

COMPLETE A'LEVEL ICT NOTES: STUDENTS HANDBOOK

Topic 1: INTRODUCTION TO COMPUTERS

DEFINITION

- ✓ **A computer** is an electronic device that can be programmed to accept data (input), process it into useful information (output), and store it (storage) for future use.
- ✓ It is also defined as a programmable device that accepts data input, processes it under special programs to produce the desired meaningful output that is kept and later retrieved for use.

The terms **data** in the definition refers to raw facts that are entered in the computer while the **information** refers to processed data that has meaning to the user

CHARACTERISTICS /FEATURES OF GOOD/MODERN COMPUTER

- ✓ **Speed** .Modern Computers are fast in their operation. They execute instructions at very high speeds and their speed is measured in Millions of Instructions Per Second (MIPS) or Megahertz (MHz)
- ✓ **Accuracy**. Computers are known to be accurate. They can process large amounts of data and generate error- free results, provided the data entered is correct. Hence the acronym “**Garbage In Garbage Out**” (GIGO)
- ✓ **Storage**. For a computer to be able to work, it must have some form of workspace where data is stored before being processed or where information is stored before being given out to particular devices. This storage is called memory.
- ✓ **Automation**. Good /modern Computers work automatically. They use the installed programs to work and do not need any supervision in order to perform programmed routines.
- ✓ **Diligence (Consistency)**.good Computers have the ability to perform the specific tasks again and again for a long time without getting tired and with o mistakes (errors).
- ✓ **Artificial intelligence** Computers are artificially intelligent. They can respond to requests given to them and provide solutions. This is because of the programming. Evidence is seen in computer games.
- ✓ **Versatility (Flexibility)**. Computers are capable of performing many different kinds of tasks. Take an example of smart phone that is used to make mobile call. The same device can be used to perform tasks on numbers, edit images, read and edit documents, etc

WHY DO WE TAKE COMPUTER STUDIES

People take up the computing studies for many reasons, but these general can't escape mention;

- **Acquire skill**. Students of computer acquire skills in the use of IT for enhanced productivity and development, this is because many of jobs today need computers skills to determine production, predict future production using computer application programs.
- **Jobs** .computing gives a vast range of many jobs that students take up .these jobs include the following; Database administrators, Network administrators, Web masters, Computer Systems Analyst, Computer Support Specialist, Computer Scientist, Computer Systems Designer, Computer Programmer, Software Engineer, Computer technician, etc
- **Awareness**. Students are able to get aware of the new innovation in the field of technology and are able to tell the future in technology.

- **Attain creative knowledge.** Learners are able to acquire creative knowledge for problem solving. They are able to solve complex problems requiring sensitive thinking and imagination.
- **To acquire critical and analytical thinking.** Learners are able to get hands on skills and are driven to innovation through research in the deferent scientific fields e.g. health.

COMPUTERS AND OTHER ICTs IN SOCIETY TODAY

ICT (Information and Communication Technology) refers to a set of devices that accept data, process it into information, store it, later retrieve it and retransmit it. These include devices like; digital cameras, radios, TV, internet, computers, etc. There are many area of application (*positive effects*) of computers and other ICTs in society today,

1. Health

- ✓ They are used to maintain Electronic health records in hospitals, clinics and other health centers.
- ✓ They are used to carry out computer – assisted diagnosis in clinics and hospitals using systems like x-ray systems, ultra sound systems and magnetic imaging systems
- ✓ Doctors and other medical workers used computers to carry out research about new medicine and diseases for instance research on Ebola vaccine.
- ✓ They are used during implanting of computerized devices (i.e. Pace makers e.g. heart) that allow patients to live longer.
- ✓ Computes are used to control computer – controlled devices that require great precision during operations. These operations include laser eye surgery and heart surgery.
- ✓ They are used in treating patients from a distance through use of computers with videoconferencing capabilities. This is called telemedicine.
- ✓ Medical training. They are used by experienced doctors and surgeons to train others through computer – aided surgery prior to performing surgery on live humans.

2. Business

- ✓ Companies and business organizations have succeeded in getting wide range of marketing facilities with the use of websites, social networks like twiter, Facebook, etc
- ✓ Support business transaction through Electronic fund transfer (EFT).
- ✓ Finance management has been made easy through use of computer software such as excel, financial information systems, etc are used to manage financial accounts in business companies.
- ✓ Business managers are able to manage their businesses away from the actual location by sending and receiving information through computers and other ICTs. This is called telecommuting.
- ✓ Computers and the other ICTs are used in all business companies for communication through services like chat rooms, e-mails, through social networks like Facebook, twitter, etc
- ✓ **E-commerce.** This refers to business transactions that take place across a network e.g. Internet. They could include the following.
 - a. Online shopping and banking are two popular types of e-commerce that uses either electronic money (e-money) or electric data interchange

(EDI).

- b. E-money is a means of paying for goods and services over the Internet.
- c. EDI is a set of standards that control the transfer of business data and information among computers both within and among companies.

Advantages of e-commerce:

- a) Transactions can occur immediately and globally, thus saving time for participants on both ends.
- b) Transactions can occur 24 hours per day.
- c) Businesses have access to millions of people with Internet connections.
- d) Businesses have the ability to gather customer information, analyze it, and react if appropriate.
- e) Information can be changed and be available quickly.
- f) Customers can compare prices easily.
- g) Feedback can be immediate.
- h) Manufacturers can buy and sell directly, avoiding the cost of the middlemen.
- i) Distribution costs for information are reduced or eliminated.

3. Banking

- ✓ An automatic teller machine (ATM) is a self-service banking machine attached to a host computer through a telephone network. It allows the following
- ✓ People are able to make transactions like deposits, withdraw cash, and transfer money between accounts electronically and remotely.
- ✓ Computers, mobile phones and other ICTs like internet can be used to have access to your account information in the bank e.g. receiving information on bank account balance.
- ✓ Used in branding bank property
- ✓ Facilitate communication among bank stakeholders
- ✓ Used to count money notes in the bank using notes counting devices
- ✓ Devices like magnetic ink character recognition (MICR) are used to process cheques.

4. Art, Leisure and Entertainment

- ✓ People use computers in playing modern computer games. These include Solitaire, Tetris, Free Cell, Packman, GTA, FIFA 2015, etc.
- ✓ People at their leisure play and listen to music using application programs like VLC, virtual DJ, windows media player, etc
- ✓ Computer software and hardware can be used to compose and edit both video and audio clips.
- ✓ Images can be edited by image editing application programs like Photoshop. These can be used in magazines, in news, etc
- ✓ People are able to read their favourite magazines online or even download them using facilities like internet.

5. Education /school

In the field of education /schools the use of computers and other ICTs have a wide range of application which include the following;

i. Students

- ✓ **Interactive learning** .A computer aided instructions(CAI) and Computer Aided Learning (CAL) packages usually contain multimedia effects which make learning more interesting and interactive.
- ✓ **Personal learning**. Students can learn by themselves when the teacher is not available.
- ✓ **Feedback**. Students can usually get their results or feedback immediately after they have answered the question or taken an action.
- ✓ **Learning resources**. There are rich educational resources on CD-ROMs and the Internet.
- ✓ **Teaching aid**. They use them as learning aids. They can be used to perform complex mathematical calculation e.g. scientific programmable calculator.
- ✓ **Distance learning**. Through use of computers and internet, distance learning has been possible.
- ✓ **Interesting learning**. Computer-Assisted Instructions (CAI), so that teachers can use computers and other IT equipment to present teaching materials in a more interesting way. E.g. power point.
- ✓ **Ease assessment**. Computer-Assisted Assessment (CAA), which may reduce the time and labour to mark the answer scripts.
- ✓ **Simulations**. Teachers can show experiments that are difficult to perform or dangerous in nature through simulations software.
- ✓ **E-learning**. A teacher can conduct lessons a way from class through facilities like videoconferencing.

ii. Administrators and other support staff.

- ✓ **Library management**. Electronic library system for searching, borrowing, and returning books.
- ✓ **Information systems**. The School Administration and Management System (SAMS) for keeping records of students and producing report cards or other related documents.
- ✓ **Edutainment**. This is a type of educational software that combines education with entertainment.
- ✓ **Easy documentation** .They are used by secretaries to quickly produce exams, and other administrative documents.
- ✓ **Record keeping**. Administrators use computers to keep records of employees' personal data (e.g., Employees' Date of birth, Nationality, Marital Status, Job Title, etc) such kind of information is kept in for of an "Employees' Database.

6. **Communication**. Administrators also use computers for communication purposes – communicating instructions to their juniors at work or to partners and Board members

7.

8. Industry

- ✓ In Manufacturing Industries/Factories, Computers are used to make the production and sometimes packaging processes faster.
- ✓ In Food and beverage Processing Industries, computers are used to determine the right portions of each ingredient that should make up the final product. This is also called computer aided manufacture.
- ✓ Computer driven machines such as robots are used to carry out repetitive tasks, lift heavy equipment, and carry out tasks which require a high degree of precision.

- ✓ They are used for research about new stock especially through the use of the internet.
- ✓ Computerized machines are used in packaging eg in soap industry
- ✓ Control stock of goods and sales using computers
- ✓ Maintain security in industries using CCTVs
- ✓ Facilitate communication among workers in the industry

9. Politics and governance.

- ✓ Governments nowadays use computer software to predict the economy of the country and make plans to improve production.
- ✓ Electronic family planning measures like the use of coil have been introduced to control the rapid growing population of the countries.
- ✓ Most countries have introduced ICT systems to carryout elections (e-voting).
- ✓ Governments use computers to keep citizens records like national IDs, passport information etc.
- ✓ They are also used to typeset and print national documents like constitution, memos, budgets, reports etc

10.Homes

- ✓ Computers nowadays are used in shopping goods and services over the internet (online shopping).
- ✓ In homes computers are used in playing music, movies and the modern computer games.
- ✓ Electricity, water, rent, TV, etc bills are nowadays are paid for using electronic means like mobile money, western union, etc.
- ✓ People /students carry out their research and any other education activities using computers and other ICTs at home. Some take online courses and even others learn how to speak and communicate in deferent languages.

11.Security, etc

- ✓ **Facilitate communication between security personnel e.g. by use of Walkie-talkie.**
- ✓ **Closed circuit televisions (CCTVs) are used to** record video and audio captions that provide surveillance to homes ,offices ,banks, laboratories, etc
- ✓ **Fire alarms.** These systems provide signals in case of fire out break hence providing security.
- ✓ **Systems like Traffic lights** are computer based systems that control traffic on high ways.
- ✓ **Automatic bombs.** These are programmed to go off/ on/burst in case an insurgence is detected.
- ✓ **Track down criminals using phone tapping, GPS and crime scene monitoring devices like breathalyzers (kawunyemu)**

Negative effects/disadvantages of computers and other ICTs in society

- **Unemployment.** Computers have brought about unemployment in the society by replacing the skills of millions of workers and managers.
- **High maintenance costs.** Hardware and software costs are too high and not affordable to some individuals.
- **Moral degeneration.** Youth and children are being exposed to ill – material via the internet leading to moral decay.
- **Computer crime and fraud.** Computers are being used to forge documents like

certificates, receipts, invoices, tax tickets, report cards, stamps, company seals, etc.

- **Health risks.** Prolonged or improper computer use can lead to RSI (Repetitive Strain Injuries) and disorders of the hands, wrists, elbows, eyes, necks, and back.
- **Computers are expensive** to buy and maintain (servicing, repair and electricity costs)
- **Violation of Privacy:** private information like medical records, credit reports, tax records, etc if not properly protected, have been violated and identities stolen.

