Introduction to Computers

What is a Computer?

A **COMPUTER**, IN SIMPLE TERMS, CAN BE DEFINED AS AN ELECTRONIC DEVICE WHICH ACCEPTS DATA, PERFORMS THE REQUIRED MATHEMATICAL AND LOGICAL OPERATIONS AT HIGH SPEED, AND OUTPUTS THE RESULT.

Full form of Computer

C = Commonly

O = Operating

M = Machine

P= Particularly

U = Used for T= Technical E = Educational R = Research

Data and Information

- Computer accepts ***data***, processes it, and produces ***information***.
- Data refers to some raw facts or figures, and information implies the processed data.
- For example, if 12-1-96 is the date of birth of a student, then it is data (a raw fact/figure). However, when we process this data (subtract it from the present date) and say that the age of the student is 18 years, then the outcome is information.

History of Computer

The history of computer starts out/begning with 19th centuary English mathematics professor name Charles Babbage.He designed the analytical engine and it was this design that the basic framework of the computers of today are based on. His design Contained the five Key characcteristics of modern computers:

- An input device
- Storage for numbers waiting to processed
- A unit to control the task and the sequence of its calculations.
- An output devices

Characteristics of Computers

SPEED: COMPUTERS CAN PERFORM MILLIONS OF OPERATIONS PER SECOND. THE SPEED OF COMPUTERS IS USUALLY GIVEN IN NANOSECONDS (NS) AND PICOSECONDS (PS), WHERE 1 NS = 1×10^{-9} SEC AND 1 PS = 1×10^{-12} SEC.

VERSATILE: COMPUTERS CAN PERFORM MULTIPLE TASKS OF DIFFERENT NATURE AT THE SAME TIME.

MEMORY: COMPUTERS HAVE INTERNAL OR PRIMARY MEMORY (STORAGE SPACE) AS WELL AS EXTERNAL OR SECONDARY MEMORY TO STORE DATA AND PROGRAMS.

Characteristics of Computers

Accuracy: A computer always gives accurate results, provided the correct data and instructions are input to it. If the input data is wrong, then the output will also be erroneous. This is called *garbage-in, garbage-out (GIGO).*

Automation: Computers perform a task without any user intervention.

Diligence: Unlike humans, computers never get tired of a repetitive task.

Characteristics of Computers

No IQ: Computers do not have any decision-making abilities of their own. They need guidance to perform various tasks.

Economical: Computers are considered as short-term investments for achieving long-term gains. They save time, money, and energy.

Generations of Computers

THE WORD '*GENERATION*', WHEN APPLIED TO COMPUTING, REFERS TO THE DIFFERENT ADVANCEMENTS IN COMPUTER TECHNOLOGY.

THE FOCUS OF EVERY NEW GENERATION HAS BEEN ON MINIATURIZATION, SPEED, POWER, AND EFFICIENT COMPUTER MEMORY.

First Generation (1940-1956): Vacuum Tubes

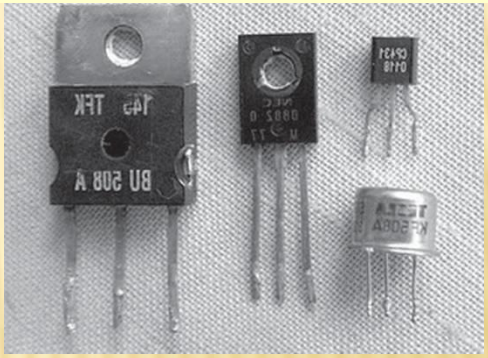
Advantage

- Fastest calculating devices of their time

Disadvantages

- Generated a lot of heat
- Consumed a lot of electricity
- Bulky in size
- Prone to frequent hardware
- Required constant maintenance because of the low mean time between failures
- Limited commercial use
- Very expensive

Second Generation (1956-1963): Transistors



Advantages

- Consumed less electricity
- Generated less heat
- Faster, cheaper, smaller, and more reliable
- Could be programmed using assembly and high-level languages
- Had faster primary memory and a larger secondary memory

Disadvantage

- Transistors had to be assembled manually, which made commercial production of computers difficult and expensive

