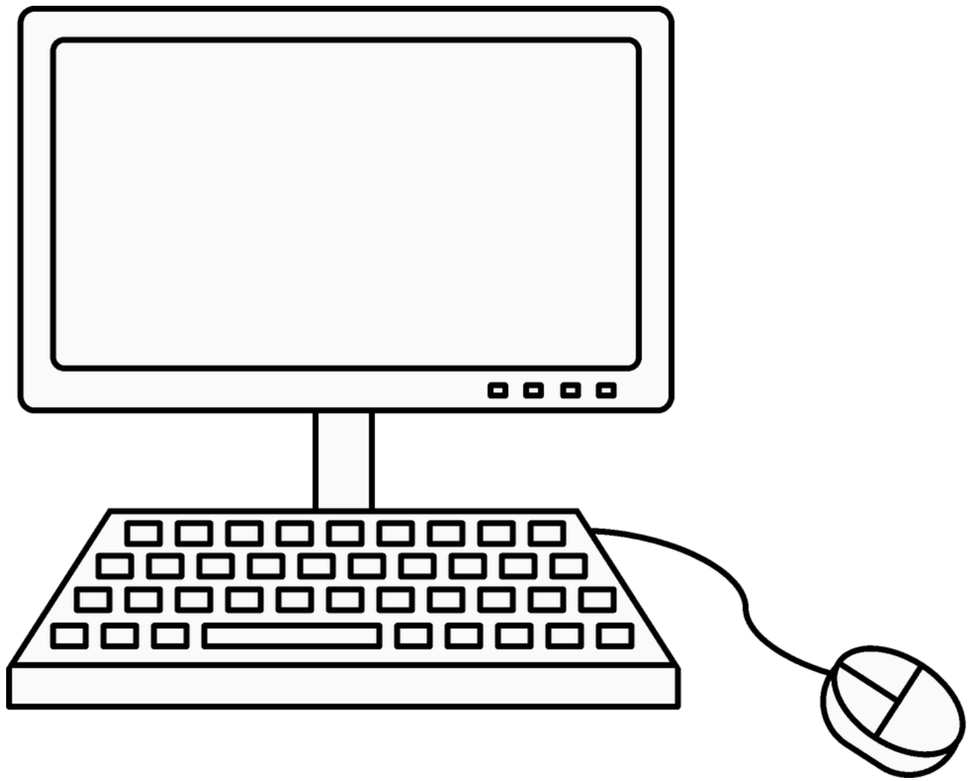
ICT

IGCSE ICT – CHAPTER 1
TYPES AND COMPONENTS OF COMPUTER SYSTEMS
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LEARNING OBJECTIVES

By the end of this chapter, students should be able to:

1. Identify hardware and software components.
2. Explain analogue and digital data.
3. Describe the CPU and its main components.
4. Compare RAM and ROM.
5. Identify input and output devices.
6. Explain backing storage and its types.
7. Describe the functions of an operating system.
8. Compare different types of computers.
9. Explain emerging technologies, including AI, VR and AR.

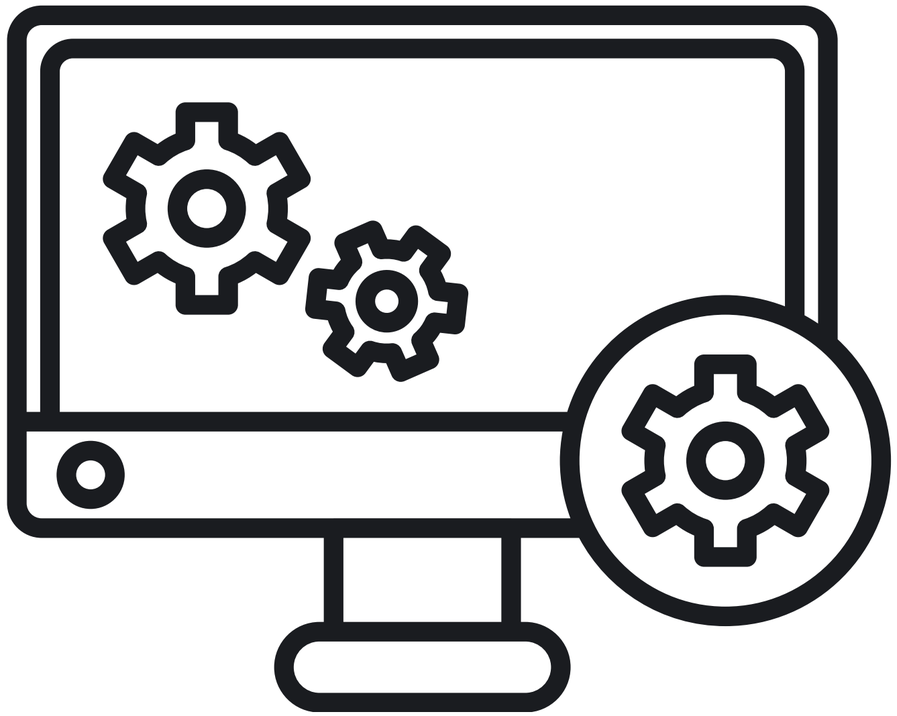
WHAT IS A COMPUTER SYSTEM?

