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# DIGITAL LITERACY

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## CHAPTER 1: INTRODUCTION TO DIGITAL LITERACY

### Concepts of Digital Literacy

- ❖ *Computer* – it is an electronic device that receives input data through an input device, processes it and gives out the output through an output device.
- ❖ *Data* – raw facts and figures fed into the computer system.
- ❖ *Information* – processed data.
- ❖ *ICT* - the use of computing devices and computer technology to process data and communicate information.

### Typical parts of a computer

- |                    |                                     |
|--------------------|-------------------------------------|
| 1. CPU (processor) | 7. Monitor                          |
| 2. RAM             | 8. Power supply unit                |
| 3. Hard disk drive | 9. System unit (computer case)      |
| 4. Motherboard     | 10. Cards for video, sound, network |
| 5. Mouse           | 11. CD/DVD drive (optical drive)    |
| 6. Keyboard        | 12. Fan                             |

### Bootling

Bootling is the process of starting up a computer.

### Types of Bootling

- **Cold Bootling (Hard Bootling)** – refers to the starting of a computer or switching on of a computer from an off state.
- **Warm Bootling (Soft Bootling)** – basically refers to restarting a computer.

Q. Explain the circumstances that may prompt a computer user to perform warm bootling.

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## Classification of Computers

Classification of computers can be based on Functionality, Purpose or Size.

### Based on Functionality (Type of processing)

- i. Analog computers – they process data that is continuous in nature
- ii. Digital computers – they process data that is in binary form.
- iii. Hybrid computers

**\*\*Students to research on Hybrid computers.**

### Based on Purpose

*General purpose computers* – they can perform a wide range of tasks e.g., creating Word documents, listening to music, browsing the internet etc.

*Special purpose computers* – are specialized to perform a specific task e.g., aircraft flight control, patient diagnosis, process control in factories etc.

### Based on Size

*Supercomputers* – used in weather forecasting, scientific research etc. It is the largest in size, has the fastest speed of processing, has the largest memory and secondary storage capacity, and has the most computational power.

*Mainframe computers* – they are sometimes referred to simply as mainframes. They are used by big companies to process huge financial transactions, store and manage huge consumer data and statistics etc. They can support multiple terminals.

*Minicomputers* – used for stock control, payroll.

*Microcomputers* – they include desktops, laptops, tablets. They use a microprocessor.

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## Computer Ergonomics

It is the practice of making sure the computer design and the workspace arrangement are set up in way that reduces the risk of pain, fatigue or injury on the part of the user. The measures that can contribute to reduced pain, fatigue or injury on the user include:

- i. Use of computer ergonomic chairs to minimize back pains and fatigue
- ii. Taking breaks between sessions
- iii. Working in shifts
- iv. Regulating screen brightness and contrast to minimize eye strain
- v. Use of computer ergonomics keyboards to minimize wrist pain
- vi. Ensure proper ventilation for a conducive environment
- vii. Adjust the screen position so that the user does not have to lean forward or backward while using the computer.
- viii. Reposition the screen or adjust the room lighting to avoid screen glare.

## Computer Care and Maintenance

- ❖ Lock the computer room while not in use to prevent from theft.
- ❖ Close the windows when it rains to prevent entry of draughts (rain droplets).
- ❖ Blow dust from the computer equipment regularly.
- ❖ Use a piece of cloth and a cleaning agent to wipe out dust from the external parts of computer.
- ❖ Do not place drinks or food near the computer.
- ❖ Safely keep discs (CDs and DVDs) in their casings and store them in shelves.

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- ❖ Use a surge protector to protect computers against power surge and Uninterruptible Power Supply Unit (UPS) units to provide power in the event of power loss or disconnections from the mains supply.
- ❖ Switch off the computer when not in use.

## **Factors to consider before purchasing a computer**

1. Processor type and speed – latest processor types are more efficient than the previous ones. For example, a core i7 processor is more efficient than a core i5 processor, which in turn is more efficient than a core i3 processor. Speed is measured in terms of Hertz. A 2 GHz is faster than a 1 GHz computer.
2. Memory (RAM) capacity – the bigger the RAM capacity the better the computer performance. Memory is measured in terms of Bytes. For example, a computer with 4 GB of memory capacity is more powerful than that with 3 GB of memory capacity.
3. Hard disk capacity – bigger storage means more data stored.
4. Cost – the computer to be bought should be affordable.
5. User needs – the user needs to know what the main needs for buying the computer are. For instance, if the computer is mainly for producing engineering drawings or playing video games then it should have a highly effective graphics card, have large enough monitor size, large RAM and disk capacities, and be of very high speed. A computer bought by a student mainly for things like browsing the internet, listening to music, typing class assignments needs not to be a powerful computer.
6. Portability – if your work involves a lot of movement then you should buy a portable computer.
7. Warranty –

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Q. Discuss the advantages and disadvantages of using computers in the society.

