is concerned with the development of machines that emulate human like qualities as learning, communication, seeing and hearing.

#### Applications

1. **Expert System:** Software designed to make a computer operate at a level of a human expert on a specific narrow area of specialization. Examples are;

- Mycin- blood and meningitis
- Prospectors- Predicting mineral deposit in certain geographical site
- Delta- Repair diesel electric locomotive
- Xcon

## Components of artificial intelligence are;

1. **Knowledge base:** Expert system's database of knowledge about a particular subject.

It contains relevant facts, beliefs, assumption and procedures for solving particular problems.

2. **Inference engine:** Software that controls the search for knowledge in the knowledge base , procedures and conclusions.
3. **User interface:** Display screen that enables the user to interact with the system.

## 2. Natural language programming:

3. **Artificial neural network:** use of electronic devices and software to enable the neurological structure of human basic. Essential attributes;

- The neurodes can be trained to distinguish between what constitutes a signal and what doesn't.
- They are capable of recognizing patterns in large amount of data that are too complex for human beings.

4. **Robotics:** Computer controlled device that emulates human beings in carrying out tasks that would otherwise be dangerous and different.

### Merits

- A robot can work on repetitive task without getting bored or tired.
- Can work on dangerous areas unlike human beings
- Increased production because they are capable of working at a high speed
- Leads to less operating expenses since less personnel is required

### Demerits

- Lead to job replacement
- Expensive to install

## 3. Expanded superhighway

Involves integration of cabled and wired technologies for the purpose of data and information transmission.

End of topic

Did you understand everything?

If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

1. Identify four problems associated with the introduction of computers in a society. (4mks)

- Job displacement and replacement
- Computer crimes, e.g. piracy, fraud, hacking
- Health effects, e.g. repetitive strain injury, eye problems
- Cultural effects and immorality (DVD's, pornographic literature on the Internet)

2. Distinguish between “job replacement” and “job displacement” in reference to Computerization (2mks)

- In job replacement, the unskilled workers may be replaced with the

skilled ones. In job displacement, some employees may be displaced/moved to new working areas as the computer may serve to perform tasks that may be performed by several people.

**3. A recent breakthrough in the manufacturing industry is the development of a full manufacturing plant, that can produce vehicles using robots only.**

a) **Give three advantages of fully automated manufacturing. (3mks)**

- Increases efficiency due to the balancing of workload and production capacity.
- Production increases in the workplace
- Improves customer service
- Enables production of adequate & high quality goods in time
- Enables efficient utilization of resources, e.g. raw materials, personnel and equipment; hence reducing operating expenses.

b) **State three other areas where automation is applicable. (3mks)**

- Intelligent control of traffic lights
- The autopilot in aircrafts
- Use of robots in industries
- Manufacturing industries such as vehicle assembly plants, oil refineries, and food processing companies.

**4. Discuss the applications of Artificial Intelligence in each of the following fields:**

i) **Expert systems**

- In medical institutions for diagnosis of diseases
- In mining companies for prospecting of minerals.
- Financial forecasting, e.g. formulation of taxation & marketing policies, and making of investment decisions.
- Financial forecasting, e.g. formulation of taxation & marketing policies, and making of investment decisions.

ii) **Natural language processing (2mks)**

- It involves development of programming languages, whether spoken or written
- This will make the task of data processing even faster

iii) **Artificial neural networks. (2mks)**

- This is the use of electronic devices & software to emulate the learning process of the human brain and how it recognizes patterns.

**5. Explain the impact of information technology on organization in each of the following areas**

(i) **Competition (2 mks)**

- Ability to advertise in the internet
- Improved quality goods & services
- Reduced operational costs

(ii) **Pace of growth (2 mks)**

- Reduced costs
- Reduced need for manpower
- Reduced space requirement
- Greater output

**6. State three reasons why users may resist the introduction of information and**

**communication Technology (ICT) to their place of work**

- (i) Fear of change- people are creatures of habit, hence are afraid of change
- (ii) Fear of losing their jobs: By installing the computer into an organization, employees fear that they might end up losing their jobs
- (iii) Fear of failure – Since the computer is very new in a given working environment, the people will be afraid that they might never get used to it.
- (iv) Loss of control: The management fear that once a computer system is implemented, they might lose control of the organization.