A computer system is an electronic system that accepts data, processes it, stores it and produces information.

Main stages:

1. Input – Data is entered into the computer.
2. Processing – Data is processed by the CPU.
3. Output – Information is produced.
4. Storage – Data and information are saved.





HARDWARE COMPONENTS

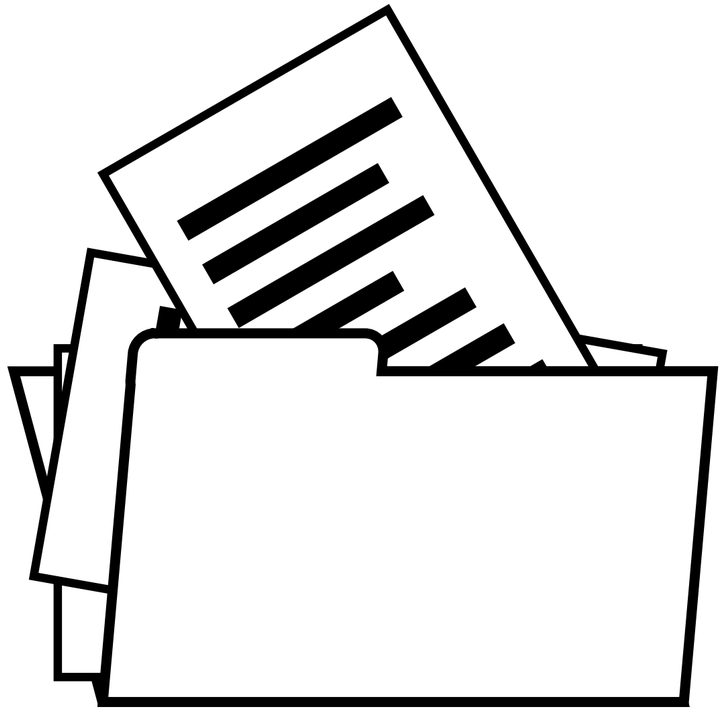
Hardware refers to the physical components of a computer system that can be seen and touched.
Examples:

- Monitor
- Keyboard
- Mouse
- CPU
- Motherboard
- RAM
- Hard disk drive

SOFTWARE COMPONENTS

Software is a collection of programs and instructions that tell a computer what to do. Two main categories:

- System software: Controls and manages computer hardware. Example: Windows, Linux and device drivers.
- Application software: Helps users perform specific tasks. Example: Microsoft Word, Excel and web browsers.



ANALOGUE AND DIGITAL DATA

Analogue data is data represented by continuously changing values.

Characteristics:

- Values change smoothly over time.
- Can have an infinite number of possible values within a range.
- Often obtained from real-world measurements.

Examples:

- Temperature
- Sound waves
- Light intensity
- Analogue clock

DIGITAL DATA

Digital data is represented using discrete values.
Computers process digital data using binary digits (bits).

- Binary 0 represents one state.
- Binary 1 represents another state.
- A bit is the smallest unit of data.
- Eight bits make one byte.