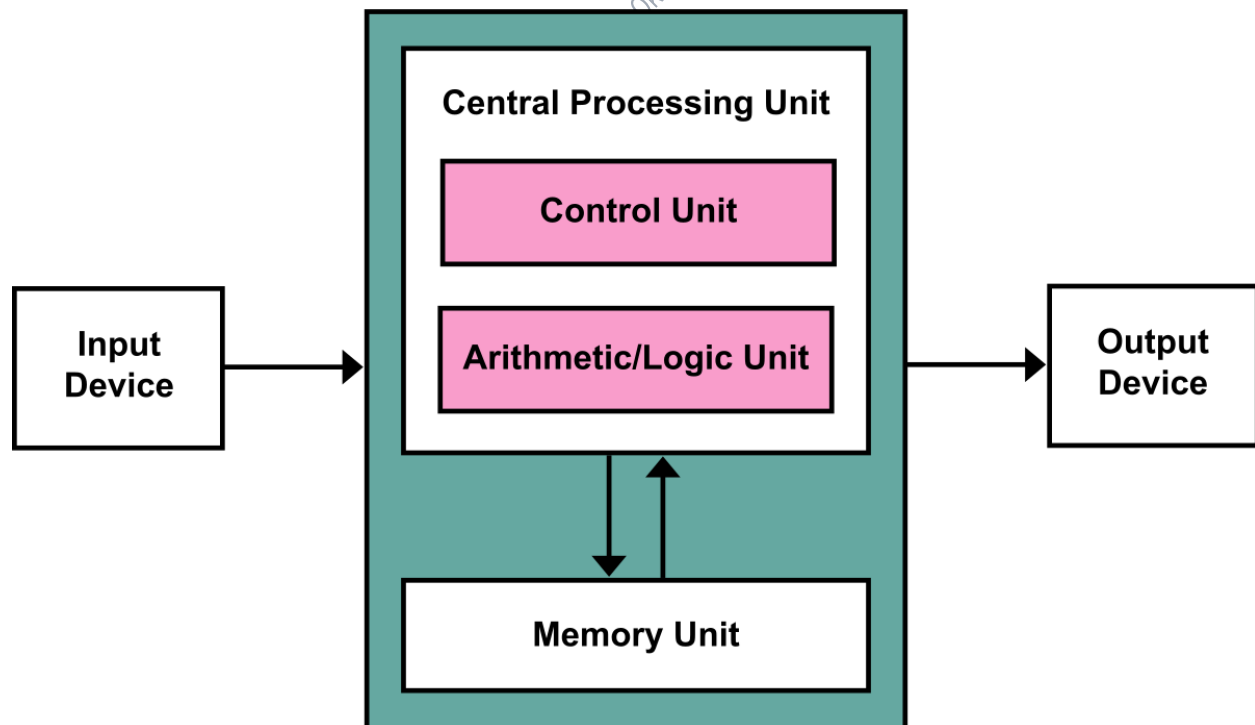
Q. Discuss the applications of computers in the fields of Entertainment, Manufacturing, Multimedia, Science and Research, Aviation, Education, Health and Medicine, Military, Commerce, Agribusiness, Security/Criminology.

## CHAPTER 2: COMPUTER HARDWARE

Computer hardware refers to the physical parts of a computer system. The functional hardware components are: ***CPU, Memory Unit and Peripheral devices***. The peripheral devices include I/O devices and secondary storage.

### Central Processing Unit (CPU)

This is the brain of the computer. It is where data processing takes place. It is made up of Control Unit and Arithmetic Logic Unit (ALU).



Hardware configuration diagram

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## **Computer Memory**

Computer Memory refers to the physical devices in a computer used to store data and/or instructions either temporarily or permanently. It is classified into Primary memory and Secondary memory.

### **Primary Memory**

It is a type of memory that temporarily stores data and instructions that are currently being processed.

It is also known as **Main memory** or **Random Access Memory (RAM)**.

### **Characteristics of RAM**

- ❖ Its contents are readily available for direct retrieval.
- ❖ It is volatile, i.e., its contents are lost in case of power disconnection or power outage.
- ❖ It is read/write i.e., data can be added to it and retrieved from it.

### **Read Only Memory (ROM)**

It is a type of memory that permanently stores data and instructions, known as firmware, required for the computer to boot. The instructions are installed during the time of manufacture of the computer.

### **Characteristics of ROM**

1. Stores data and instructions permanently
2. It is non-volatile, i.e., its contents cannot be lost in case of power disconnection or power outage.

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## **Other types of memory**

1. Video memory – temporarily holds data relating to graphics. This memory is found on the video card of the computer.
2. Buffer memory – temporarily holds data and transmits it between two communicating devices with varying speeds e.g., between RAM and hard disk.
3. Cache memory – stores frequently and recently accessed data.
4. Virtual memory – it is created on the hard disk by the Operating system to temporarily hold programs when the RAM capacity is full.

## **Secondary (Auxiliary) Storage**

This is memory that stores data permanently for future use. It is non-volatile. There are three types of secondary storage devices:

- a) Magnetic storage media
- b) Optical storage media
- c) Solid State Drives (SSD)

### ***Magnetic storage media***

These include hard disk drive, magnetic tape, floppy disk (diskette). They store data by means of electromagnetism. Hard disk drive, or simply hard disk, is also known as magnetic disk and is normally used as the internal secondary storage for computers. There are also external hard disk drives available in the market.

Magnetic tape is cheaper than magnetic disk but is much slower because it uses the *sequential method* of data access. It is rarely used nowadays.

*NB: Floppy disk (diskette) had a storage capacity of 1.44MB. It is now obsolete.*

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## **Precautions for handling magnetic storage media**

1. Keep them away from extreme temperatures
2. Never place heavy objects on top of them
3. Keep them away from dust
4. Regularly scan them for viruses
5. Keep them away from electromagnetic fields like those from radios, TVs, etc.

## ***Optical storage media***

These include CDs, DVD and Blu-ray discs. They store data by means of light from a laser beam.