COMPUTERS AND HEALTH RISKS

Prolonged computer usage can lead to health risks such as

- a) Eye strain
- b) Back pain due to poor sitting posture
- c) Electromagnetic radiation especially with CRT monitors
- d) Addiction from use
- e) Wrist pain to do non-ergonomic
- f) Repetitive Strain Injury (RSI)
- g) Headaches
- h) Neck pain
- i) Stress due to noise from fans, printers, power inputs
- j) Ear problems for use of ear phones especially with embedded systems

Precautions to help prevent such risks include

- a) Pay attention to sitting posture.
- b) Take a break to stand up, walk around, or stretch every 30 to 60 minutes.
- c) Place the display device about an arm's length away from the eyes with the top of the screen at eye level or below.
- d) Adjust the lighting in the room.
- e) Ensure that the workplace is designed ergonomically. Ergonomics means adding comfort, efficiency, and safety into the design of items in the workplace.
 - Some keyboards have built-in wrist rests.
 - Most display devices have a tilt-and-swivel base and controls to adjust the brightness, contrast, positioning, height, and width of images.
 - Most CRT monitors today also adhere to the MPR II standard, which defines acceptable levels of electromagnetic radiation.

COMPUTER LABORATORY

A computer laboratory is an organized place where students learn practical uses of computers, such as programming or how to use a spreadsheet program, database management, etc.

Factors to consider when preparing computer laboratory include;

1. Security of computers, programs and other resources.
2. Reliability of the source of power.
3. The number of computers to be installed, available floor space.
4. Maximum number of users that the laboratory can accommodate

Laboratory rules of computer care and safety

- a) Handle every computer device with maximum care without dropping them down.
- b) Do not allow external diskettes, flash disks and other external storage devices. These may have viruses.
- c) Do not expose computers to dusty environments, damp place and strong heat.

- d) Do not expose computers to direct sunlight.
- e) You should move with a lot of care when you are in the lab. Never enter the lab while running.
- f) Call the lab technician or any experienced person in case you encounter any problem when you are using the computer.
- g) Avoid smoking from the Computer lab.
- h) Avoid disconnecting the parts of the computer unless you have been told to do so.
- i) Always report any case of theft within the lab to the concerned authorities.
- j) Do not eat or drink anything near computers. Liquid can splash on the machines and spoil them.
- k) Avoid abrupt on and off of computers to avoid damage. Always shut them down through the right procedure.
- l) Cover the hardware devices after they have been cooled down.
- m) Always clean the surface of the hardware with a clean, dry piece of cloth. Avoid using water.
- n) Always follow instructions of the instructors while in the computer lab.

Measures taken to protect computers

- a) Burglar proofing the room to prevent unauthorised access.
- b) Installing fire prevention and control equipment
- c) Providing stable power supply. This can be done through use of regulators like the Uninterrupted Power Supply (UPS).
- d) Installing lightening arrestors on the computer room to prevent the building from lightening.
- e) The room should be well laid out with enough space for movement Computers should be placed on a table, wide enough to prevent slipping off.
- f) Dust and dump proofing the computer room
- g) Cables and power sockets should be well insulated and of the correct power rating to avoid short circuits that can damage computers.
- h) The users should not eat or drink in the computer laboratory. This prevents spilling of drinks on the hardware devices to prevent rusting.

Measures that protect the user

- a) **Proper insulation.** All cables should be insulated to avoid the danger of electric shock to the users.
- b) **Proper cabling.** Cables should be laid away from user paths to avoid tripping on them.
- c) **Ergonomics.** Providing standard furniture to avoid poor posture during machine use which may lead to strain injury and limb fatigue
- d) **Anti-glare screen filters.** Providing antiglare screens (light filters) and adjustable screens to avoid eye strain and fatigue caused by over bright cathode ray tube (CRT) monitors
- e) **Proper ventilation.** The room should be properly ventilated to avoid dizziness caused by lack of adequate oxygen and to allow the computers to cool.
- f) **Proper wall colours.** The walls of the computer room should not be painted with over bright reflection oil paints and the screens should face away from the window to avoid glare caused by bright backgrounds.
- g) **Control of movements.** Running and playing in the computer room is not allowed
- h) **Avoid overcrowding.** Overcrowding in the computer room is not allowed. This may cause suffocation.

Causes of data loss in the computer laboratory

- a) **Accidental deletion.** This is when files, folders or content in a file is deleted/ erased unaware, which causes data loss.
- b) **Power fluctuation.** Power fluctuations cause system failure and data/information loss.
- c) **Computer viruses.** Computer viruses refer to computer programs that cause/alter the normal functioning of the computer. These also corrupt the files hence data loss.
- d) **System failure.**
- e) **Software corruption.**
- f) **Natural disasters.**
- g) **Hardware problems e.g. drive failures.**
- h) **Computer theft and computer loss.**

Ways data loss in a computer laboratory can be controlled.

- a) *Use of passwords.*
- b) *Backing up data.* This is duplicating data files in the computer for storage to be used in the future in case of loss of the original.
- c) *Installing and activating firewalls.* A firewall is a set of hardware or software installed to prohibit communication from untrusted sources.
- d) *Installing and updating computer antivirus programs.* Antivirus programs scan and fix/delete computer viruses
- e) *Use of data recovery utility programs.* This is part of the systems software that helps in recovery of lost files.
- f) *Sensitizing users.* The computer users in the laboratory should be sensitized on the ways data is lost, the ways in which it can be recovered. For instance teaching the users how to use the recovery software
- g) *Punishing offenders.*
- h) *Creating resource access control rules.*
- i) *Installing a data loss control software e.g. deep freeze.*

COMPUTER SYSTEM

A computer system is a series of computer hardware, software, data, and users, procedures that work together to accomplish a task.

Elements of a computer system:

- ❖ Hardware
- ❖ Software
- ❖ Data and information
- ❖ People (users) / Human ware
- ❖ Procedures

COMPUTER HARDWARE

Computer hardware refers to physical and tangible components of a computer.

These devices can be seen, touched and felt .computer hardware can be categorised as follows;

- ❖ Input devices
- ❖ Output devices
- ❖ Storage hardware
- ❖ Processing hardware
- ❖ Communication hardware

INPUT HARDWARE DEVICES

Input hardware devices refer to devices that feed, generate, compose and enter data into the computer such as a keyboard, scanner, mouse, mouse, digital camera, etc

Input hardware devices are classified as follows;

- ❖ Pointing input devices.
- ❖ Text input hardware devices.
- ❖ Gaming input hardware devices.
- ❖ Video, image input devices.
- ❖ Audio input devices.
- ❖ Biometric input devices.

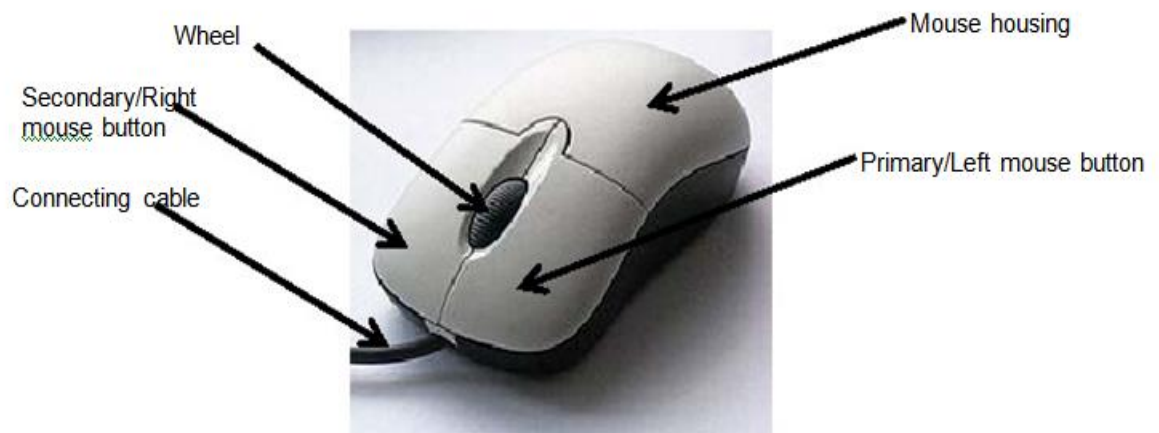
A. POINTING DEVICES.

These are input devices that control the movement of a cursor or pointer in a Graphical User Interface (GUI). They include;

1. Mouse.

Is a hand held pointing device for computers, involving a small object fitted with one or more buttons and shaped to sit naturally under the hand. **Advantages of using a mouse include**

- ❖ A mouse is user-friendly for computer beginners.
- ❖ A mouse is easy and convenient to use with a graphical user interface.
- ❖ Using a mouse to select items or move to a particular position on the screen is faster than using a keyboard.



Disadvantages of using a mouse include

- ❖ It is not easy and convenient to input text with a mouse.
- ❖ Issuing commands by using a mouse is slower than by using a keyboard.
- ❖ It needs some practice in order to control a mouse properly.
- ❖ A mouse is not accurate enough for drawings that require high precision.
- ❖ A mouse usually requires a flat surface to operate.

Types of mice

- ❖ **Mechanical mice:** They have a rubber or metal on its underside that can roll in all direction. There are mechanical sensors that detect the direction of the rolling ball and move the screen pointer accordingly.
- ❖ **Optical mice:** They use laser to detect mouse cursor /pointer movement.

- ❖ **Opto-mechanical mice:** these are the same as mechanical mice but use optical sensors to control cursor/pointer movement.

Ways in which mice connect to computers

- ❖ Serial connection
- ❖ Bus connection
- ❖ PS/2 connection
- ❖ Cordless or wireless connection

COMMON MOUSE TECHNIQUES

- ❖ **Point**(move the mouse and place it on a given icon, folder, file, command, menu, e.t.c.),
- ❖ **Drag**(press a button as you move an icon, folder or file),
- ❖ **Drop**(release a button in the process of dragging an icon, folder, file),
- ❖ **Click**(press either the left or right button on the mouse),
- ❖ **Single click**(press the left hand button of the mouse only once),
- ❖ **Double click**(press the left hand button in a two quick successions. It is normally used to open a file, folder or execute a program),
- ❖ **Left click**(means to press the left hand mouse button),
- ❖ **Right click**(means to press the right hand mouse button. It normally returns a menu short-cut),
- ❖ **Scroll**(means to use the mouse to move the page in any direction to allow the user to navigate it well). A user can scroll using the scroll wheel that exists on all new types of mice

2. Tracker ball

It is an input device where a finger is used to rotate a ball that moves a pointer on the screen.

Advantages of a tracker ball over a mouse.

- ❖ Doesn't need much desk space as a mouse.
- ❖ Is not tiring since less motion is needed.

Disadvantages of using a tracker ball over a mouse.

- ❖ Require proper control of the ball with one finger.
- ❖ Repeated motion of the finger can cause carpal pains.

3. Touch screen.

This is a screen in which data is entered by touch of a finger on the screen. It is an input /output device.

4. Touch pad(glide pad)

It is a pointing device where a finger is dragged along a surface to move a pointer on the screen. This can be connected to the computer or inbuilt on laptop computers.

Advantages of using a touch pad.

- ❖ Does not need desk space like a mouse especially for laptop computers.
- ❖ Can easily be inbuilt on the key board.
- ❖ It can either use buttons or simple taps on the pad for clicking.

5. Pointing stick.

It is a pointing device that looks like a pencil eraser that a user moves with a forefinger to move the pointer on the screen. It's between the G, H and B keys on the keyboard.

6. **Stylus.**

It is a device that enters data on pressure sensitive screens. It's mostly used in common PDAs.

Other common pointing devices include;

7. **Graphics tablet.** It is used in drawing new images or tracing old ones.8. **Light pen.** It connected to a video terminal used to draw pictures or select options by pressing the pen button.9. **Cyber glove.**10. **Eye gaze/eye tracking.****B. TEXT INPUT HARDWARE.**

These are input devices that enter character data (text) into the computer. These include the following;

a. Keyboard

It is a primary input device made up of numbers, letters, symbols and special keys used to enter data into the computer. The arrangement of keys on the keyboard is called **key board layout**.