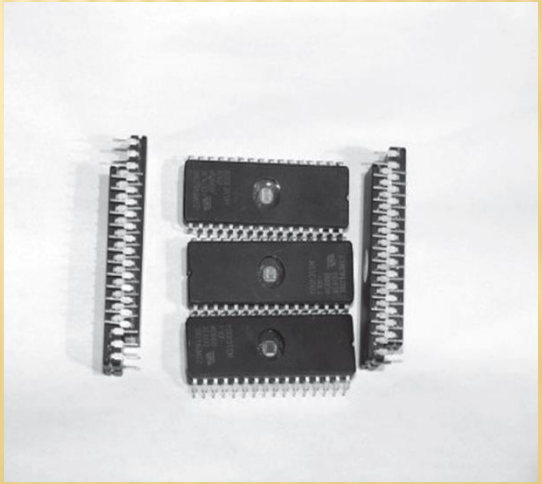
Third Generation (1964-1971): Integrated Circuits

Advantages

- Faster and could perform one million transactions per second
- Smaller, cheaper, and more reliable
- Faster and larger primary memory and secondary storage
- Widely used for scientific as well as business applications
- Supported time sharing operating systems

Disadvantages

- Difficult to maintain
- Got heated very quickly



Fourth Generation (1971-1989): Microprocessors

Advantages

- Smaller, cheaper, faster, and more reliable
- Consumed less electricity and generated less heat
- Faster and larger primary memory and secondary storage
- Could be used as general-purpose computers
- GUIs enabled people to learn to work with computers very easily
- Lead to widespread use of computers in offices and at homes
- Networks allowed sharing of resources

Disadvantage

- Not intelligent systems

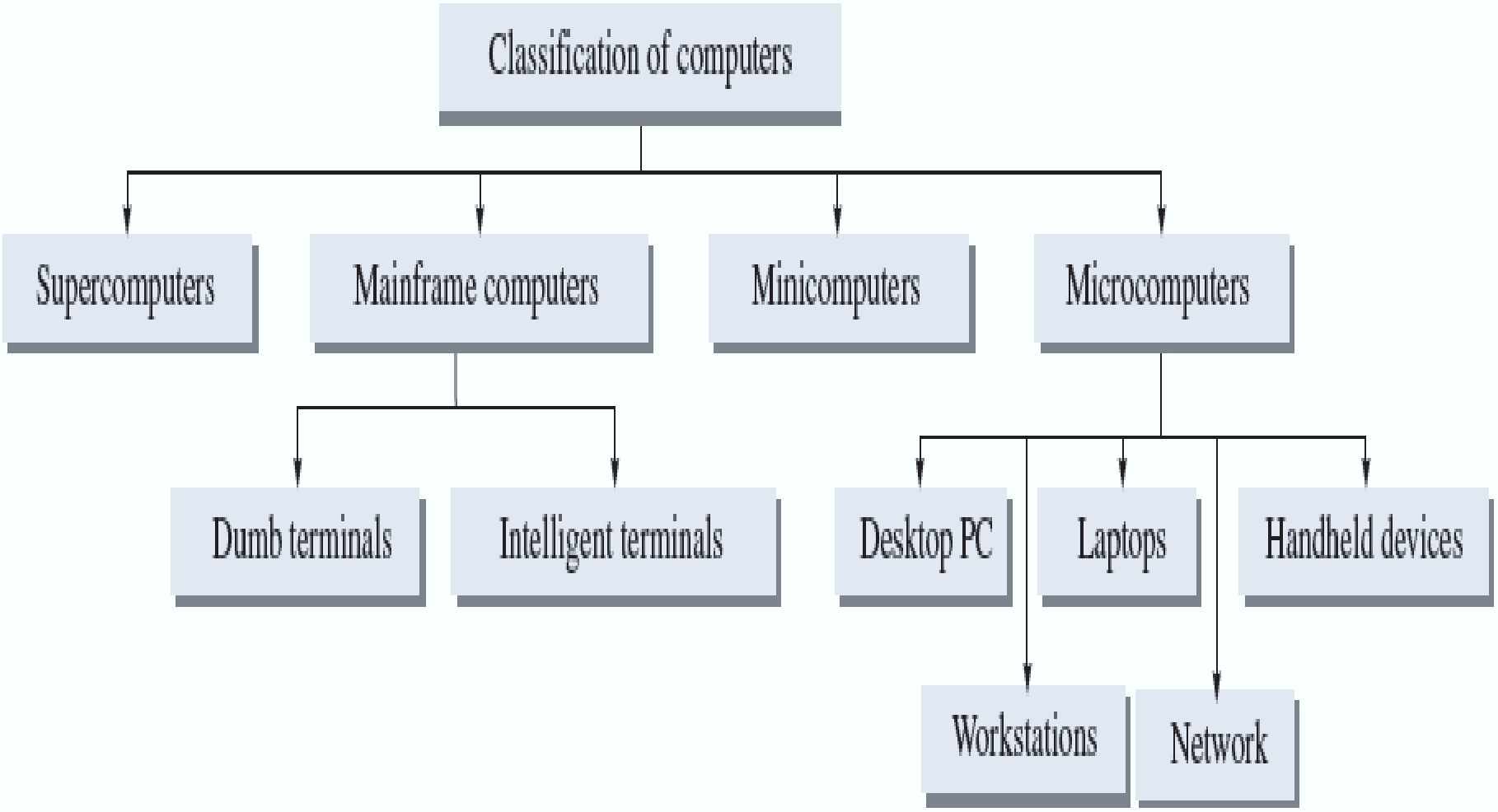
Fifth Generation (Present and Beyond): Artificial Intelligence