**Q. Explain the differences between CD-R, CD-ROM and CD-RW.**

## ***Solid State Drives (SSD)***

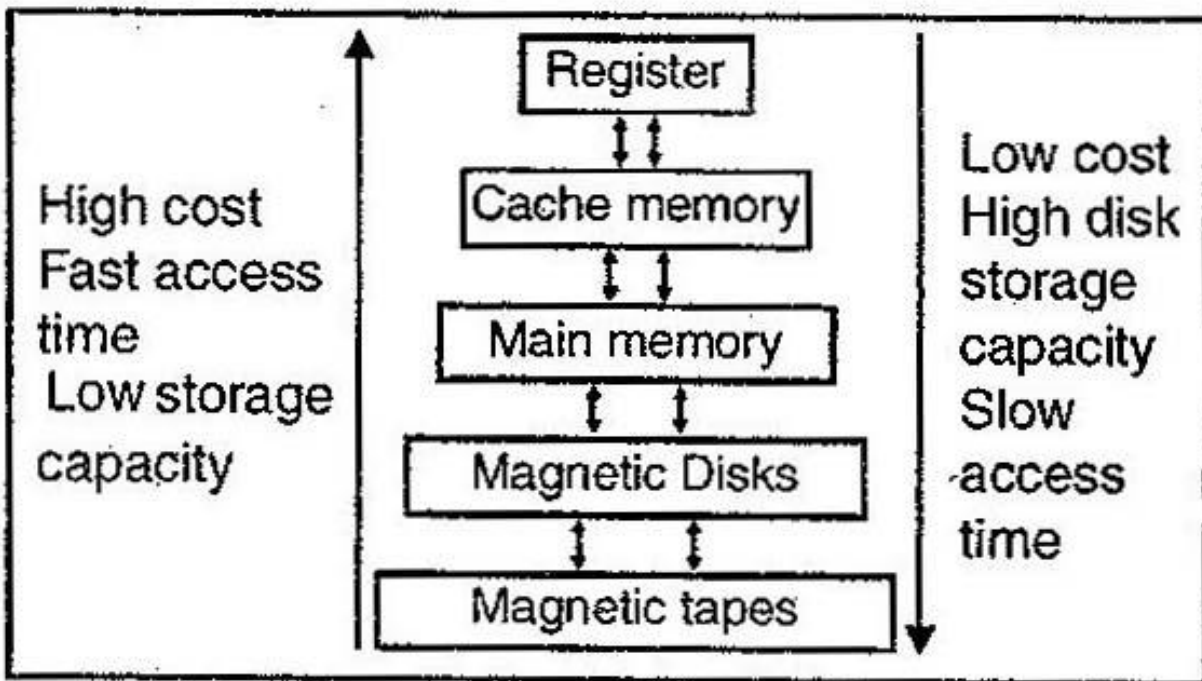
They are a new generation of storage devices. They are slowly replacing the traditional hard disks. They use flash memory to store data.

They have no moving parts, unlike the magnetic disks, hence, they are significantly faster than the hard drives. They are, however, more expensive per MB than hard disks.

Examples of SSDs are: flash disk, memory card, etc.

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## Computer Bus

A computer bus is an electronic path within the computer that allows components to communicate with each other.

The main types of Computer Bus are: *Data Bus*, *Address Bus* and *Control Bus*.

1. **Data Bus** – transmits data and instructions to and from the processor (CPU).
2. **Address Bus** – transmits address of the memory location or peripheral devices where data is to be fetched.
3. **Control Bus** – transmits command/control signals from the processor to the other components in the computer, i.e., main memory, I/O devices, secondary storage.

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## Input & Output Devices

### Input Devices

An input device is a peripheral which receives data from the user and sends it to the computer for processing. They are classified into: *keyboard, pointing and touch devices, scanning devices, point-of-sale devices, document readers, speech recognition.*

### **Keyboard**

It has keys which are categorized into: *Alphanumeric keys, Special keys, Function keys, Navigation keys, Arrow keys, Numeric keypad.*

1. *Alphanumeric keys include alphabetic keys, punctuation keys and symbol keys found on a traditional typewriter.*
2. *Special keys include Ctrl, Shift, Alt, Esc, Enter, Delete, Backspace, Caps Lock, Space bar, Num Lock and Windows key. Ctrl, Shift, Alt keys are normally used in combination with other keys.*
3. *Function keys include F1, F2.... F12 keys. The function of a particular Function key defers from program to program., Navigation keys, Arrow keys, Numeric keypad.*
4. *Navigation and Editing keys – they are used to move around the document. They include Page Up, Page Down, Home, End, Delete, Insert.*
5. *Direction/Arrow keys – are used to move the cursor either down, up, left or right.*
6. *Numeric keypad – consists of numeric keys. It is used to type numbers.*

**Q. State the functions of the various keyboard keys.**

**Q. What is the difference between Delete and Backspace keys?**

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## Mouse

It is used for pointing at, selecting and clicking on text, objects, commands, icons.

### Parts of a Mouse

- ❖ Left and right buttons
- ❖ Scroll

### Mouse Techniques

1. Point
2. Left-click
3. Right-click
4. Double-click
5. Click-and-drag (drag-and-drop)

Q. State the uses of the following input devices: MICR, OMR, OCR, stylus, joystick, barcode reader, scanner, light pen, touchscreen, voice input (microphone), touchpad, webcam, smart card, graphics tablet, card reader, sensor.

Q. Highlight the various types of keyboards, scanners and mice.

## Output Devices

These are peripheral devices that are used to produce computer output either in hardcopy or softcopy. Hardcopy output is produced on a physical medium while softcopy output is displayed on screen or listened to.

## **Visual Display Unit (VDU)**

It is commonly referred to as Monitor. The three types of monitors are: Cathode Ray Tube (CRT), Liquid Crystal Display (LCD) and Light Emitting Diode (LED).

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## ***CRT (cathode ray tube) monitors***

These monitors employ CRT technology, which was used most commonly in the manufacturing of television screens.

While CRT monitors can still be found in some organizations, many offices have stopped using them largely because they are heavy, bulky, and costly to replace should they break.

## ***LCD (liquid crystal display) monitors***

The advantages of LCD monitors include their compact size which makes them lightweight. They also don't consume much electricity as CRT monitors, and can be run off of batteries which makes them ideal for laptops.

Images transmitted by these monitors have little flicker. However, this type of monitor does have disadvantages, such as its relatively high price, an image quality which is not constant when viewed from different angles, and a monitor resolution that is not always constant.

## ***LED (light-emitting diodes) monitors***

LED monitors are the latest types of monitors on the market today. These are flat panel, or slightly curved displays. LED monitors are said to use much lesser power than CRT and LCD and are considered far more environmentally friendly.