There are many layout among which includes the following;

- ❖ QWERTY
- ❖ Dvorak
- ❖ GKOS
- ❖ British layout
- ❖ American layout, etc

The keyboard has five basic parts i.e;

- ❖ Numeric pad
- ❖ Functional keys
- ❖ Typewriter keys/alphanumeric pad
- ❖ Cursor /navigation/arrow keys
- ❖ Special keys

- i. **Numeric pad** .These are keys at the right hand of the keyboard used to enter figures into the computer.
- ii. **Functional keys**. These are keys named from **F1** to **F12**. They perform special operations depending on the application program e.g. **F1** for help in word processing.
- iii. **Typewriter keys/alphanumeric pad**. These are made up of numbers and letters at the centre of the keyboard. They are the mostly used keys in typing.
- iv. **Cursor /navigation/arrow keys**.These are used to navigate a document or a web page. They include up, down, left, right arrows.
- v. **Special keys**. These many on the keyboard and do deferent roles as follows;
- vi. **Caps Lock**. When activated, text characters can be typeset in capital letters by default.
- vii. **Space bar**
 - ❖ Enables the user to insert gaps in text being type set.
 - ❖ Scroll through a webpage.
 - ❖ To align text in office 2003.
 - ❖ Pause music.

- viii. **Shift key** is a modifier key used in a combination with other keys e.g. it is used with the control key to type in capital letters, it's also used to type upper characters on the alphanumeric pad.
- ix. **Alt key** It is used the same the shift key is used i.e. in combination with other keys
- x. **Enter key** A button found on a computer's keyboard if pressed, creates a new paragraph. It is also used to perform many other functions like:
 - ❖ It is used to confirm a command in a DOS platform.
 - ❖ Used to create a page break if used in combination with the ctrl key.
 - ❖ Used to confirm entry of data in a spreadsheet program.
- xi. **Control key:** Is a key, which when pressed in combination with another key, will perform a special operation. The Control key is a modifier key; it is used in the same fashion as the Shift key.
- xii. **Delete key:** it is used to erase characters at the right hand side of the cursor while typing.
- xiii. **Backspace:** it is used to erase characters at the left hand side of the cursor while typing.
- xiv. **Num lock:** when pressed, activates the numeric pad.

Advantages of using keyboards for data input include:

- ❖ It is not necessary to buy additional equipment because most computers are normally supplied with keyboards.
- ❖ Entering data and instructions with keyboards is generally faster than with pointing devices.
- ❖ Keyboards are more reliable and usually produce fewer errors than other input methods such as voice input and optical character recognition.

Disadvantages of using keyboards for data input include:

- ❖ It takes a lot of time to practice in order to type quickly and accurately.
- ❖ Typing speeds are still very slow when compared with computer speeds.

b. Optical character recognition devices.

These convert scanned images of machine-printed or handwritten text (numerals, letters, and symbols) into a format that a computer can process; also known as optical character recognition (OCR). A typical OCR system contains three logical components: an image scanner, OCR software and hardware, and an output interface.

c. Speech recognition systems

These are systems that accept speech input and act on it or transcribe it into written language.

d. Bar code readers

A bar code is a set of parallel printed lines of differing thicknesses, which are used to store coded information about an item.

Bar codes are read using a *Bar Code Reader*, which can be in the form of a hand-held 'wand' or a stationary laser scanner over which the bar code is passed. This method of data entry is used in big shops and supermarkets and in libraries.

Advantages of using bar code readers

- a) A fast method of data entry.
- b) Eliminates possible human error during data entry.
- c) Eliminates theft in case of a business since prices are the same all through.

Disadvantage of using bar code readers

- a) Scratched or crumpled barcodes may cause problems.

e. Quick Response Code Reader(QR reader)

The **QR code** is the trademark for a type of two-dimensional bar codes in which information is represented by black and white dots (so-called "square data dots" or "data pixels").

To read information off a QR code, a QR code reader is used on smart phones, android phones or by modern bar code readers.

f. Magnetic Ink Character Reader (MICR reader)

Characters are printed using special magnetic ink, which contains iron oxide. As the document passes into the M.I.C.R. reader, the ink is magnetized, so that the shapes of the characters can be recognized electronically. They are commonly used in banks to read cheques.

Advantages of using magnetic ink character readers

- a) Documents are difficult to forge.
- b) It is fast and cuts out human error.
- c) Documents can still be read after being written on, folded, spilt on etc...

Disadvantages

- a) M.I.C.R. readers and encoders are expensive.
- b) The system can only accept a few characters.

g. Handwriting recognition system

It is the ability of a computer to receive intelligible handwritten input. The image of the written text may be sensed "off line" from a piece of paper by optical scanning (optical character recognition).

C. GAMING INPUT HARDWARE DEVICE:

These are devices with which one control and play a game on personal computer

1. Joystick

Is a computer peripheral or general control device consisting of a handheld stick that pivots about one end and transmits its angle in two or three dimensions to a computer. Joysticks are often used to control games, and usually have one or more push-buttons whose state can also be read by the computer.

2. Game pad (or joy pad)

Also called joy pad or control pad, is a type of game controller held in the hand, where the digits (especially thumbs) are used to provide input. Game pads generally feature a set of action buttons handled with the right thumb and a direction controller handled with the left.

Others include:

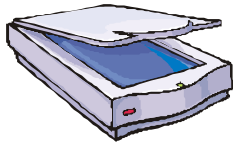
- a) Paddle
- b) Power Pad
- c) Light guns,
- d) Dance pads
- e) Motion-sensing controllers

D. Image, Video Input Hardware Devices

Are devices that are used to record video, images and other moving activities with one late downloads to the computer for storage, saving, copying onto media.

They include among others

1. Image scanner



A scanner is a device used to digitize graphics for a computer. Hand-held scanners may be passed over a picture. Flatbed scanners remain still while the picture is scanned. As well as digitizing pictures, scanners may be used for capturing text from documents (see OCR). It is also used as a photocopying device.

2. 3D scanner:

A graphics input system that records x, y and z coordinates of a real object. Contact is made with various points on the object's surface by a light sensor.

3. Digital camera



A photograph can be taken by a *digital camera* and then downloaded into the computer from the camera. There is no need to buy film. Some digital cameras are used as surveillance cameras e.g. for taking pictures of speeding cars.

4. Digital camcorder



It is a light weight, handheld video camera, especially one that records data in digital form onto a storage device such as a videotape, DVD, or hard disk.

5. Webcam



It is a digital video camera that can be directly connected to a computer. It usually takes a digital picture at regular intervals and uploads the picture to an Internet website.

Web cams are used for *teleconferencing/video conferencing*. Users communicate with each other using microphones and speakers as well as web cams to see each other on their monitors.

6. Digital video recorder

A digital video recorder (DVR) (or personal video recorder (PVR) is a device that records video without videotape to a hard drive-based digital storage medium.

1. Digital video cameras

It can record video in digital form so that it can be downloaded to a computer for editing.

E. AUDIO INPUT DEVICES

Are devices with which helps a user to record sound waves into a digital file on a computer. Examples include:-

1. Digital voice recorder.

It is a sound recording device most commonly used to record speech for later playback or to be typed into print.

2. Microphone



Is the input device used (in union with software such as "sound recorder") to turn sound waves into digital files that a computer can understand.

F. BIOMETRIC INPUT HARDWARE

A biometric device is an input device that translates a personal characteristic into digital codes that are compared with a digital codes stored in the computer. these are biological characteristics that are unique to individuals. They include the following;

a) Finger print scanner.

This captures curves and indentations of a finger print. Some shops today use finger print scanners as a means of payment especially with credit cards.

b) Face verification systems

This captures a live image of the face of an individual and compares it with the storage image for verification. Most building with important materials especially in offices of law enforcement use face recognition systems to secure these materials. It is now used on PCs at boot up.

c) Hand geometry system

These measure the shape and area/size of individual hands. They are mostly used by companies to register times and attendances of workers or by day care centers to tell real parents while they pick children.

d) Voice recognition system

A **voice verification system** compares a person's live speech with their stored voice pattern. Some larger organizations use voice verification systems as time and attendance device. Many companies also use this technology for access to sensitive files and networks.

e) An iris recognition system

High security areas use iris recognition systems. The camera in an *iris recognition system* uses iris recognition technology to read patterns in the iris of the eye to verify claiming individuals.

Other specialized input devices include:

1. *Midi instrument for musical notes*
2. *Sensors for signals*
3. *Remote controls for ray signals*

OUTPUT HARDWARE

Output is data that has been processed into a useful form called *information*.

Categories of output;

- ✓ Text output
- ✓ Graphics
- ✓ Audio
- ✓ Video/image output

Examples of output devices include;

- ✓ Display devices e.g. monitors, projector, etc
- ✓ Printers
- ✓ Speakers
- ✓ Fax machine

DISPLAY DEVICES (text, graphics, video)

These are output devices that visually present text, graphics, and video information. The information displayed on the screen is called **soft copy**. Most of these display devices are screens. Most especially PCs use monitors as display devices.

Monitors

Monitors can be either monochrome (single colour which is black and white) or coloured (display many colours).

Types of monitors✓ **CRT(Cathode Ray Tube)**

A CRT monitor works like a standard television because it also contains a Cathode Ray Tube (CRT). The front of the CRT is the screen, which is coated with tiny dots of phosphor material. Each dot consists of a red, a green, and a blue phosphor and the three dots combine to make up each pixel.

Advantages of CRT monitors include

- a) Can produce fast color output.
- b) Can be viewed from a very wide angle.
- c) Cheaper in cost than LCD monitors in general.

Disadvantages of CRT monitors include

- a) Emit higher electromagnetic radiation (EMR) than LCD monitors.
- b) Consume more energy than LCD monitors.
- c) Consume much desk space.

✓ **LCD(Liquid Crystal Display)**

A LCD (Liquid Crystal Display) monitor uses liquid crystal rather than a cathode ray tube, to create images on the screen.

Advantages of LCD monitors include

- a) LCD monitors require less than one-third the power of a CRT.
- b) LCD monitors take up less desk space than traditional CRT monitors.
- c) Radiation emitted by LCD monitors is less than that of CRTs.
- d) They have a narrow viewing angle compared to CRT monitors.
- e) They have a higher refresh rate compared to CRT monitors.
- f) They have a higher color rich resolution than CRTs.

Disadvantages of LCD monitors include

- a) LCD monitors are usually more expensive than CRT monitors.
- b) LCD monitors can only be viewed from a very narrow angle.

Measurements of monitor performance

The performance of a monitor is measured by the following parameters:

- a) **Luminance** is measured in candelas per square meter (cd/m² also called a Nit).
- b) **Aspect ratio** is the ratio of the horizontal length to the vertical length. Monitors usually have the aspect ratio 4:3, 5:4, 16:10 or 16:9.
- c) **Viewable image size** is usually measured diagonally, but the actual widths and heights are more helpful since they are not affected by the aspect ratio in the same way. For CRTs, the viewable size is typically 1 in (25 mm) smaller than the tube itself.
- d) **Display resolution** is the number of distinct pixels in each dimension that can be displayed. Maximum resolution is limited by dot pitch.

- e) **Dot pitch** is the distance between sub pixels of the same colour in millimetres. In general, the smaller the dot pitch, the sharper the picture will appear.
- f) **Refresh rate** is the speed that the monitor redraws images on the screen. Refresh rate is measured in hertz, which is the number of times per second the screen is redrawn.
- g) **Response time** is the time a pixel in a monitor takes to go from active (white) to inactive (black) and back to active (white) again, measured in milliseconds. Lower numbers mean faster transitions and therefore fewer visible image artifacts.
- h) **Contrast ratio** is the ratio of the luminosity of the brightest colour (white) to that of the darkest colour (black) that the monitor is capable of producing.
- i) **Power consumption** is measured in watts.
- j) **Viewing angle** is the maximum angle at which images on the monitor can be viewed, without excessive reduction in quality of the image. It is measured in degrees horizontally and vertically

PRINTERS (text, graphics)



A printer is an output device that produces text and graphics on a physical medium such as paper. Printed information is often called **hard copy** because the information exists physically and is a more permanent form of output than that presented on a display device (**soft copy**).