Comparison

Analogue	**Digital**
Continuous values	Discrete values
Smooth changes	Separate values
Can be affected by noise	Can be regenerated accurately
Example: analogue sound	Example: digital audio

CENTRAL PROCESSING UNIT (CPU)

What Is the CPU?
The Central Processing Unit (CPU) is the main processing component of a computer.
Main functions:

- Executes program instructions.
- Performs arithmetic calculations.
- Makes logical comparisons.
- Controls and coordinates computer operations.

COMPONENTS OF THE CPU

The main components include:

1. Control Unit (CU)
2. Arithmetic Logic Unit (ALU)
3. Registers

Component Function

CU - Controls and coordinates CPU operations

ALU - Performs arithmetic and logical operations

Registers - Hold data, instructions, and addresses temporarily

FETCH–DECODE–EXECUTE CYCLE

The CPU processes instructions through three main stages:

1. Fetch: Retrieves an instruction from memory.
2. Decode: Interprets the instruction.
3. Execute: Carries out the instruction.

This cycle repeats while the computer runs programs.

INTERNAL MEMORY (RAM AND ROM)

Internal memory is memory directly accessible by the CPU.
Two important types:

- RAM – Random Access Memory
- ROM – Read Only Memory

RAM	ROM
Volatile	Non-volatile
Temporary working memory	Stores essential instructions
Read and write	Normally read-only in use
Data lost when power is off	Data retained without power

Exam practice: Explain three differences between RAM and ROM.

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RAM (RANDOM ACCESS MEMORY)

RAM is temporary memory used to store programs and data currently being used by the computer.

Characteristics:

- Volatile memory.
- Data is lost when power is switched off.
- Can be read from and written to.
- Stores currently running programs and data.
- Allows quick access to stored information.

Example: When opening a web browser, its active program data is loaded into RAM.

ROM (READ ONLY MEMORY)

ROM is non-volatile memory used to store essential instructions required to start or operate a computer.

Characteristics:

- Non-volatile memory.
- Retains data without electrical power.
- Normally stores firmware.
- Data is not normally changed during everyday operation.

Example: Firmware containing instructions needed to start a computer.

INPUT AND OUTPUT DEVICES

Input Devices

An input device is hardware used to enter data and instructions into a computer.

Examples:

- Keyboard
- Mouse
- Scanner
- Microphone
- Webcam
- Barcode reader
- Touchscreen

INPUT AND OUTPUT DEVICES

Specialised Input Devices

Device	Purpose
Barcode reader -	Reads barcodes
QR code reader -	Reads QR codes

OCR - Converts printed characters into editable text
OMR - Detects marks on specially designed forms
MICR - Reads magnetic ink characters
Biometric scanner - Identifies users using biological characteristics
Sensors - Detect physical conditions such as temperature or pressure

INPUT AND OUTPUT DEVICES

Output Devices
An output device presents processed data as information.

Examples:

- Monitor
- Printer
- Speakers
- Headphones
- Projector
- Plotter

TYPES OF PRINTERS

Two major categories:

Impact printers

- Print by physically striking an ink ribbon against paper.
- Example: Dot matrix printer.
- Useful for multi-part forms.

Non-impact printers

- Print without physically striking the paper.
- Examples: Laser printer and inkjet printer.

TYPES OF PRINTERS

Inkjet	Laser
Sprays liquid ink	Uses toner powder
Good for colour photographs	Fast for large volumes of text
Often suitable for home use	Often suitable for offices

BACKING STORE

What Is Backing Store?

Backing store is non-volatile storage used to save data and programs for long-term use.

Functions:

- Stores files and documents.
- Saves programs and applications.
- Retains data when power is switched off.
- Provides additional storage capacity.

BACKING STORE

Types of Backing Store

1. Magnetic storage
   - Hard Disk Drive (HDD)
   - Magnetic tape
2. Optical storage
   - CD
   - DVD
   - Blu-ray disc
3. Solid-state storage
   - Solid State Drive (SSD)
   - USB flash drive
   - Memory card

BACKING STORE

Storage Comparison

Storage	Advantages	Disadvantages
HDD	Large capacity, low cost	Moving parts, slower than SSD
SSD	Fast, durable, no moving parts	Generally more expensive per GB
Optical disc	Portable, useful for distribution	Lower capacity and slower access
Magnetic tape	Low cost for large backups	Sequential access, slower retrieval

Exam focus: Explain why an SSD may be preferred to an HDD in a laptop.