- **Gaming:** Computers are programmed to play games such as chess and checkers. More recent examples of such gaming systems include PlayStation by Sony.
- **Expert systems:** Computers are programmed to take decisions in real-world situations.
- **Natural languages:** Computers are programmed to understand and respond to natural human languages.

Fifth Generation (Present and Beyond): Artificial Intelligence

- **Neural networks:** Systems are programmed to simulate intelligence by reproducing the physical connections that take place in animal brains.
- **Robotics:** Computers are programmed to look, listen, and react to other sensory stimuli.

Classification of Computers



Supercomputers

- Fastest, most powerful, and most expensive computer
- Used to process large amounts of data and to solve complex scientific problems
- Can support thousands of users at the same time
- Mainly used for weather forecasting, nuclear energy research, aircraft design, automotive design, online banking, etc.
- Some examples of supercomputers are CRAY-1, CRAY-2, Control Data CYBER 205, and ETA A-10

Mainframe Computers

- Large-scale computers, but smaller than Supercomputers
- Very expensive
- Need a very large clean room with air conditioning
- Used as servers on the World Wide Web
- Some examples are IBM S/390, Control Data CYBER 176, and Amdahl 580

Minicomputers

- Smaller, cheaper, and slower than Mainframes
- Can be used as servers in a networked environment
- Widely used in business, education, hospitals, government
- Some examples are AS/400 computers (IBM Corporation), Data General Corporation, and Prime Computer

Microcomputers

Desktop PCs

- Most popular model
- Widely used in homes and offices

Laptops

- Very handy and easily portable
- Storage capacity is almost equivalent to that of a desktop computer
- For input, laptops have a built-in keyboard and a touchpad
- More expensive than desktop computers

Microcomputers

Workstations

- Single-user computers
- Same features as PCs but with higher processing speed
- Have advanced processors, more RAM and storage capacity
- Can be used as servers in a networked environment

Microcomputers

Network Computers

- Designed to be used as terminals in a networked environment
- Have less processing power, memory, and storage
- Those used to access Internet or Intranet are often known as Internet PCs or Internet boxes
- Some used in homes do not even have a monitor. They may be connected to a TV. They are called WebTV

Microcomputers

Handheld Computers

- Single-user computers
- Can fit in one hand
- Have small-sized screens and keyboards
- Some examples of handheld computers are
  - Personal Digital Assistants (PDA)
  - Cellular Phones
  - H/PC Pro Devices