The advantages of LED monitors are that they produce images with higher contrast, have less negative environmental impact when disposed, are more durable than CRT or LCD monitors, and features a very thin design. They also don't produce much heat while running. The only downside is that they can be more expensive, especially for the high-end monitors like the new curved displays that are being released.

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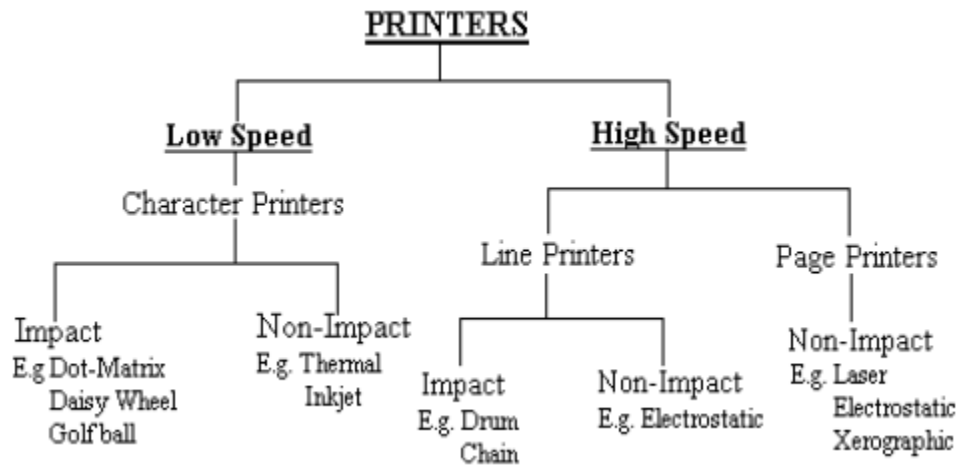
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## Printer

It is a device used for printing documents containing text or graphical output coming from a computer connected to the printer.

Printers vary in size, speed, sophistication and cost. More expensive printers are used for higher-resolution color printing.

### Classification of Printers



Character printers – these printers print one character at time.

Line printers – these printers print one line at time.

Page printers – these printers print one whole page at time.

Impact printer: are printers that form characters through direct physical contact between the ink ribbon and the paper. Non-impact printers: are printers that form characters and images without direct physical contact between the ink ribbon and the paper.

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| Impact printer                                       | Non-impact printer                                          |
|------------------------------------------------------|-------------------------------------------------------------|
| Uses ink ribbon to produce print on paper            | Uses toner or cartridge for printing on paper               |
| Prints characters only except for dot-matrix printer | All non-impact printer can print both characters and images |
| Difficult to produce multiple copies                 | Can produce multiple copies                                 |
| It is noisy when in operation                        | Works silently                                              |
| Slow in operation                                    | It works faster                                             |
| Produces low quality prints                          | Produces high quality prints                                |
| Less expensive than non-impact printer               | More expensive than impact printer                          |

## Plotter

They mainly produce large graphical output, e.g., diagrams, maps, engineering drawings, etc. Plotters can print on A1 sized paper, unlike printers which can be used to print on A3 sized paper at most. The two types of plotters are: flatbed plotter and drum plotter.

Other output devices include speaker, projector, Computer Output on Microform (COM).

Q. State any five limitations of speech/voice input (microphone) as a method of input.

Q. Explain the reason why, as an engineer, it is appropriate to produce engineering drawings on a plotter rather than on a printer.

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## CHAPTER 3: COMPUTER SOFTWARE

Software refers to all programs which enable the computer hardware to operate effectively, and also help the user to perform various tasks on the computer.

Without software a computer cannot operate.

A program is defined as a set of instructions which a computer executes to perform a given task.

Computer software is classified into:

1. System software
2. Application software

### System Software

This refers to software that manages the operations of a computer and makes sure that the computer works efficiently. System Software is installed in the computer during manufacture.

System Software is divided into *Operating system* and *Utility software*.

*Operating system* – ensures the computer operates as intended by the manufacturer. It also provides a platform for application software to run.

*Utility software* – these are programs that help in analyzing, configuring, optimizing and maintaining a computer system.

### **Examples of Utility Software**

- i. *Antivirus utility (virus checker)* – used to scan for viruses
- ii. *Backup utility* – used to back up files and programs on an external drive e.g., flash drive, external hard disk, and also to restore them from the drive when needed.

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- iii. *Disk defragmentation utility* – consolidates pieces of scattered, related files stored on the hard disk so that they can be quickly accessed. This improves computer performance.
- iv. *Disk clean-up utility* – helps in removing unnecessary files hence availing more storage space. The files could be those in the recycle bin, those downloaded in the background while browsing the internet, etc.
- v. *File compression utility* – reduces files into smaller sizes. Can be useful during file transmission where the transmitted file is not allowed to be above a certain size.

Q. Explain the terms *disk formatting* and *disk partitioning*

## Application Software

These are software that are developed to perform a specific task for the user e.g., creating a text document, performing financial calculations, drawing architectural designs, etc.

Application software is classified into *customized software* and *application packages*.

### i. Custom/In-house/Special purpose/Tailor-made/Bespoke Software

These are programs developed to carry out specific tasks for a specific organization, company or individual and may not suit the needs of other organizations, companies or individuals. Types: business process automation system, automated invoicing, etc.

### ii. Application packages/General purpose/Generic/Off-the-shelf Software

These are software developed and supplied by software companies like Microsoft, Adobe, at a price. They are designed for many users and can meet the requirements

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or needs of the many users in the market. Types include: *Word processors, database applications, presentation applications, email applications, web browsers, spreadsheets, graphics software, desktop publishing applications.*

Q. Give examples of the types of generic software mentioned above.

Q. Explain five merits of generic software.

## **Factors to consider before buying a computer software**

- a) User-friendliness – the software should be easy and convenient to use.
- b) Authenticity – authentic software is original software and is normally supported by the developer. It is usually licensed and protected by a license key.
- c) Cost – this will depend on the software's functionality and complexity. For example, a customer database application developed using Oracle will be more expensive than that developed using Microsoft Access.
- d) Hardware requirements – these include RAM and hard disk capacity as well as processor type and speed. Ensure that those requirements can support the software.
- e) Portability – it should be possible to transfer data created using the software into another software without having to retype it, e.g., ability to transfer a Word document into PageMaker, or ability to transfer an image from a Adobe Illustrator Microsoft Word document, etc.
- f) Compatibility – Compatibility – The software to be bought must be compatible with the computer at hand, i.e., it should work on the computer.
- g) Documentation – this assists the user in knowing how to use the software, and also provides solutions to some technical problems. It could be a

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manual/guide. The documentation can also help the user on information about how to fix errors that may arise while running the software.