OPERATING SYSTEMS

What Is an Operating System?
An operating system (OS) is system software that manages computer hardware and software resources and provides an interface between the user and the computer.
Examples:

- Microsoft Windows
- macOS
- Linux
- Android
- iOS

OPERATING SYSTEMS

Functions of an Operating System

1. User interface management: Allows users to interact with a computer.
2. Memory management: Allocates and manages memory.
3. File management: Organises files and folders.
4. Device management: Controls peripheral devices.
5. Processor management: Manages CPU time and processes.
6. Security management: Controls access and user permissions.

OPERATING SYSTEMS

Types of user interfaces:

- Graphical User Interface (GUI)
- Command Line Interface (CLI)
- Menu-driven interface
- Voice-controlled interface

TYPES OF COMPUTERS

Desktop Computers
A desktop computer is designed to be used at a fixed location.
Characteristics:

- Usually consists of separate components.
- Requires an external power supply.
- Generally easier to upgrade.
- Often has a larger screen and keyboard.
- Suitable for offices, schools and homes.

TYPES OF COMPUTERS

Mobile Computers

Laptop

- Portable computer.
- Has an integrated screen, keyboard and touchpad.
- Usually powered by a rechargeable battery.

Smartphone

- Mobile phone with advanced computing functions.
- Supports applications, internet access and communication.

Tablet

- Portable touchscreen computer.
- Usually larger than a smartphone.
- Often uses an on-screen keyboard.

Phablet

- A device combining features of a smartphone and a small tablet.
- Has a relatively large screen.

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TYPES OF COMPUTERS

Desktop vs Mobile Computers

Desktop	Mobile
Usually fixed location	Portable
Often more upgradeable	Usually limited upgradeability
Separate components	Integrated components
Requires mains power	Often battery-powered
Generally larger workspace	Smaller screen and keyboard

Discussion: Which type of computer is more suitable for a student who needs to work while travelling? Explain your answer.

EMERGING TECHNOLOGIES

Artificial Intelligence (AI)
Artificial Intelligence refers to computer systems designed to perform tasks that normally require human intelligence.
Examples of AI applications:

- Voice assistants
- Image recognition
- Recommendation systems
- Language translation
- Chatbots
- Autonomous vehicles

EMERGING TECHNOLOGIES

Artificial Intelligence (AI)

Advantages:

- Automates repetitive tasks.
- Can analyse large amounts of data.
- Can improve efficiency and accuracy in suitable applications.

Disadvantages:

- Can produce incorrect results.
- May introduce bias.
- Can affect employment.
- Raises privacy and security concerns.

EMERGING TECHNOLOGIES

Virtual Reality (VR)
Virtual Reality creates a computer-generated environment that users can experience as an immersive world.
Characteristics:

- Uses a VR headset.
- Can include 3D graphics and sound.
- Allows interaction with a simulated environment.

Applications:

- Gaming
- Education and training
- Medical simulations
- Virtual tours

EMERGING TECHNOLOGIES

Augmented Reality (AR)
Augmented Reality adds computer-generated elements to the real-world environment.
Characteristics:

- Combines real and digital information.
- Can use a smartphone, tablet or AR glasses.
- Allows users to see digital objects overlaid on the real world.

Applications:

- Education
- Navigation
- Retail product visualisation
- Maintenance and repair

EMERGING TECHNOLOGIES

Virtual Reality (VR) Augmented Reality (AR)

VR vs AR

VR	AR
Creates a virtual environment	Adds digital elements to the real world
Often blocks out the real environment	Keeps the real environment visible
Uses VR headsets	Uses phones, tablets or AR glasses

REVISION AND ASSESSMENT

Key concepts to remember:

- Hardware = Physical components.
- Software = Programs and instructions.
- CPU = Processes instructions.
- RAM = Volatile memory.
- ROM = Non-volatile memory.
- Input = Enters data.
- Output = Produces information.
- Backing store = Long-term storage.
- OS = Manages computer resources.
- AI = Performs tasks associated with human intelligence.
- VR = Immersive virtual environment.
- AR = Digital information added to the real world.