The material on which information is printed is called a **print material**. This can be paper, cloth, glass, wood, plastic, etc

Printers come in different types depending on the nature of work as designed by the manufacturer. Printers can be categorized in several ways the most common distinction is the **IMPACT** and **NON-IMPACT** printers.

IMPACT PRINTERS.

These are printers that produce hard copy output by the print heads physically touching the print media. These include;

- a) **Character printers:** These print one character at a time mimicking a typewriter. E.g. **daisy wheel printer, thimble printers.**
- b) **Line printers:** These print an entire line at a time. eg **band- matrix printer, shuttle-matrix printer.**
- c) **Dot matrix printer:** these form characters by print heads forming a pattern of dots on paper to give an out put. eg **Epson series.**
- d) **Page printers:** These print an entire page at a time. These are faster than the above categories. eg Epson LQ 1170.

Advantages of impact printers

- ❖ They are easy to maintain since they withstand most conditions.
- ❖ They are inexpensive.
- ❖ They have long life spans.
- ❖ Can print heavy graphics.
- ❖

Disadvantages of using impact printers.

- ❖ They are noisy during operation.
- ❖ They tend to overheat during operation.

- ❖ They produce poor quality compared to non-impact printers.
- ❖ They are slow compared to non-impact printers.
- ❖ They require special form of papers.

NON-IMPACT

These are printers that produce hard copy output without the print heads physically touching the print media. These include;

- a) **Inkjet printers:** are non – impact printers that form characters and graphics by spraying tiny drops of liquid ink onto a piece of paper.
- b) **Photo printers:** This is a color printer that produces photo-lab-quality pictures.
- c) **LaserJet printers:** It creates images using a laser beam and powdered ink, called toner, which is packaged in a cartridge. These have memory and are generally fast.
- d) **Thermal printers:** These are printers which generate images by pushing electronically heated pins against heat sensitive paper.

Advantages of using non- impact printers

- ❖ They are quiet during operation.
- ❖ They don't overheat during operation.
- ❖ They produce good quality compared to impact printers.
- ❖ They are fast compared to impact printers.
- ❖ They require little power compared to the impact printers.

Disadvantages of using non-impact printers.

- ❖ They are expensive compared to impact printers.
- ❖ Most are selective on the type of paper they use.
- ❖ Cartridges are special for most of these printers.

Factors to consider before buying a printer

- a) **Resolution:** A printer's resolution helps to determine quality of images it can produce. Higher resolution means higher quality images. Printer resolution is measured in dots per inch (dpi).
- b) **Speed:** A printer's speed determines how quickly it can output pages. Speed is measured in two ways: in Characters Per Second (cps) or in Pages Per Minute (*ppm*). Printers usually slow down quite a bit when printing pages with a lot of complicated graphics, or colour images.
- c) **Ink Cartridges and Toner:** computers are a lot faster than most printers are, so they can send information faster than the printer can accept it. A printer buffer or spooler fixes this problem.
A **print buffer** works like a dam: it holds back the information and releases it at a rate that the printer can handle.
- d) **Cost of Ink/ cartage;** Today many Inkjet printers are cheap. The ink for most printers costs a lot of money. Inkjet printers use ink cartridges that seem to run dry at an alarming speed. Laser printers use toner cartridges filled with the same messy black powder that is found in copy machines. Laser toner cartridges last a lot longer than Inkjet cartridges, but they also cost significantly more.
- e) **Memory:** Laser printers have their own memory, or RAM, just like a computer. This memory is used to store pages before they are printed. Memory is important for printing complex or high - resolution images. Most laser printers have anywhere from 2 MB to 8 MB of memory.

- f) **Print Buffer and Spooler:** Computers are a lot faster than most printers are, so they can send information faster than the printer can accept it. A printer buffer or spooler fixes this problem. A print buffer works like a dam: it holds back the information and releases it at a rate that the printer can handle.
- g) A printer's resolution helps to determine quality of images it can produce.
- h) A printer's speed determines how quickly it can output pages.
- i) Purpose of the printer.
- j) Cost of the printer.
- k) Multifunction vs. stand alone printing capabilities.
- l) Type of printer to be bought? Is it impact or non impact?
- m) Running cost of the printer.
- n) Whether the printer can carry out duplex printing.
- o) Number of paper trays available.
- p) Capability of sharing the printer through a network for large organisations.

Ways a user cares for a printer;

- **Keep your printer clean** - Be sure to clean the printer regularly inside-out and close the paper feed trays when not in use.
- **Keep it covered** - When not in use, cover the whole printer unit with a cloth or a plastic cover.
- **Turn it off** - When the printer is not in use, press the Power button on the printer to shut it down and turn off the mains.
- **Use it frequently** - Use your printer at least once every two weeks to ensure that it is in a proper working condition.
- **Maintenance Mode** - Every printer features a maintenance mode that self checks the entire unit to make sure everything is working well. So carry out the printer maintenance every 1 or 2 months.
- **Avoid cheap/refilled ink cartridges and toners** - Not only can they be messy, but they also stand to affect the printer's performance and the quality of your prints. Always use original cartridges as recommended by the manufacturer.
- **Avoid cheap paper** - Using cheap, low quality papers with your printer can affect the print quality and cause paper jams. Manufacturers generally specify the type of paper you need to use.
- **The paper** - Try not to use papers that are bent, folded, torn or previously used, as they will affect the final print output. Always store papers in a low humidity environment.
- **Refer to the manual** - Printers generally vary in terms of functionality, operation and maintenance across different manufacturers. So always refer to your printer's user manual or service manual to see what is recommend for your printer.
- **Replacing cartridges and handling** - As printers get smaller and more functional, they use the latest technologies and electronics to keep them going. So when you need to replace the cartridges or check something inside the printer, make sure you are as gentle as possible, so as to not affect any components inside the unit or use excessive force during this process.

SPEAKERS (audio/speech)

Audio output devices produce sound /speech or beeps. These include;

- ❖ Speakers.
- ❖ Headphones/headsets.

- ❖ Earphones.

PROJECTORS

This displays information from the computer screen on a large screen that the audience can clearly see.

Most schools use projectors in their classrooms. These can also be connected on a network and operated remotely.

Types of projectors

- ❖ LCD(Liquid Crystal Display)
- ❖ DLP(Digital Light Processing)

INPUT/OUTPUT DEVICES

There are devices that enter data into the computer as well as present/display information from the computer. These include;

- ❖ Fax machine.
- ❖ Multifunctional peripheral like printers, scanners, etc
- ❖ Interactive white board (smart board).
- ❖ Digital camera.
- ❖ Touch screen.

COMPUTER STORAGE

Data storage refers to keeping data for some time. This time can be short (temporary) or long time (permanent).

Common terms used in computer storage.

- Reading** is the process of transferring data, instructions, and information from a storage medium into memory.
- Writing** is the process of transferring these items from memory to a storage medium.
- Memory** is a temporary area for holding data, instructions, and information.
- Storage capacity** refers to how much data a storage medium is able to hold.
- Storage medium** refers to the physical material actually holds data e.g. CD, H, memory card, flash disk, hard disk, etc
- Storage device** refers to hardware components that are used to record and retrieve data to and from a storage medium eg.CD drive, HDD,Flash disk drive, etc
- Data/information access mode** refers to how an item can be accessed on a medium either sequentially or randomly .there are two type of data access modes ie
 - ❖ **Direct/random access mode.** This is a mode of access in which data items are accessed without following any sequence.eg flash, a CD, HDD, SD,DVD, etc
 - ❖ **Sequential access mode.** This is a type access in which data items are accessed in order from the first to the last eg tape, .
- Access time** refers to the time it takes to locate an item on a storage medium.
- Transfer rate** this refers to the speed at which data is transferred from one device to another.

FACTORS CONSIDERED IN CLASSIFYING STORAGE.

- ❖ Amount of data stored.
- ❖ Method of data access.
- ❖ Technology used to store data.
- ❖ Whether the storage medium is fixed or removable?
- ❖ Whether the storage device is internally or externally connected?
- ❖ Whether the storage device can hold data for a short time or for a long period of time?

- ❖ Whether the storage device is fast or slow at being accessed?

Primary memory

Refers to a storage location that is directly acced by the Proccessor. Examples of primary storage include:

1. **Random Access Memory:** is an example of primary volatile memory in the system unit. Contents in RAM can be updated, adjusted and modified. RAM is directly connected to the central processing unit. Items in RAM that are needed for future use must be saved to a storage device before the computer is turned off. The two basic types of RAM are **Dynamic** RAM and **Static** RAM. RAM chips are usually packaged on a small circuit board that is inserted into the motherboard.
2. **Read Only Memory:** ROM (Read- Only Memory) is an example of non-volatile memory. ROM chips containing data, instructions, or information, which is recorded permanently by the manufacturers are known as firmware.

Variations of ROM chips include

- a) Programmable read-only memory (PROM), which is a type of ROM chip on which permanently items, can be placed.
 - b) Erasable programmable read-only memory (EPROM)
 - c) electrically erasable programmable read-only memory(EEPROM) are ROM chips designed to be modified by users
3. **Virtual Memory:** With virtual memory (VM), the operating system allocates a portion of a storage medium, usually the hard disk, to function as additional RAM. The area of the hard disk used for virtual memory is called a swap file. The amount of data and program instructions swapped or exchanged at a given time is called a page.
 4. **Cache Memory:** cache memory speeds the processes of computing by storing frequently used instructions and data.
 5. **BIOS:** contains the basic input/output system (BIOS), which is a sequence of instructions the computer follows to load the operating system and other files when the computer is turned on.

When you turn on your computer, the BIOS does several things. This is its usual sequence:

- a) Check the CMOS Setup for custom settings.
 - b) Load the interrupt handlers and device drivers.
 - c) Initialize registers and power management.
 - d) Perform the Power-On Self-Test (POST).
 - e) Display system settings.
 - f) Determine which devices are bootable.
 - g) Initiate the bootstrap sequence.
6. **CMOS:** CMOS (Complementary metal-oxide Semiconductor) is used to store configuration information about the computer, which includes amount of memory, types of disk drives, keyboard, monitor, current date and time, etc. CMOS chips use battery power to retain information even when the computer is turned off. The CMOS chip is updated whenever new components are installed.

7. **Registers**; these are high speed temporally storage locations used to hold instructions in the proccer.

Functions of primary memory

- a) It stores programs and files under current use.
- b) Stores files needed for a complete boot process of the computer.
- c) It determines efficiency and performance of a computer.
- d) It provides extra space for the CPU while processing data by swapping files in and out of the hard drive.
- e) It established the basic communication between basic input and output devices on a computer e.g. mouse, keyboard, and monitor, etc
- f) It stores a log of frequently visited files which increases the speed of accessing that particular file.
- g) Primary memory enables the user to recover work in memory for the last 5 minutes in case of a power cut.
- h) Very important for a user to take a purchase decision of a computer set e.g. amount of RAM, amount of Video card ROM BIOS, etc

MEMORY MEASUREMENT

In a computer system, data is represented using the binary coding system (a combination of binary digits called bits) .there are only two binary digits; 1(on) and 0(off). 8 of these bits are arranged to represent a character.