## Operating System

An Operating System is a software which manages all activities in a computer system and provides an environment for application programs to run. It can also be defined as a group of programs that together control the operation of a computer system. Examples of Operating System include *Microsoft Windows, Macintosh, Unix, Linux, Ubuntu, Novell Netware, Android, iOS, Symbian, MS-DOS*, etc.

## Functions of Operating System

- a) **Memory management** – Operating system allocates memory space to running programs and deallocates memory space from programs that are being closed.
- b) **File management** – Operating system helps the user to create, save, copy, move, rename and delete files.
- c) **User interface** – it enables the computer user to interact with and use the computer system.
- d) **Secondary storage management** – it also keeps track of the amount of disk space that is currently being occupied and the unused space.
- e) **Protection and security** – Operating system enhances protection and security of user files and programs from unauthorized access through usernames and password.
- f) **Error detection** – it detects technical errors that might occur when a program is running. It then notifies the user through an error message and prompts them for an appropriate corrective response.

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- g) **Device management** – Operating system also controls and manages all devices connected to the computer system. For example, it manages transfer of data between the computer and an external device, e.g., printer, flash drive etc.
- h) **I/O management** – Operating system responds to keystrokes and mouse clicks. Additionally, it detects when an I/O device is faulty or disconnected.

## User Interface

It is the method by which a computer user and a computer system exchange information and commands in an interactive mode.

### Types of User Interface

#### *Command line Interface*

It is the oldest type. The user interacts with the computer system by typing commands. It is used in MS-DOS.

#### Pros

- i. It is suitable for experienced users and experts.
- ii. Can be used in a computer which has very little memory and is slow.

#### Cons

- ❖ It is difficult to remember all the commands
- ❖ Continuous typing can be tedious
- ❖ Errors are frequent
- ❖ It is a slow method for inexperienced users

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## ***Menu-driven Interface***

This interface comprises a series of menus and sub-menus which the user access by pressing buttons. It is usually used in ATMs, ticket machines, etc.

### Pros

- i. No need to remember commands as they are readily displayed on the screen
- ii. Easy to use because the commands are self-explanatory
- iii. It is a faster method than command line interface

### Con

- ❖ One may have to switch several screens to access a particular menu.

## ***Graphical User Interface (GUI)***

In this type of interface, the user interacts with the computer by using a pointing device such as mouse, trackball or touchpad. GUI uses a WIMP system.

NB: WIMP stands for Windows Icons Menus Pointer

### Merits of GUI

- i. Many programs use GUI hence use a similar interface. It is, therefore, easy to learn how to use a new program
- ii. Most operations are self-explanatory, so the user does not have to memorize commands like in command line interface
- iii. GUI supports multiprogramming where multiple programs can run concurrently, each having its own window
- iv. Most GUIs provide good help facilities
- v. It is easier and faster to use than command line interface
- vi. The interface has a more appealing look than command line interface

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## Demerits of GUI

- i. It takes up a lot of memory space
- ii. It requires a fast computer

## ***Form-based Interface***

It is an interface that enables the user to interact with an application via an electronic form. The user interacts with the application by entering data through text boxes, text areas, check boxes, radio buttons, drop-down menus.

## ***Voice User Interface***

This allows the user to interact with the computer through voice or speech commands.

*Q. What are the merits and demerits of Voice user interface?*

## **CHAPTER 4: DATA SECURITY AND CONTROL**

### **Introduction**

Data and information must be protected against unauthorized access, disclosure, modification or damage. This is because it is a scarce and valuable resource for any business organization or government. It is mostly used in transactions, it can be shared, and has high value attached to it.

### **Data Security**

Data security refers to the protection of data and information from accidental or intentional disclosure to unauthorized persons.

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## Data Privacy

**Private data** is the data which belongs to an individual and must not be accessed by or disclosed to any other person, without direct permission from the owner.

## SECURITY THREATS TO DATA AND INFORMATION

These include Computer viruses, Theft. Unauthorized access.

### COMPUTER VIRUSES

A computer virus is a destructive program that attaches itself to other files when the files are opened for use, and also installs itself on the computer, without the knowledge of the user. It is a program designed specifically to damage other programs or interfere with the proper functioning of the computer system. It is able to replicate itself and spread in the computer system.

#### Types of computer viruses

- ❖ Boot sector virus – it destroys the booting information on storage devices
- ❖ File virus – it attaches themselves to files, either erasing or modifying them.
- ❖ Hoax virus – it comes as e-mails with an attractive subject and activates themselves when the e-mail is opened.
- ❖ Trojans – they appear to perform necessary functions, but perform other undesirable activities in the background without the knowledge of the user.
- ❖ Resident virus – virus that embeds or stores itself in the computer memory, allowing it to infect any other file that runs in the computer.

#### Examples of destructions/damages caused by a virus attack

- i. It can delete or modify data and files on storage devices (disks) or memory during normal program execution

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- ii. May attack the format of a disk making any program or data on it impossible to recover.
- iii. Systematically destroy all the data in the computer memory.
- iv. Can change keystroke values or data from other I/O devices, e.g., change the effect of the SHIFT key.
- v. Consumes computer memory space, hence, slowing down its performance or causing the system to crash.
- vi. It can change colour of the display.
- vii. Can cause boot failure.