REVISION AND ASSESSMENT

Multiple Choice Questions

1. Which component performs arithmetic calculations?
   - A. RAM. B. ALU C. ROM D. HDD
2. Which type of memory is volatile?
   - A. ROM B. SSD C. RAM D. DVD
3. Which device is used to read marks on examination answer sheets?
   - A. OCR. B. OMR C. MICR D. Barcode reader
4. Which storage device uses magnetic technology?
   - A. HDD B. SSD C. USB flash drive D. Blu-ray disc
5. Which technology creates a fully immersive virtual environment?
   - A. AI B. AR C. VR D. GUI

REVISION AND ASSESSMENT

Short Answer Examination Questions

1. Define hardware and software. [2]
2. State two differences between RAM and ROM. [2]
3. Describe the three stages of the fetch–decode–execute cycle. [3]
4. Explain two functions of an operating system. [4]
5. Describe two differences between an HDD and an SSD. [4]
6. Explain the difference between Virtual Reality and Augmented Reality. [4]

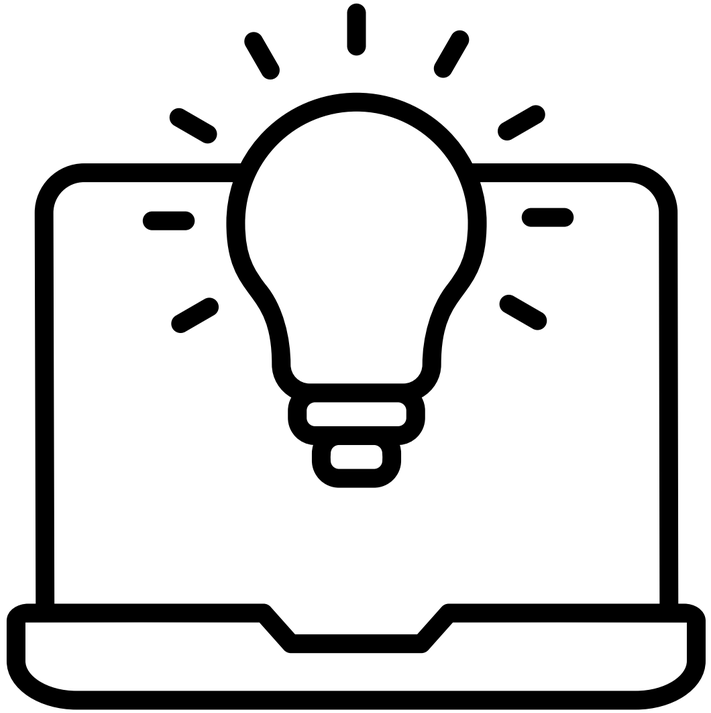
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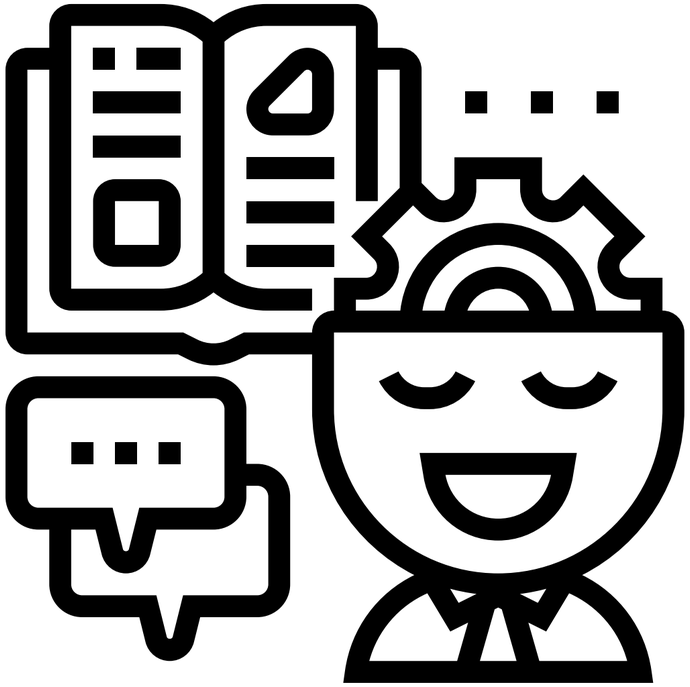
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THANK YOU

Keep Learning. Keep Practising.

IGCSE ICT – Chapter 1
Types and Components of Computer Systems

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