Definition

- ❖ **Bit.** This is the smallest unit of memory measurement
- ❖ **Nibble.** This is a group of four binary bits.
- ❖ **Byte.** This is a set of eight bits. Each byte represents a character.
- ❖ **Kilo byte.** This is a set of 1024 bytes.
- ❖ **Megabyte.** This is a set of 1024 KBs.
- ❖ **Giga byte.** This is a set of 1024 MBs.
- ❖ **Tara byte.** This is a set of 1024 GBs4

Classification depending on technology used

1. **Magnetic storage**, these use electromagnetic fields

- a) Magnetic tape formats
- b) Reel-to-reel audio tape recording
- c) Compact audio cassette
- d) Digital Audio Tape
- e) Floppy disk
- f) Hard disk

2. **Optical Media formats:** These use a bean of light (lesser beam)

- a) Compact disc
- b) DVD
- c) Blue ray

3. **Solid-state storage:** these are totally electronic and have no moving parts

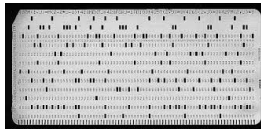
- a) Flash disk.
- b) Memory cards.
- c) SSD hard drive

Storage Medium: these are hardware components are capapble of retaining/ holding data. They perform the following functions:

- a) Serves to work as backing storage.
- b) It stores large programs and files needed by the computer to work for example application software and operating system software.
- c) It is a yardstick considered when a user is to take an accurate decision before computer purchase.
- d) It is used in the music and film industry in distribution of their products.
- e) It is used in the software industry as an ideal storage location and distribution of software products to end users.

Storage medium includes;

1. **The punched card (or "Hollerith" card):** Is a recording medium for holding information for use by automated data processing machines. Made of stiff cardboard, the punch card represents information by the presence or absence of holes in predefined positions on the card.



2. **Magnetic Tape:** Data is stored as magnetic fluctuations along the length of a specially coated plastic tape, similar to the common audiotape. The coded data is processed (or translated) into useful information by the computer. Data is accessed sequentially as the first to store will be the first to access and the last will be the last to access in that order
 - a) Can hold thousands of megabytes (MB) of data depending on the length of the tape.
 - b) Useful for daily backups of all work and programs on a large network.
 - c) Can be set to run automatically during the night and then will only be needed in an emergency.



Disadvantage of using tape:

- (a) Very slow, as need to wind tape (perhaps a long way) to find any specific position of data to view.

3. **Floppy Disk:** Data is stored magnetically and uses a material similar to tape. It needs to be formatted to provide a layout of tracks and segments to organize where the data is stored. One spin of the disk provides access to all the data and so much faster access than tape (about 36 KB per second) but it only starts spinning when requested. Each disk can hold only 1.44 megabytes or 360 KB of data.



Care and maintenance of the floppy diskettes:

For proper use of the floppy diskettes, one must study the following aspects:

- a) Keep diskettes away from magnet fields, such as near wire telephones, loud speakers, and other appliances, which contain magnets.
- b) Do not keep heavy objects on top of the diskettes.
- c) Do not fold or bend diskettes.
- d) While labeling or writing on the diskettes use felt tip pen, not pencil or ballpoint pen.
- e) Do not expose the disk to excessive heat or light.
- f) Do not use alcohol thinners, to clean the disk surface.
- g) Do not touch the disk surface.

- 4. Hard Disk:** Made of stronger material (aluminum) and fixed permanently together with its drive mechanism inside the computer. Data is stored magnetically. Spinning at the required speed all the time. It is very much faster to access than a floppy disk or CD-ROM (faster than 1 MB per second). It can hold thousands of megabytes (gigabytes) of data. It is used for storing all programs and work files for very fast access by the computer.



Advantages of using hard disk for data storage

- ❖ They provide a greater storage capacity
- ❖ They are speedy
- ❖ They are cheaper than floppy disks per mega byte.
- ❖ They are more reliable than floppy disks
- ❖ It's not easy to misplace them since they reside inside.
- ❖ The life of hard disks is long once in use.

Disadvantages of using hard disks for data storage

- ❖ They are not portable compared to flash disks
- ❖ They are easily attacked by viruses in unprotected systems.
- ❖ They lose data due to vibration and shaking.

- 5. Compact Disk (CD-ROM):** Uses laser (light) technology to store the data. Comes with the data already on it for reading only (ROM = Read Only Memory) and hence cannot be written to for everyday storage. Like a floppy disk, it has to spin up to the correct speed each time it is accessed.

Advantages of using a CD – ROM

- (a) Much faster to access than a floppy but currently slower than a hard disk .
- (b) Can hold 650 MB -700 MB(megabytes) of data and more.
- (c) Useful for the distribution of today's large programs and information libraries, which you can then copy (all or in part) onto your hard disk.
- (d) Also widely used by the music industry as they give better quality sound and do not wear out like audiocassette tape.
- (e) It is the safest form of storage, provided that you don't attack it with a sharp or heavy object.

- 6. Digital Versatile Disc (DVD):** (Also known, as a Digital Video Disk) is a very large capacity CD with similar access speed. It can store up to 4.7 GB (gigabytes) of data, which is more than enough to store 8 music albums with full video presentation, or 4 feature-length films. A DVD drive can also read a normal CD-ROM.

- 7. Blue Ray:** refers to the blue laser used to read the disc, which allows information to be stored at a greater density than is possible with the longer-wavelength red laser used for DVDs. These store large amounts of data than other optical devices (up to 128GB)

PROCESSING HARDWARE (THE CPU)

This is a computational device whose major task is to process data. It is also called the *brain* of the computer. It carries out all instructions and tells hardware components how to work. The CPU has the following functions;

- ❖ It controls devices under its care.
- ❖ It helps in all the stages of data processing.

- ❖ It is the chief brain of the computer which performs logical, computational and comparisons of data.
- ❖ It determines how fast the computer performs a given function.
- ❖ It is used as yardstick to determine type and model of computer.
- ❖ It helps the user to work with many programs at the same time.
- ❖ It controls which part to handle which category of task within the computer.

Parts of the CPU

1. Control unit

The control unit directs and coordinates most of the operations in the computer.

2. Arithmetic logical unit

Specifically, the ALU performs the arithmetic, comparison, and logical operations. Arithmetic operations include addition, subtraction, multiplication, and division.

Comparison operations involve comparing one data item to another, and determine if the first item is greater than, equal to, or less than the other item. Logical operations work with conditions and logical operators such as AND, OR, and NOT.

3. Registers

Registers are high-speed temporary storage locations used to hold data and instructions in the CPU.

A microprocessor contains many different types of registers, and each performs a specific function.

Common types of registers include

- a) **Program counter**, which holds the address of the next instruction to be fetched from the memory.
- b) **Instruction register**, which holds the current instruction fetched from memory.
- c) **Instruction decoder**, which interprets, or decode, the instruction currently held in the instruction register.
- d) **Accumulator**, which holds the data item to be processed and the results of arithmetic and logical operations.
- e) **Status register**, which holds a collection of condition flags, which describe the status of the most recent operation carried out by the ALU.

The machine cycle

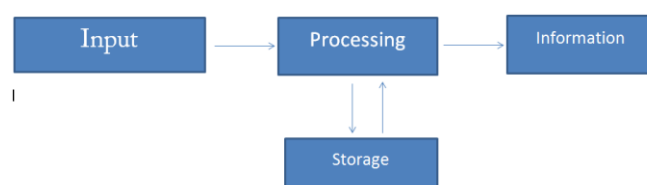
The central processing unit carries out instructions in a series of stages called the machine cycle. The four basic operations of the machine cycle are

1. **Fetching** is the process of obtaining a program instruction or data item from memory.
2. **Decoding** is the process of translating the instruction into commands that the computer understands.
3. **Executing** is the process of carrying out the commands.
4. **Storage** is the keeping of data in the CPU location temporary.

THE INFORMATION PROCESSING CYCLE

This refers to a series of input, process, storage, and output activities.

INFORMATION PROCESSING CYCLE



Data is a collection of raw and unprocessed facts, figures, and symbols. Such facts are of little meaning or significance until they are sorted or put in more useful manner. Examples of data include: letters (e.g., a, b, c...), words and symbols, numbers, examination scores, musical notes

Information is data that is processed, organized, meaningful, and useful. E.g. Words (e.g., apple, boy, cat), a report, a letter, an essay, mathematical formula, Comments, grades

The six basic stages of information processing

1. Collection of Data -- capturing data from their sources and recording it onto some media (e.g., paper).
2. Preparation of Data -- copying, grouping, or arranging data in a more convenient way for input. Checking and verifying the data collected are often done at this stage.
3. Input of Data -- entering the data or sending the stored data into the processing system. Checking the accuracy and validity of the input data are often done at this stage.
4. Processing of Data -- calculating or manipulating the input data and even storing the results for future use.
5. Output of Information -- giving out the processed results in a readable form (e.g., a report).
6. Data/information storage --the keeping of raw facts or information in a computer until such a time when the user needs it.

BUSES

A bus is a common pathway through which information is connected from one component to another. This pathway is used for communication and can be established between two or more computer components.

Functions of Buses

- Data sharing - the expansion bus must be able to transfer data between the computer and the peripherals connected to it.
- Addressing - A bus has address lines, which match those of the processor. This allows data to be sent to or from specific memory locations.
- Power - A bus supplies power to various peripherals that are connected to it.
- Timing - The bus provides a system clock signal to co-ordinate the peripherals attached to it with the rest of the system.

Computers can be viewed to be having just two types of buses:

- System bus: The bus that connects the CPU to main memory on the motherboard. The system bus is also called the front-side bus, memory bus, local bus, or host bus.
- A number of I/O Buses, (I/O - Acronym for input/output), connecting various peripheral devices to the CPU.

Examples of buses used in data processing

- **Control Bus:** Is used by the CPU to direct and monitor the actions within the central processing unit.
- **Address Bus:** An address bus consists of all the signals necessary to define any of the possible memory address locations within the central processing unit.
- **Data Bus:** Sometimes referred to as memory bus, the data bus is used to transfer instructions from memory to the CPU for execution. It carries data (operands) to and from the CPU and memory as required by instruction translation.

Common information processing systems

1. A **batch processing system:** is one where data are collected together in a batch before processing starts..

Advantages of a batch processing system include

- a) Once data is submitted for processing, the computer may be left running without human interaction.
- b) The computer is only used for a certain period of time for the batch job.
- c) Jobs can be time-tabled for when the computer is not busy.

Disadvantages of a batch processing system include

- a) There is always a delay before work is processed and returned.
- b) Batch processing usually involves an expensive computer and a large number of trained staff.

2. Real-time Processing System: is one that processes data without significant delay.

- a) Examples of real-time processing systems include anti-missile defense systems, airplane landing control system, flight simulation systems, electronic fund transfer systems, and tickets reservation systems.
- b) Real-time processing systems are usually interactive processing systems.

Advantages of a real-time processing system include

- a) There is no delay for response.
- b) Information is always up-to-date.
- c) Output from the computer may be used to adjust and improve the input.

Disadvantages of a real-time processing system include

- a) A computer must be dedicated only to the task.
- b) The computer must be continually online.

3. Interactive Processing System: is one that involves communications between the user and the computer during processing.

- a) Examples of interactive processing systems include electronic fund transfer systems, tickets reservation systems, and point-of-sales systems.

4. Multi-tasking System: is one that can handle a number of different jobs at the same time.

- a) Actually, the CPU cannot do two things at the same time, but makes use of 'idle time' to increase the capacity of a computer.
- b) An example of multi-tasking is typing in a word processor while listening to music played from a CD-ROM.
- c) Both batch and interactive jobs may be run in a multi-tasking environment.

5. Multi-user System: is a time-sharing system that allows different users to independently run different programs at the same time.**6. Time-sharing System:** is one that allows multiple users to share time on a single computer.

- a) The following are common data collecting and processing equipment in offices today. Typewriters - manual/electronic, Fax machines, Electronic mails and internet, Telephones, Computers.

Disadvantages of Manual systems

- 1. Slow** i.e. it takes a lot of time to find particular information and put it in a more useful way depending on a need at particular time.