## CHAPTER THIRTEEN

### CAREER OPPORTUNITY IN ICT

#### Specific Objectives

By the end of the topic the learner should be able to:

Describe career opportunities in ICT.

#### Content

a.) Description of careers in the field of ICT e.g.

- i) Computer Operators
- ii) Programmers
- iii) Software Engineers
- iv) Database Administrators
- vi) System Administrators
- vii) Computer Technicians
- viii) Computer Engineers
- ix) Information Systems Managers
- x) Computer Trainers
- xi) Web Administrators
- xii) Systems Analysts

b.) Identification of further Educational Opportunities

- i) Colleges
- ii) Institutions

- iii) Polytechnics
- iv) Universities
- v) Research Institutions

## Introduction

### Computer Operator

- 1. Entering data into the computer for processing
- 2. Keeping up to date records (log files) of all information processing activities.

### Computer Technician

- 1. Troubleshooting computer hardware software related problems
- 2. Assembling and upgrading computers and their components
- 3. Ensuring that all computer related accessories e.g. printers, storage media, modems are in good working conditions
- 4. Help hardware engineers in designing and creating some computer components e.g. motherboard, storage devices

### System Analyst

- 1. Attributes/ Qualities of a good system analyst
- 2. Good problem solving skills and creativity: experience in problem solving
- 3. Good communication skills
- 4. Must have business knowledge
- 5. Technical knowledge in hardware, software and processing

### Responsibilities

- Reviewing the current manual system and making recommendations on how to replace it
- Preparing system specification
- Working with programmers to construct and test the system
- Preparing instruction manual
- Coordinating training for users of the new system

### Computer Programmer

- 1. Writes in-house application programs/ system programs

2. Customize commercial application packages to suite the organization needs
3. Test, install, debug and maintain programs developed

## Software Engineers

1. Develop system and application software
2. Develop user and technical documents for the new software
3. Maintaining and updating software to meet day to day requirement while overcoming challenges.

## Computer Engineers

1. Design and develop computer components such as storage devices, motherboard and other components
2. Determining the electrical power requirements of each computer component
3. Re-engineer computer components to enhance its functionality and efficiency
4. Design and develop engineers and manufacturing computer controlled devices such as robots

## Information Software Manager

1. Making sure that all tasks in the IT department are done correctly and online in order to support business planning, control and design making process
2. Providing budgets for the department
3. Keeping the department inventory records up to date
4. Managing human resources within the department

## Database Administrator (DBA)

1. Designing and developing database application for the organization
2. Setting up security measures needed to control access to data and information
3. Keeping the database up to date by adding new records, modifying and editing
4. Computer Trainer
5. Training people how to use computer and other application programs

## Computer Trainer

1. Developing training reference materials
2. Guide learners on how to acquire knowledge through carrying out research
3. Advising learners on the best career opportunities in the broad field of ICT
4. Preparing learners for ICT examination

## Web Administrator/ Webmaster

1. Developing and testing websites
2. Maintain, updating and modifying information on website to meet new demands

3. Monitoring access and use of internet connection by enforcing security measures
4. Downloading information vital for the organization

## Computer graphics designing and typesetting

- Designing graphical objects and professional publication

## Network Administration

1. Set-up a computer network
2. Maintaining and enforce security measures on the network
3. Monitoring the use of network resources
4. Maintaining and troubleshooting network related problems

## Computer Sales Representatives

1. Analyzing customer needs
2. Advertising them accordingly

### Characteristics of a good computer sales representative

- Must be confident
- Be persuasive
- Proficient in business communication

## Further Education Opportunities

### Universities

1. **Public universities:** They are established by state through the award of charter run by state appointed management term.
2. **Private universities:** They are self-sponsored institutions set-up by individuals, churches or Non Governmental Organizations (NGOs)

### Research Institutions

1. **Polytechnics:** Offer diploma and certificate courses
2. **Colleges:** Offer diploma, certificate and craft courses.

End of topic

Did you understand everything?

If not ask a teacher, friends or anybody and make sure you understand before going to sleep!