Basic Organization of Computers

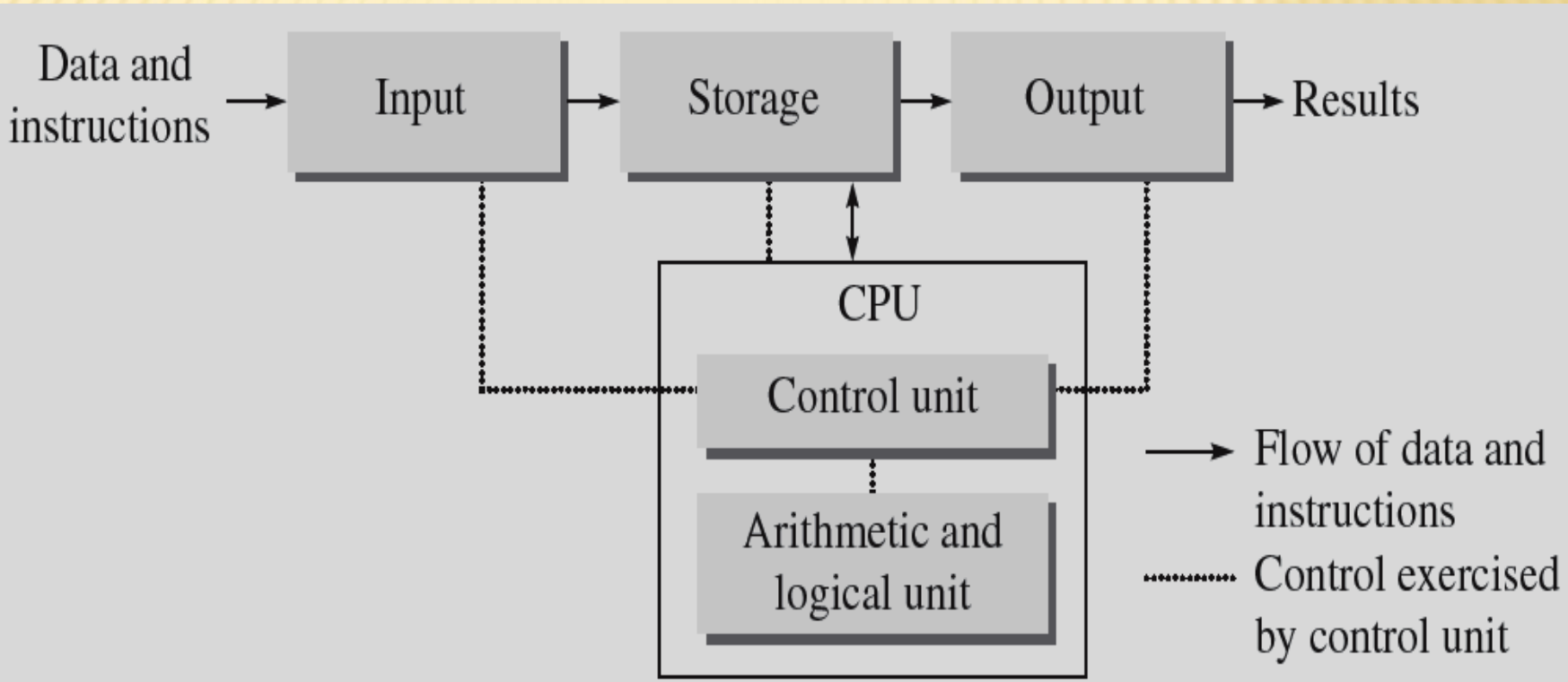


Fig. 1.9 Block diagram of a computer

Basic Organization of Computers

- **Input:** The process of entering data and instructions (also known as *programs*) into the computer system

- **Storage:** The process of saving data and instructions permanently in the computer so that they can be used for processing. A computer has two types of storage areas:

  - **Primary storage (main memory)** is the storage area that is directly accessible by the CPU at very high speeds

  - **Secondary storage (secondary or auxiliary memory)** supplements the limited storage capacity of the primary memory

Basic Organization of Computers

- **Processing:** The process of performing operations on the data as per the instructions specified by the user (program)
- **Output:** The process of giving the result of data processing to the outside world (external to the computer system)
- **Control Unit:** It is the central nervous system of the computer system that manages and controls all the other components