2. **Rigid:** Information is normally kept in a given order and may not be changed to another form easily.
3. **Space:** Paper files and archives take large space to store. This may be quite expensive.

Advantages of manual systems

1. Cheap
2. Simple to understand.
3. Power failure does not affect the system.

SYSTEM START-UP

Booting a computer

Booting is the process of starting or resetting a computer, which involves loading an operating system into memory.

There are two methods of booting a computer. They include:

1. **Cold booting:** is the initial process of turning on a computer after it has been powered off completely.

The steps that occur during a cold boot using the Windows operating system are:

- a) If all the cables are well connected, turn on the wall switch that sends the power to the power supply unit.
- b) The power supply sends an electrical signal to the motherboard and other devices located in the system unit.
- c) The CPU resets itself and looks for the ROM that contains the BIOS
- d) The BIOS executes the Power-On Self Test (POST) to make sure that the computer hardware is connected properly and operating correctly
- e) The results of the POST are compared with data in a CMOS chip on the motherboard.
- f) If the POST is completed successfully, the BIOS looks for the boot program that loads the operating system.
- g) Once located, the boot program is loaded into memory and executed, which then loads the kernel of the operating system into RAM.
- h) The operating system loads system configuration information, and the remainder of the operating system is loaded into RAM, and the desktop and the icons display on the screen.

2. **Warm booting:** Alternatively referred to as a soft boot, a warm boot is one method of resetting a computer system that is already powered on.

A warm boot can be accomplished by pressing the CTRL - ALT - DEL keys simultaneously, or by selecting the restart command from an operating system menu. Warm boots run faster than turning a computer off and on again.

Reasons for restarting a computer include:

1. Commonly used to recover from errors that cannot be recovered.
2. When a computer locks or freezes.
3. After installing of certain new software program.
4. After installing a new hardware device like a flash disk.
5. After uninstalling a hardware device.
6. After uninstalling a software program.
7. When the computer slows down.
8. After changing CMOS or BIOS setup.
9. When a computer has a virus, it can constantly restart itself.

Kernel

This is the core of an operating system responsible for;

- ✓ managing memory,
- ✓ Managing files and devices,
- ✓ maintaining the computer's clock,
- ✓ starting applications and

- ✓ Assigning the computer's resources such as printers, scanners.

NB The kernel is referred to as a memory resident because it remains in memory while the computer is running.

Topic: COMPUTER SOFTWARE

What is computer software?

Software is the series of instructions that tells the hardware how to work.

Categories of Computer Software

Software is categorized into ;

1. System software
2. Application software

1. Systems Software

System software consists of programs that control the operations of a computer and its devices. System software also serves as the interface between the user, the application software and hardware. There are three categories of systems software.

Three categories of system software are;

- **Operating system,**
- **Programming languages**
- **Utility programs.**

The Operating System

An operating system (OS) is a set of programs containing instructions that co-ordinate all the activities among computer hardware devices. The operating system so much relies on the **device driver** to communicate with each hardware device.

NB. a device driver is a small program that tells the OS how to communicate with the device.

Popular operating systems for microcomputers include:

1. DOS
2. Windows OS
3. Mac OS
4. NetWare
5. UNIX
6. Linux
7. Solaris
8. Palm OS
9. Pocket PC 2002

Functions of operating systems

- It provides basic working environment/user interface on a computer.
- It helps to control the use of peripherals.
- It helps to control the loading and running of application programs.
- It helps to organize the use of memory/Memory management
- It helps in the booting process of a computer.
- It helps in file management
- It helps in protecting hardware and software.
- It helps in the process of connecting devices to work with a computer (configuring devices)
- It helps in the processor management e.g. multitasking and time sharing.

Types of operating system software

There are different types of operating systems. These are as follows:

1. **Real-time Operating System:** It is a multitasking operating system that aims at executing real-time applications.
2. **Distributed Operating System:** An operating system that manages a group of independent computers and makes them appear to be a single computer is known as a distributed operating system.
3. **Embedded System:** The operating systems designed for being used in embedded computer systems are known as embedded operating systems.
4. **Single-user, single task:** As the name implies, this operating system is designed to manage the computer so that one user can effectively do one thing at a time. The Palm OS for Palm handheld computers is a good example of a modern single-user, single-task operating system.
5. **Single-user, multi-tasking:** this operating system is designed to manage the computer so that one user can effectively do more than one task at a at the same time, it's entirely possible for a Windows user to be writing a note in a word processor while downloading a file from the Internet while printing the text of an e-mail message.
6. **Multi-user operating system:** enables two or more users to run a program simultaneously.
7. **Multitasking operating system:** allows a single user to work on two or more applications that reside in memory at the same time
8. **Multiprocessing operating system:** can support two or more CPUs running programs at the same time.

User Interfaces

This is the environment given by the OS to control how a user enters data and instructions and how information is displayed. There are two types of user interfaces;

1) Command line interface (CLI)

This is the type of an interface in which users enter data and instructions by typing key words or pressing special keys.

Advantages a CLI

- ✓ Takes little memory space
- ✓ Does not require very fast processors.
- ✓ Operations are fast since command are entered using the keyboard.
- ✓ Many commands can be sent together as a batch file for repetitive tasks.

Disadvantages of CLI

- ✓ Commands have to be learnt and memorised.
- ✓ It is not user friendly
- ✓ The interface may vary from one application to the other.

2) Graphical user interface.

This is a type of interface in which users use menus and visual images (icon) to enter command into the computer.

Advantages of a GUI

- ✓ It is user friendly
- ✓ No need to type or memorize any command language
- ✓ The interface is similar for any application.

Disadvantages of a GUI

- ✓ Requires more memory
- ✓ Requires very fast processors.
- ✓ It is difficult to automate functions for expert users.
- ✓ Occupies more disk space to hold the files for all the different applications

UTILITY PROGRAMS

Utility programs are part of system software which are designed to configure, analyze, optimize and maintain a computer in its working operations.

OR

These are programs that enhance the performance of the computer

Functions of the utility programs

- ✓ Scan and fix computer viruses.
- ✓ Help in file back up.
- ✓ Compress files of disks.
- ✓ Partition disks into individual logical drives.
- ✓ Perform tasks on files (move files, delete files, merge files, etc)
- ✓ Diagnose computer problems.

Examples of utility programs

- ✓ **Anti-virus utilities:** scan for computer viruses and remove them.
- ✓ **Backup utilities:** can make a copy of all information stored on a disk, and restore either the entire disk
- ✓ **Data compression utilities:** output a smaller file when provided with a stream of files.
- ✓ **Disk checkers:** scans the content of a hard disk to find files or areas that are
- ✓ **Disk cleaners:** finds files that are unnecessary to computer and can decide to delete.
- ✓ **Disk compression utilities:** transparently compress/uncompress the contents of a disk, increasing the capacity of the disk.
- ✓ **Disk defragmenters:** increase efficiency by moving data to one side of the disk.
- ✓ **Disk partitions manager:** divides an individual drive into multiple logical drives
- ✓ **Disk space analyzers:** to get the size for each folder/ sub folders & files in folder or drive. Showing the distribution of the used space.
- ✓ **Disk storage utilities:** ensures that data is stored and files arranged in order of ascending. It also helps the computer to re-arrange data files.
- ✓ **Archive utilities:** output a stream or a single file when provided with a directory or a set of files. Archive utilities, unlike archive suites, usually do not include compression or encryption capabilities.

- ✓ **File managers:** provide a convenient method of performing routine data management tasks, such as deleting, renaming, cataloging, un cataloging, moving, copying, merging etc.
- ✓ **Memory testers:** check for memory failures.
- ✓ **Network utilities:** analyzes the computer's network connectivity, configure network settings, check data transfer or log events.
- ✓ **Registry cleaners:** clean and optimize the Windows registry by removing old registry keys that are no longer in use.
- ✓ **Screensavers:** were desired to prevent phosphor burn-in on CRT and plasma computer monitors. Modern screensavers are used primarily for entertainment or security.
- ✓ **System monitors:** for monitoring resources and performance in a computer system.
- ✓ **System profilers:** provide detailed information about the software installed and hardware attached to the computer.
- ✓ **Sorting utility:** for organizing files in any choose order
- ✓ **Merging and combining utility:** Merges or combines different files in one.
- ✓ **Diagnostic utility:** compiles technical information about a computer's hardware and certain system software programs and then prepares a report outlining any identified problems.
- ✓ **Debuggers:** helps the computer to find out the error and fixes it.
- ✓ **Data recovery:** enables the user to get back all the data that might have been deleted or lost by virus from a computer.
- ✓ **System recovery:** it enables the user to get back to the last best known configuration settings of a computer.
- ✓ **Uninstall utility:** it enables the user to remove an application program and its associated attributes from the system.

Programming Languages

Programming languages are computer tools, editors, compilers etc used to make programs/software. Programming tools are software in the form of programs or applications that software developers (*also known as programmers, coders, hackers or software engineers*) use to create, debug, maintain (i.e. improve or fix).

Categories of programming languages

- ✓ **High level languages.** These are languages understood by human beings alone. They are machine-independent and contain **syntax** that enables a programmer to generate **codes** that solve a problem. E.g. Java, Python, C, C⁺, C[#]
- ✓ **Low level languages.** These are languages that are only understood by computer. These are represented in binary form (electronic).e.g. machine language, assembly languages

Language processors (translators)

These are programs used to translate high level programming languages to low level programming languages that the processor understands.

1. **Compilers:** These translate a program written in a high level language into machine code language. The entire program is translated into machine code at once.
2. **Assemblers:** These translate a low level language (assembly language) into machine code.
3. **Interpreters:** These translate source program, line by line while the program is running.

4. **.Linkers:** These programs combine compiled programs and determine where the program will be located in memory.

The common examples of programming languages

- ✓ COBOL(Common Basic Oriented Language): it was used to produce business applications like payroll, accounting and stock control.
- ✓ BASIC (Beginners All Purpose Symbolic Instruction Code): it was common used in school to teach students how to use a computer.
- ✓ FORTRAN (Formula TRANslation): it was mostly use to develop application used in engineering since it has mathematical functions.
- ✓ PASCAL: It was used to develop business and scientific applications.
- ✓ ADA: it was named after ada Augusta lovelance of the USA defence department .it was developed to improve software reliability.
- ✓ LISP (List Processing) : it was developed for artificial intelligence.
- ✓ LOGO: it was developed for educational use.
- ✓ ALGOL (Algorithmic Language) for scientific and engineering computations.
- ✓ C, C+, C++: high level language for web design.
- ✓ JAVA: for web design.
- ✓ HTML (Hyper Text Mark up Language) for web designing.

Characteristics of a good programming language

- ✓ ***Simplicity:*** *A good programming language must be simple and easy to learn and use. It should provide a programmer with a clear, simple and unified set of concepts, which can be easily grasped.*
- ✓ ***Naturalness:-*** *A good language should be natural for the application area, for which it has been designed. That is, it should provide appropriate operators, data structures, control structures, and a natural syntax to facilitate the users to code their problem easily and efficiently.*
- ✓ ***Abstraction:-*** *Abstraction means the ability to define and then use complicated structures or operations in ways that allow many of the details to be ignored.*
- ✓ ***Efficiency:*** *- Programs written in a good programming language are efficiently translated into machine code, are efficiently executed, and acquire as little space in the memory as possible..*
- ✓ ***Structured:*** *- Structured means that the language should have necessary features to allow its users to write their programs based on the concepts of structured programming.*
- ✓ ***Compactness:*** *- In a good programming language, programmers should be able to express intended operations concisely. A verbose language is generally not liked by programmers, because they need to write too much.*
- ✓ ***Locality:*** *- A good programming language should be such that while writing a programmer concentrate almost solely on the part of the program around the statement currently being worked with.*

Forms of computer software

Packaged software: is commercial software, which is copyrighted and designed to meet the needs of a wide variety of users.