## **Sources of Computer viruses**

1. Contact with contaminated systems – if a diskette is used on a virus infected computer, it could become contaminated. If the same diskette is used on another computer, then the virus will spread.
2. Use of pirated software – pirated software may be contaminated by a virus, or it may have been amended to perform some destructive functions which may affect your computer.
3. Infected proprietary software – a virus could be introduced when the software is being developed in computer laboratories, and then copied onto diskettes containing the finished software product.
4. Fake games – some virus programs behave like computer games software, and the virus can spread very fast.
5. Using infected external removable storage devices e.g., flash drives
6. Opening email attachments from unknown sources
7. Clicking on unauthentic internet links and pop ups or ads
8. Viruses can also spread through software or data distributed via networks.
9. Installing applications from non-trusted sources

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## Symptoms of viruses in a computer system.

The following symptoms indicate the presence of a virus in your computer;

- a) Boot failure
- b) Files and programs disappearing mysteriously
- c) Unfamiliar graphics or messages appearing on the screen. For example, the virus might flash a harmless message such as *Merry Christmas* on the computer display
- d) Gradual filling of the free space on the hard disk
- e) Corruption of files and programs
- f) Program taking longer than usual to load
- g) Some programs may fail to open
- h) Slowing down of computer system performance e.g., files and applications taking too long to load, or booting process becoming too slow
- i) Unusual error messages occurring more frequently
- j) Frequent read/write errors
- k) Unknown programs starting on your computer
- l) Computer hangs anytime when running a program
- m) Less memory available than usual
- n) Change in the size of files
- o) Computer may reboot itself several times
- p) Frequent crashes. Does your computer randomly crash on you? Does your screen freeze and become the infamous 'blue screen of death'? This could be a sign that your device has been infected with a virus.
- q) Computer battery draining quickly – as the virus continues to multiply, it uses resources from your computer and creates more activity on your computer. As a result, your battery life is diminished.

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## **Some control measures against virus attack**

- ☐ Restrict the movement of foreign storage media e.g., diskettes in the computer room. If they must be used, they must be scanned for viruses
- ☐ Use an Antivirus software to scan and remove viruses
- ☐ Update your Antivirus software
- ☐ Write-protect disks after using them
- ☐ Back up all software and data files at regular intervals
- ☐ Install pop-up blocker (ads blocker)
- ☐ Do not boot your computer from disks which you are not sure are free from viruses
- ☐ Avoid pirated software; if possible, use the software from the major software houses

## **Computer worm**

A computer worm is a type of malware that spreads copies of itself from computer to computer. A worm can replicate itself without any human interaction, and it does not need to attach itself to a software program in order to cause damage.

### ***How do computer worms work?***

Worms can be transmitted via software vulnerabilities. Or computer worms could arrive as attachments in spam emails or instant messages (IMs). Once opened, these files could provide a link to a malicious website or automatically download the computer worm. Once it's installed, the worm silently goes to work and infects the machine without the user's knowledge.

Worms can modify and delete files, and they can even inject additional malicious software onto a computer. Sometimes a computer worm's purpose is only to make copies of itself over and over — depleting system resources, such as hard drive

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space or bandwidth, by overloading a shared network. In addition to wreaking havoc on a computer's resources, worms can also steal data, install a backdoor, and allow a hacker to gain control over a computer and its system settings.

## ***How to tell if your computer has a worm***

If you suspect your devices are infected with a computer worm, run a virus scan immediately. Even if the scan comes up negative, continue to be proactive by following these steps.

- ✓ **Keep an eye on your hard drive space.** When worms repeatedly replicate themselves, they start to use up the free space on your computer.
- ✓ **Monitor speed and performance.** Has your computer seemed a little sluggish lately? Are some of your programs crashing or not running properly? That could be a red flag that a worm is eating up your processing power.
- ✓ **Be on the lookout for missing or new files.** One function of a computer worm is to delete and replace files on a computer.

Q. Explain the meanings of the term malware and the term spyware.

## **Unauthorized Access**

Data is always under constant threat from people who may want to access it without permission. Such persons will usually have bad intentions, either to commit fraud, steal information and destroy or corrupt the data. Unauthorized access may take the following forms:

- ❖ Eavesdropping – this is tapping into communication channels to get information, e.g., hackers mainly use eavesdropping to obtain credit card numbers.

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- ❖ Surveillance (monitoring) – this is where a person may monitor all computer activities done by another person or people. The information gathered may be used for different purposes e.g., for spreading propaganda or sabotage.
- ❖ Industrial espionage – involves spying on a competitor so as to get or steal information that can be used to finish the competitor or for commercial gain. The main aim of espionage is to get ideas on how to counter by developing similar approach or sabotage.
- ❖ An employee who is not supposed to see some sensitive data gets it either by mistake or by design
- ❖ Strangers who may stray into the computer room when nobody is using the computers.
- ❖ Forced entry into the computer room through access points.
- ❖ Network access in case the computers are networked and connected to the external world

## **Control measures against Unauthorized access**

- a) Enforce data and information access control policies on all the employees to control access to data
- b) Keep the computer room closed when nobody is using it
- c) Reinforce weak access points e.g., doors and windows with metallic grills and burglar alarms
- d) Use file passwords to prevent any person from getting access to the electronic files
- e) Enforce network security measures e.g., use of firewalls
- f) Encrypt the data and information during transmission
- g) Perform frequent audit trails to identify threats to data and information

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## Theft

Some information is so valuable such that business competitors or some government officials can decide to pay somebody so as to steal it for them to use.

### **Control measures against theft of information, hardware and software**

- Create backups and store in locations away for the main computing center
- Reinforce weak access points e.g., the windows, doors and roofing with metallic grills and strong padlocks
- Put burglar proofs in the computer room
- Employ guards to keep watch over data and information centers and backups.

## **Computer Crime**

It is also known as cyber-crime.