## Solved KCSE Questions on the topic

### 1. Give a brief description of the following careers available in the computing field.

(i) A Software engineer is one who is skilled in software development and technical operations of computer hardware

He develops and updates both system and application software together with the associated documentations.

### (ii) Data processing managers (DPM) ( 2 mks)

A data processing manager is the person who usually is in charge of the overall running of the data processing department in an organization

He plans, monitors and controls the personnel, ensures that resources and labour are available as required and interfaces to users

### 2. Differentiate between software engineer and a computer engineer ( 2 mks)

Software engineer develops software/ programs as per requirements; computer engineer designs computer hardware and improves on existing ones.

**3. (a) Sate three public universities where one can further her computer studies ( 3 mks)**

- Nairobi university
- Moi University
- Kenyatta University
- Jomo Kenyatta University of agriculture and Technology (JKUAT)
- Egerton University
- Maseno university

**(b) Identify at least three related courses offered at**

**(i) College level**

- Certificate in information technology
- Diploma in information technology
- Diploma in Education (computer science)

**(ii) University level**

- Bsc. Computer science
- Bsc. Information technology
- Msc. Information systems

**4. (a) Name three responsibilities that are carried out by a:**

**(i) Web administrator**

- Develop & test websites
- Maintains, updates & modifies information on the websites to meet new demands by the users.
- Monitors the access & use of internet connection by enforcing security measures
- Downwards information needed by an organization or institution from internet websites

**(ii) Computer trainer**

- Training people on how to use a computer & the various application programs
- Development training reference materials
- Guiding learners on how to acquire knowledge through carrying out research
- Advising the learners on the best career opportunities in the broad field of ICT
- Preparing learners for ICT examinations

**5. Explain two factors one would consider before enrolling for an ICT course in a college**

- The cost of the course
- Marketability of the course, i.e. whether it offers courses recognized both locally and internationally.
- Basic course requirement, e.g. qualifications
- Job opportunities

## PROJECT

### Specific Objectives

**By the end of the Project, the learner should be able to:**

- a) Identify and define a problem;
- b) Carry out fact finding through either or all of these methods:
  - i) Investigation
  - ii) Observation
  - iii) Interviews
  - iv) Questionnaires;
- c) Define systems hardware and software requirement;
- d) Design a system;
- e) Construct a system that would:
  - i) Input data through forms or screen
  - ii) Update: modification, deletion of existing data
  - iii) Carry out data validation
- IV) Search/filter/query/retrieve records
- v) Generate/print reports.
- f) Test the system;
- g) Prepare a project report(Documentation) that includes
  - i) Reports on fact finding system flowchart/flow diagram
  - ii) System flowchart/flow diagram
  - iii) Table/file structure descriptions
  - iv) Sample input and test data
  - v) Output reports
  - vi) User manual.

## GENERAL REQUIREMENTS

Schools intending to offer Computer Studies are expected to have the following minimum equipment:

- 1) Computer Laboratory/classroom(s)
- ii) Computer desks that accommodate monitor at eye level
- iii) At least one computer per every four students (1:4) in Forms one and two and one computer for every two students (1:2) for Forms three and four.
- iv) At least one printer for every four computers
- v) Printing Stationery
- vi) Appropriate storage devices e.g. diskettes
- vii) Storage facilities for diskettes and other consumables e.g. disk banks
- viii) Appropriate software for the curriculum
- ix) Relevant reference materials

*Note: The computers to be used for the course should preferably be IBMs or IBMcompatibles due to their low maintenance costs and availability of spare parts.*

In addition to the above, the following facilities though not mandatory will greatly assist in achieving the objectives of the course.

### **1. HARDWARE**

- i) The PCs should be Pentium II or higher
- ii) The PCs should have a CD-ROM drive
- iii) At least one of the PCs in the school should be full multimedia
- iv) A network environment
- v) Internet connection
- vii) Printers with graphic capabilities (not necessarily in colour)

### **2. SOFTWARE**

- i) It is recommended though not necessary that the operating system be a Graphical User Interface (GUI)
- ii) Software for the application packages may also be GUI - based which supports pointing devices
- iii) Up to date anti-virus software are highly recommended.