- **Software suite:** A software suite is a collection of individual application software packages sold as a single entity. A Microsoft Software suite usually includes application software: a word processor, spreadsheet software, database software, and presentation software.

Advantages of software suites include

- a) A software suite normally costs significantly less than purchasing each of the application packages separately.
- b) Ease of use because applications within a suite usually use a similar interface and share common features.

Examples of software suites

- ✓ Documents To Go (Android and others)
- ✓ *Microsoft Office*
- ✓ *Microsoft Works*
- ✓ Office suites for Android, BlackBerry, iPhone, Symbian, Windows Mobile, Windows Phone, and others.

Integrated software: this combines application programs such as word processing, spreadsheet, and database into a single, easy-to-use package. Like a software suite, the applications within the integrated software use a similar interface and share some common features. Unlike a software suite, the applications within the integrated software cannot be purchased individually.

The most popular integrated software is Microsoft Works.

Advantages of integrated software include

- a) Integrated software normally costs significantly less than a software suite, or purchasing each of the application packages separately.
- b) Ease of use because applications within a suite usually use a similar interface and share common features.

Disadvantages of integrated software include

- a) The applications within the integrated software normally do not have all the capabilities of stand-alone application software of the same kind.

Forms of integrated software include:

1. **Freeware:** is copyrighted software provided at no cost to users.
2. **Shareware:** is copyrighted software that is distributed free for a trial period, and payment is required for using the software beyond that trial period.
3. **Public-domain software** is free software donated for public use and has no copyright restrictions.

- **Computer aided design software (CAD)**

This is software which is mainly used for creating engineering, architectural and scientific drawings. It can be plans for buildings. These may include;

- ✓ AutoCAD
- ✓ Autodesk
- ✓ Micro visual technical

- **Project Management Software**

It is a kind of software used to plan, schedule, and track and analyze the events, resources and costs of a project. It helps people such as a publisher or general contractors to complete projects on time and within budget. Examples of this software;

- ✓ Microsoft project.

- **Web Page Authoring Software**

This is specially designed software for creating web pages that contain text and multimedia elements. Some web page authoring software such as Micro media Dreamweaver have capabilities of organizing, managing and maintain websites.

Examples include;

- ✓ Macromedia Dreamweaver
- ✓ Adobe Golive
- ✓ Adobe page mill
- ✓ Microsoft front page

- **Paint Nad Image Editing Software.**

This is software used in creating and modifying graphics and photo images. The paint software is used to draw pictures and shapes. The image editing software is used to retouch images and photos. These include;

- ✓ Paint shop pro
- ✓ Adobe Photoshop
- ✓ Corel draw
- ✓ Adobe illustrator
- ✓ Micro media freehand
- ✓ Microsoft photo draw

- **Video And Audio Editing Software.**

Video and audio editing software are used to modify audio and video clips, merging a series of clips and adding some effect. They include;

- ✓ Adobe premier
- ✓ Ulead video studio
- ✓ Uleadmedio studio pro
- ✓ Adobe audition
- ✓ Windows media maker

- **Communication Software.**

This consists of features that help to establish connection to another computer or network. It helps in data transmission, instruction and information between computers and other devices.

Features of communication software

- ✓ Dialing features
- ✓ File transfer features
- ✓ Terminal emulation features
- ✓ Internet access features

Examples of communication software

- ✓ E-mail software
- ✓ Web browser
- ✓ Chat room software
- ✓ News reader

- ✓ Instant messenger
- ✓ Video conferencing software

- **Multimedia Authorizing Software.**

These combine text, graphics, animations, audio and video into one application. Examples;

- ✓ Micro media author ware
- ✓ Micro media director
- ✓ Micro media flash

Application of multimedia

- ✓ Video games
- ✓ Magazines
- ✓ Electronic books
- ✓ Electronic news papers
- ✓ Simulation
- ✓ Virtual reality

Other terms used in relation to software:

- A **software update** provides bug fixes and minor software improvements and is made available by free download. Software updates sometimes include new drivers to support the latest hardware such as printers, CD drives and DVD drives.

A **software update** is sometimes called a software patch because it is applied over software that you already have installed. A software update does not provide a full software package installation.

- A **software upgrade** is a purchase of a newer version of software you currently use of a more fully-featured version of your current software.
- **Software version** is a software upgrade with enhanced and modified functionalities.

2. APPLICATION SOFTWARE

- ✓ *Application software are programs that perform specific tasks for users.*
- ✓ *They are programs designed to enable a computer to do a specific job.*

Types of application software

- 1 Off -shelf software (already made/general purpose software)
- 2 Customised software (tailor made /special purpose software/inhouse software/bespoke/)

1 Off-Shelf Software

Off-the-shelf software is software that is ready-made, available to lots of people, and a user usually pay a license fee to use it. For example, Microsoft Office

Advantages of Off-the-shelf Software

1. The software is relatively cheap as the cost of development can be spread over a large number of users.
2. The software can be very advanced (e.g. Excel or Word) as the revenues from a very large numbers of users' means that a lot of resources can be applied to its development.
3. It is easy to get support, literature and training is usually widely available as there are many other users using exactly the same software.

4. It is easy to share files produced by the software with others as chances are they also have the software available to open the file.
5. You don't have to dedicate any of your time to the development process (e.g. helping with specifications, testing etc.).
6. It is faster to get set up, as the development work has already been done.
7. If it is a commonly used package, users and I.T. staff may already be familiar with it, saving on learning time and training costs.
8. It often has more functionality than bespoke software, because the developers try to satisfy more use-cases.
9. The application is more reliable when compared to custom built software because its reliability is proven through the use by other organizations.
10. It is more maintainable because the systems documentation is provided with the application.
11. The application is higher quality because competition improves the product quality.

Disadvantages of Off-the-shelf Software

1. The software can be highly complex and will usually include large sections that you will never use (the average Word user is reputed to only use about 10% of the available facilities).
2. It tends to be a compromise. By its nature it is designed for many different types of users, each of whom will have different requirements.
3. As the software tends to be large and complicated it may take a long time to learn properly (some of the most asked for additions to later versions of Word were ones that already existed in the previous version!).
4. You may have to adjust the way that you work in order to fit in with the way that the software has been designed.
5. There will probably be operations that you require that you simply cannot do with the software.
6. As one small voice amongst many others your requests will not carry much weight.
7. If you have problems you are usually at the mercy of a large and faceless organization who may not be quite as concerned as you are if you have a major problem that absolutely **MUST** be fixed before tomorrow morning!
8. As the same system can be bought by your competitors it is very difficult to gain any competitive advantage from its use.
9. You may have to compromise on your requirements – it is unlikely you will find ready-made software that does everything you would like it to.
10. As your requirements change, the software may not be able to change to keep up – this can lead to a costly switch to a new package.
11. Lack of customization can be an issue if the software does not perform an action or process that your business requires.
12. Business processes can be an issue as you may need to change your business to fit the off-the-shelf software rather than having your software fit the business.
13. Off-the-shelf software may not provide a single solution for your requirements as a result you may have to use multiple off-the-shelf packages to achieve a final result.
14. On-going licensing costs can add to the overall cost of an off-the shelf software solution

2 Customised Software

Refers to application software that has been developed to meet special users' specific needs

The advantages of customized software

1. It is specifically designed for a particular requirement and can be tailored to fit in exactly with the way the business or organization wishes to operate.
2. It can be customized to work with other software that operate with the potential to provide a fully integrated IT infrastructure across the whole organization
3. Users usually find it easier and more interesting to use as it does not contain unnecessary or redundant facilities.
4. It is much more flexible than packaged software and can be modified and changed over time requirements and business practices change
5. The user receives much better support and can in many cases talk directly to the developers concerned.
6. If you are lucky and find a good developer then they can significantly add value to your company by suggesting alternatives, improvements and by acting as a source of IT advice and information
7. The use of professionally developed bespoke software applications can give you a significant business advantage over your competition
8. The software more closely meets your requirements, as it is developed especially for you.
9. It can be more easily integrated with existing software/other systems you have, reducing data duplication.
10. Custom software is able to perform tasks that your competitors cannot. Possibility to license the software to other companies to get back some/all of the investment.

The Disadvantages of customized Software

1. If you do not have the source code you are dangerously exposed and are wholly dependent upon the developer's continuing existence and good will. To avoid this problem make sure you choose a developer who provides you with the source code.
2. If you pick the wrong developer you could end up with an application that is unstable, unreliable and full of **bugs**.
3. The investment required will usually be much higher than with packaged software.
4. An unacceptable proportion of developers are either incompetent, unprofessional or are 'cowboys' and it can be difficult to sort out the good guys from the bad.
5. The development process for bespoke software can take a long time, from brief to development to testing. Go live can take considerable time and input from a business.
6. Support for bespoke software can become an issue if sufficient documentation is not produced or if there is limited/ no on-going support from the Developers.
7. Custom software usually does not have all the functionality you might need. If you really know your business it is highly probable that you have ideas that the software doesn't implement.
8. You need to adjust your workflow and processes to match the software.
9. Software targets only the platform that the vendor picks.

Factors to consider before buying a computer program

- *Cost of the program, it should be affordable*
- *Usability of the program, it should be user friendly*
- *System requirements.*
- *Type of program needed.*
- *Needs of the organization.*
- *Personnel to use the program.*
- *Functionalities of the program.*
- *Free from computer bugs.*

- *Software support and call centers.*
- *Type and quality of software developer.*

Common categories of application software include

1. **Word processing software:** also known as a **word processor** is used to create, edit, format, save, and print documents that contain text and graphics. For example, Ms. Word
2. **Spreadsheet software:** is used to organize data in rows and columns, and perform calculations on the data. For example, Ms. Excel.
3. **Database software:** data is stored in large volumes to allow use of objects like queries, forms, report and modules to manipulate it well.
4. **Presentation software:** is used to create presentations, which can communicate ideas and other information to a group of audience. For example, Ms. PowerPoint.
5. **Computer-aided design software:** is mainly used for creating engineering, architectural, and scientific drawings. For example Arch CAD.
6. **Desktop publishing software:** is used to design and produce complicated documents that contain text, graphics, and brilliant colors. For example, Ms. Publisher.
7. **Project management software:** is used to plan, schedule, track, and analyze the events, resources, and costs of a project. For example Ms. One Note.
8. **Personal information managers:** helps to organize personal information such as appointments and to do lists. For example, InfoPath.
9. **Accounting software:** is used by companies to record and report their financial transactions. For example, Tally, Quick Books, Sage.
10. **Paint and image editing software:** is used to create and modify graphical and photo images. For example, Adobe Photoshop.
11. **Video and audio editing software:** is used to modify a segment of video or video clips. For example, Pinnacle Studio, U-lead, Adobe Premiere.
12. **Multimedia authoring software:** combines text, graphics, animation, audio, and video into an application. For example, Pinnacle studio.
13. **Web page authoring software:** is specially designed for create Web pages that contain text and multimedia elements. For example, Adobe Dreamweaver, FrontPage, e.t.c.
14. **Personal finance software:** is often a simplified accounting program that helps a user to pay bills, balance the checkbook, track personal income and expenses, track investments, and evaluate financial plans.
15. **Educational software:** is designed to teach a particular skill about any subject. For example Encarta.
16. **Reference software:** (e.g., encyclopedias, dictionaries, health and medical guides) provides valuable and thorough information for reference purposes. For example, Rachael encyclopedia.
17. **Entertainment software:** software includes interactive games, videos, and other programs designed to support a hobby or provide amusement and enjoyment. For example Windows Media Player.
18. **Communications software:** consists of programs that help to establish a connection to another computer or network, and manage the transmission of data, instructions, and information between computers and other devices. For example Skype, Outlook, e.t.c.

WORD PROCESSORS

Word processing: This is the process of creating, editing, formatting, saving and printing text based documents.