### **Definitions of computer crime:**

- The deliberate theft or criminal destruction of computerized data.
- The use of computer hardware, software or data for illegal activities e.g., stealing, forgery, defrauding, etc.
- Committing of illegal acts using a computer or against a computer system or user.

### **Examples of Computer Crimes**

- ❖ **Fraud** – is the use of computers to conceal information or cheat other people with the intention of gaining money or information.
- ❖ **Alteration of data** – is the illegal changing of stored data without permission with the aim spreading misinformation.

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- ❖ **Denial of service attack** – it is an attack meant to shut down a machine or network, making it inaccessible to its intended users.
- ❖ **Ransomware** – involves infecting a computer or network with ransomware. Ransomware has the capability to prevent users from accessing all of their personal data on the system by encrypting them and then asking for a ransom in order to give access to the encrypted data.
- ❖ **Identity theft** – is a form of hacking where the perpetrator accesses the victim's sensitive information such as bank account details or credit card numbers. They then use this information to spend their victim's money for online shopping or simply steal the money through fraudulent transfers.
- ❖ **Hacking** – is the practice of gaining unauthorized access to another person's computer, database, or network where private information is stored.

## Reasons for hacking

- ✓ To copy or corrupt the information
- ✓ As a hobby to test the expertise of the hacker
- ✓ Some do it for companies that want to secure the company systems – professional hacking
- ❖ **Cyber stalking/Cyber bullying/Harassment** – cyber stalkers use email, social media or online forums to stalk and harass people online.
- ❖ **Child pornography** – here the perpetrator looks to create or distribute sexual images of children.
- ❖ **Sabotage** – is the illegal destruction of the computer system by a person with grudges with the aim of crippling service delivery or causing great loss to an organization. For example, cutting off communication lines.

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- ❖ **Phishing** – this is when criminals send fraudulent emails pretending to be from legitimate businesses, in an attempt to collect sensitive, personal information.
- ❖ **Commercial espionage** – employees steal sensitive information and sell it to the outsiders or competitors for profit. This may lead to leakage important information, e.g., information on marketing strategies used by the organization, research information, medical reports, etc.
- ❖ Installing malware on someone's computer
- ❖ **Trespass** – refers to the illegal physical entry into restricted computer rooms
- ❖ **Tapping** – involves listening to a transmission line to gain a copy of the message being transmitted. A person may use special programs that are able to intercept messages being sent or received over a transmission line.
- ❖ **Cracking** – the use of guesswork by a person trying to look for a weakness in the security codes of a software in order to access to information.
- ❖ **Piracy** – refers to illegally making or distributing copies of copyrighted software or data without permission from the original owner.

Q. Discuss measures that can be taken to protect computers and computer users against cyber crimes

## Computer Security

What is computer security?

It is the safeguarding the computer and the related equipment from the risk of damage or fraud. It can also be defined as protection of data against accidental or deliberate threats which might cause unauthorized modification, disclosure or destruction.

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## Environmental threats to computers and information systems

These include: Fire, water, floods, lightening, thunderstorm, excessive heat or temperature from the computer itself, smoke, dust, vandalism.

Causes of Data loss in computers

- a) Power failure or disconnection
- b) Crashing of computers
- c) Damage to storage media
- d) Virus attack
- e) Accidental erasure

Q. Explain the possible precautions that can be taken against data loss in computers.

Q. Discuss the laws governing protection of ICT

## CHAPTER 5: COMPUTER NETWORKING AND INTERNET

### NETWORKING

Computer network: it is the interconnection of computers and other devices through transmission media for the purposes of sharing resources and exchanging information.

Network devices: server, switch, router, repeater, multiplexor, bridge, hub, Network Interface Card, network cable.

### Classification of Computer Network

Computer networks can be classified based on any of three criteria, i.e., geographical coverage, server-based or peer-to-peer network, wired or wireless network.

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## Geographical Area of Coverage

Different types of networks have different areas of coverage.

- ✓ **Local Area Network (LAN)** – is a network that covers a limited (small) geographical area.
- ✓ **Wide Area Network (WAN)** – is a network that covers a large geographical area., e.g., a country, a continent or the world.
- ✓ **Metropolitan Area Network (MAN)** – a network that covers a city or town.
- ✓ **Campus Area Network (CAN)** – is a type of network that covers a university or college campus.
- ✓ **Personal Area Network (PAN)** – a type of network that extends up to a radius of 10 meters. It is used in devices such as printers, video game consoles, scanners, PCs using Bluetooth technology.

## Client-Server Network vs Peer-to-Peer network

### **a) Client-server Network**

Also known as *server-based network*, this is a computer network in which one centralized, powerful computer (called the server) is connected to less powerful personal computers or workstations (called clients). The server is a computer or system that provides resources, data, services, or programs to the other computers, known as clients, over a network.

### **b) Peer-to-Peer Network**

Each device on the network acts as server and client, there is no central computer acting as the server.

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## Wired vs Wireless network

In wired networks, devices are connected by use of network cables. Wireless networks use radio signals (Wi-Fi) to connect devices on the network.

## **Advantages and Disadvantages of Computer Networks**

### Advantages

1. Resource sharing - a single resource e.g., printer, scanner etc., can be shared among many users on the network.
2. File sharing – files stored on one device can be accessed among different users connected to the network.
3. Increased file storage and backup – data can be stored or backed up on the server or the other connected computers and can still be accessed by everyone on the network. One standalone computer may not have enough storage capacity to store all the required data, hence the need to utilize the storage on the other computers on the network.
4. Network users can communicate by email, instant messenger, video conferencing, etc.

### Disadvantages

1. Cost: Purchasing the network cabling and servers can be expensive.
2. Managing a large network is complicated, requires training and a network manager usually needs to be employed.
3. Overdependency on the server: If the server breaks down then the network will be disabled, hence unable to offer the needed services.

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4. Rapid spread of computer virus: Viruses can spread to other computers throughout a computer network.
5. Security issues: There is a danger of hacking, particularly with wide area networks. Security procedures are needed to prevent such abuse, e.g., a firewall.