Word processor: It is an application program used to create, edit, format, save and print text based documents.

Examples of word processors include;

- ❖ Microsoft word
- ❖ Corel word perfect
- ❖ Lotus word pro
- ❖ Word pad
- ❖ Word star
- ❖ Abi word
- ❖ Mac write, etc

Features of word processors

- ❖ **Character map:** This contains all characters and symbols not found on the key board.
- ❖ **Automatic page numbering:** Numbers the pages automatically in a document.
- ❖ **Clip art gallery:** Allows a user to insert drawings, diagrams, and photographs into a document.
- ❖ **Find and search:** Allows a user to locate all occurrences of a particular character, word, or phrase.
- ❖ **Grammar checker:** Reports grammatical errors and suggests ways to correct them.
- ❖ **Macros:** Allows a user to record or save frequently used keystrokes and instructions, which can be executed later by running the corresponding macros.
- ❖ **Mail merge:** Create form letters, mailing labels, and envelopes with deferent addresses.
- ❖ **Mathematical formulae typesetting:** Allows a user to typeset complex mathematical formulae within the program.
- ❖ **Multi-columns:** Arranges text in two or more columns that look similar to a newspaper or magazine.
- ❖ **Replace:** Allows a user to substitute existing characters, words, or phrases with new ones.
- ❖ **Spelling checker:** Allows a user to check the spelling of a whole document at one time, or to check and even correct the spelling of individual words as they are typed (i.e., **AutoCorrect**).
- ❖ **Automatic Tables of contents:** with section titles and their page numbers;
- ❖ **Tables:** Allows a user to organize information into rows and columns.
- ❖ **Thesaurus:** Suggests alternative words with same meaning (i.e., **synonyms**) for use in the document.
- ❖ **Word wrap:** Allows a user to type continually without pressing the enter key at the end of each line.

Other terms related to word processors.

- ❖ **Edit:** This is the process of making changes on the existing content of a document.
- ❖ **Format:** This is the process of making changes to the appearance of the content of a document.
- ❖ **Save:** This is process of transferring data contents of a document from memory onto a storage medium.
- ❖ **Printing:** This is the process of producing a hard copy of a document on a medium such as paper.
- ❖ **Copy:** This is duplicating and storing content of a document into the clipboard.
- ❖ **Cut:** This is erasing content from a particular position of a document into the clip board.

- ❖ **Paste:** Is the process of removing copied or cut content from the clip board onto a particular position.
- ❖ **Header:** This is content that appears at the top margin of the document.
- ❖ **Footer:** This is content that appears at the bottom margin of the document.
- ❖ **Footnote and endnote:** These are features used to comment on, explain, or provide reference to text in the document.

NB *You might use footnote for detailed comments and endnotes for citing source of content in the document.*

ADVANTAGES OF WORD PROCESSING SOFTWARE OVER THE ORDINARY TYPEWRITER

- ❖ It is easy to make changes to the document.
- ❖ Have many features to create the document that look professional and nice looking.
- ❖ Documents can be previewed before printing.
- ❖ Documents can be saved for future use.
- ❖ It is convenient in making letters and mailing labels.
- ❖ It is possible to move a block of text from one position to another at the same time.
- ❖ The layout of the document can be altered before printing.
- ❖ The document can be printed many times.
- ❖ It can create graphics such as shapes, frames, etc
- ❖ It can be used to create web pages.
- ❖ One can easily count the number of words in the document.
- ❖ One can automatically create a table of contents.

PRESENTATION SOFTWARE

Definition It is an application that is used to create content, which can communicate ideas and other information to a group of audience on slides.

NB a presentation is a collection of slides, handouts, speaker's notes and outlines in a single file. This file has a file extension of **.ppt**

Common examples include;

- | | |
|-----------------------------|----------------------------|
| ➤ Microsoft power point | ➤ Apple Keynote, |
| ➤ Corel presentation | ➤ Custom Show, |
| ➤ Lotus free lance graphics | ➤ Ease, |
| ➤ Harvard graphics | ➤ Google Docs (web-based), |
| ➤ Micro media director | |

Areas where presentations are used:

Church: it is used for casting the hymn, announcements and bible verses.

Big shops: used for showing a list of goods and other related offers.

Advertising: used for example outdoor advertising media.

School: used for teaching and learning in schools.

Seminars and workshops: used to enhance speaker's notes and speeches.

At product launching: used to explain benefits from product, prices, etc

Common features in electronic presentations.

Slide: This is a single page in a presentation.

Slide layout: refers to the physical arrangement of content on a slide.

Slide sorter: a facility that enables the user to view displays all of the slides in the current presentation in **thumbnail** form for easy re-arranging.

Slide master: a slide that controls appearance of all slides in the presentation.

Placeholders: are boxes with dotted borders that contain content and reside within a slide layout. All built-in slide layouts contain content placeholders.

Slide transitions: are the animation-like effects that occur in Slide Show view when you move from one slide to the next during an on-screen presentation.

Action buttons: are buttons that if clicked, leads a user to either next or previous slide.

Speaker notes: are notes added to the presentation slides as a reference for the presenter.

Slide show: is a presentation of a series of still images on a projection screen or electronic display device, typically in a prearranged sequence.

Animation: is the process of creating the continuous motion and shape change illusion by means of rapid display of a sequence of static images that minimally differ from each other.

Handouts: is a combination of 2 to 6 slide images on a single page.

Background color: electronic presentations are rich background colors.

Templates: These are already existing professional designs in the program.

Clip art gallery: This feature provides pictures and images that relate to the topic.

Meeting minder: this feature improve communication during or after the meeting by capturing minutes of the meeting that can easily be exported to a word processor for printing.

Viewing a presentation

Slide view: it shows how a slide will appear on display or on printing.

Outline view: It enables one to view lines of text for the presentation during content development.

Notes page view: allows you to use a slide's notes page to create extended notes for the audience.

Slide show view: is a presentation of a series of still images on a projection screen or electronic display device, typically in a prearranged sequence.

MERITS OF ELECTRONIC PRESENTATION

- Presentation software usually provides a wide variety of presentation formats and layouts for the slides.
- Multimedia components such as clip art images, video clips, and audio clips can be incorporated into the slides.
- The timing of the slides can be set so that the presentation automatically displays the next slide after a predetermined period of time.
- Special transition effects can be applied between each slide.
- The presentation can normally be viewed and printed in different formats.

SPREADSHEET SOFTWARE

Definition

Spreadsheet software is an application used to organize *data* in *rows* and *columns*, and *perform calculations*.

Common examples of spreadsheet programs

1. Microsoft Excel,
2. Lotus 1-2-3,
3. Corel Quattro Pro,
4. Super calc,
5. Bean sheet,
6. Sheetster,
7. Kingsoft Office Spreadsheets,

Common terms used in electronic spreadsheets.

- **A worksheet** is a page in a spreadsheet program.
- **A workbook** is a collection of worksheets.
- **A row** is a horizontal organization of data in a worksheet. Each row is identified by a number 1, 2, 3, etc
- **A column** is a vertical organization of data in a worksheet. Each column is identified by a letter A, B, C, etc
- **A cell** is the intersection of a row and a column.
- **Range** is a rectangular selection of a worksheet containing two or more cells.
- **Syntax** is rules to be followed while using a function.
- **Cell address/cell reference** is the location of a cell in the worksheet.

Types of cell references

There are 3 types of cell references. These include;

- a) **Relative cell reference** is a type of reference in which a formula can be copied from one cell to another. eg A1
- b) **Absolute cell reference** is a type of reference in which a cell (eg.\$A\$1) is always fixed.
- c) **Mixed cell reference** is a type of reference that combines both relative and absolute references. eg \$A1.

Data entered in a spreadsheet

Labels: These are text that identify the data and help organize the worksheet. (They are not used in a calculation.)

Values: These are numbers to be used for calculations.

Formulae: These perform calculations on the data in the worksheet, and display the resulting value in the cell that contains it.

Currency: These are numbers with currency symbols.

Functions: These are predetermined formulae that perform calculations on data.

Popular features of spreadsheet programs include:

Worksheet: data is entered in cells of a worksheet (page).

Macro: Allows a user to record or save a sequence of keystrokes or instructions that can be run later.

Recalculation: Recalculates the rest of the worksheet whenever data in a worksheet changes (a valuable tool for **what-if analysis**).

Charting: Allows a user to display data in a graphical, **Charting** allows a user to display data in a graphical, rather than a numerical form rather than a numerical form.

Inbuilt functions: These are predetermined formulae that perform calculations on data. eg SUM, AVERAGE, MAX, MIN, etc

Column Auto adjusting: This feature helps a user to adjust the column size.

Common functions and their usage

Function	Example	Results
SUM	=SUM(A2:D2)	Returns total of range A2:D2
AVERAGE	=AVERAGE(C3:F3)	Returns average for range C3:F3
MAX	=MAX(H1:H12)	Returns highest value in the range H1:H12
MIN	=MIN(C4:H9)	returns lowest value for range C4:H9
RANK	=RANK(D2,\$D\$2:\$D\$11)	Returns position of values in range D2:D11 based on D2
SQRT	=SQRT(AB3)	Returns square root of a value in cell AB3
STDEV	=STDEV(C4:C7)	Returns standard deviation of values C4:C7
COUNT	=COUNT(A1:D1)	Returns number of values in the range A1:D1
IF	=IF(B2>50,"PASSED","FAILED")	Returns a comment PASSED for a value greater than 50, else FAILED.
SUMIF	=SUMIF(A2:D2,">45")	Returns total of values greater than 45
AVERAGEIF	=AVERAGEIF(B2:G2,"<=30")	Returns average for values less or equal to 30 in the range.
COUNTIF	=COUNTIF(C4:T4,">70")	Returns number of values greater than 70 in the range C4:T4
LOG	=LOG(C9)	Returns logarithm of C9
LN	=LN(N1)	Returns natural logarithm of N1

ERRORS IN EXCEL

##### error	This error occurs when a column is not wide enough, or a negative date or time is used.
#DIV/0! error	This error occurs when a number is divided by zero (0).
#N/A error	This error occurs when a value is not available to a function or formula.
#NAME? error	This error occurs when Microsoft Office Excel doesn't recognize text in a formula.
#NULL! error	This error occurs en you specify an intersection of two areas that do not intersect. The intersection operator is a space between references.
#NUM! error	This error occurs with invalid numeric values in a formula or function.
#REF! error	This error occurs when a cell reference is not valid.
#VALUE! error	This error occurs when the wrong type of argument or operand is used.

Advantages of spreadsheet software (electronic) over manual(paper) worksheet

- Easy to make changes and corrections to data on the worksheet.
- The rest of the worksheet is recalculated whenever data on a worksheet changes.
- Operation is fast with the help of built-in functions and macros.
- Calculation is always accurate, provided that data and formulae entered are correct.

- Easy to create different kinds of charts, or to change chart types.
- Information on charts is updated automatically whenever related data on the worksheet changes.
- Spreadsheets enable multiple users to enter data into one sheet through work group computing.
- It produces clean, error free and reliable results.

Areas of application of spreadsheets in a school

1. Analysis of student's performance.
2. Writing school budget forecast.
3. Time tabling school activities.
4. Monitoring and analysis of school fees payment.
5. Preparing students' roll call lists.
6. Facilitates mail – merging of documents.
7. Tracking school assets and loan repayment plan

DATABASE MANAGEMENT SYSTEMS (DBMS)

A collection of logically related data

A database is a collection of information that is related stored for a purpose..

A database management system is a program used to create and manage a database and set security to it.

Examples of database management system applications

- | | |
|-----------------------------------|--------------------|
| 1. Bento | 6. FileMaker |
| 2. Microsoft Access | 7. File Pro |
| 3. SQL(structured query language) | 8. FoxPro |
| 4. Borland Database Engine | 9. Oracle Database |
| 5. DBase | 10.Paradox |