## Network Topology

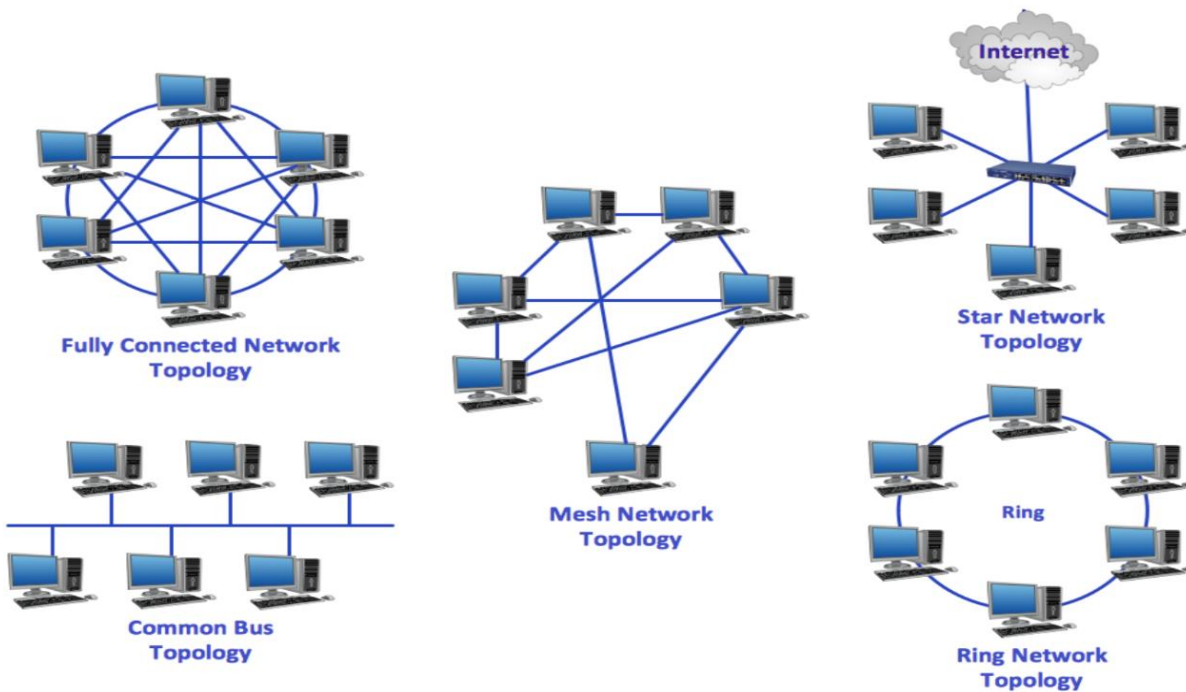
Network Topology refers to the manner in which various network devices (nodes) are interconnected or arranged.

The types of network topology include: star topology, mesh topology, tree topology, bus topology, bus topology.

1. *Star topology*: all the devices are connected through a central hub.
2. *Mesh topology*: each device is connected to every other device, i.e., there exists a link between any two devices.
3. *Bus topology*: all the nodes are connected to a single cable known as bus which is responsible for transmitting data between from one to another.
4. *Ring topology*: each node is connected to the two adjacent nodes in a circular fashion.
5. *Tree topology*: all the nodes are linked together like tree branches. It is a combination of bus and star topologies.

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## INTERNET

Internet refers to a global network that enables people to share information electronically. For you to set up Internet connection need a *computer*, a *modem*, a *transmission line* (can be physical like a fiber optic cable or can be wireless like Wi-Fi connection, cellular connection), and an *Internet Service Provider (ISP)*.

### Basic Internet Terminologies

**HTTP** – provides a procedure for a web browser to request information (web page or file) from a web server, so as to display that information to the user.

**Intranet** – is a private network created to facilitate collaboration and information sharing among employees of an organization. An intranet is only accessible by members of the organization.

**Extranet** – is an intranet that is accessible by authorized outsiders e.g., customers, partners, vendors, etc.

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**Telnet** – Telnet provides a connection to the remote computer in such a way that a local terminal appears to be at the remote side.

**Internet of things** –

**Web server** – refers to the computer where the web content is stored. It is used in running (hosting) websites.

**Website** – refers to a set of web pages usually containing hyperlinks to each other and made available online by the website owner.

**Cloud computing** –

**Home page** – it is the page that provides the introduction or content of a website with links to other web pages of the website.

**Universal Resource Locator (URL)** – refers to a web address of a website or web

**Web browser** – is an application program used to download and display web pages and files (documents, images, videos).

**Web page** – a single hypertext page that is part of a website.

**Search engine** – is a software that helps people to carry out web searches.

**Browsing/Surfing** –

**Blog** –

**Wi-Fi** –

**Hotspot** –

**Hyperlink** – is a graphic or piece of text in a webpage that links to another portion of the same webpage, or to another webpage altogether. Hyperlinks are usually coloured purple or blue.

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## EMAIL

This is a method of sending and receiving messages and file electronically from one device to another through the internet.

Email users usually have email addresses. An email address is divided into 3 parts: username, at sign and domain.

Example: [Geraldwanga@yahoo.com](mailto:Geraldwanga@yahoo.com)

An email compose window consists of six parts, namely **subject, recipient, body, attachments, CC or BCC** and **signature**.

Q. Distinguish between CC and BCC.

### Advantages of Email system over traditional Postal System

1. Message delivery is faster
2. It is cheaper since there are no stamps nor courier charges.
3. Messages not properly formatted can be accepted. In contrast, business letters and inter-office memos are expected to be error free and formatted according to certain standards.
4. Messages can be received anywhere in the world at any time.

Q. Outline 10 services offered by the Internet.

Q. Discuss the positive and negative effects of internet on the society.

Q. Name five web browsers and five search engines.