Subject Code : 1CS1010103

Subject Title: FUNDAMENTALS OF COMPUTER ORGANIZATION

UNIT-1

Computer basics, Computer generations, Classifications of Computers

Digital & Analog systems, Logic levels and pulse wave forms, digital computer, Major
parts of computer, Hardware, Software - Application and System Software. Computer generations. Classifications of Computers.

UNIT-2

Working Principles of Input / Output devices

Input devices: **Keyboard, Mouse, Light pen, Joystick, Scanner, Voice input system, Touch screen**

Output devices: **Monitor - CRT terminals (Monitor / VDU), Non – CRT terminals(LCD, Plasma display, LED) Printer - Dot matrix printer, Ink jet printer, Laser printer, Line printer, Plotter**

UNIT-3

Working Principles of Memory and Storage Devices

Understanding the principles of Main/Cache memory, Primary/Secondary memory,

Physical/Virtual memory

Magnetic memory - Magnetic Tape, Hard disk, Floppy disk,

Semiconductor memory - RAM, ROM, Flash memory

Optical memory - CD, CD-ROM, CD-RAM, DVD, DVD-ROM, DVD-RAM

Binary classification of codes - 8421 BCD code, Excess-3(XS-3) code

UNIT-4

Number system, Conversion, Binary arithmetic
Number system - Binary, decimal, octal, hexadecimal
Conversion - Binary to decimal, decimal to binary, octal to decimal, decimal to octal,
octal to binary, binary to octal, hexadecimal to binary, binary to hexadecimal, hexadecimal to Decimal, decimal to hexadecimal, hexadecimal to octal, octal to hexadecimal
Binary arithmetic – Addition, subtraction

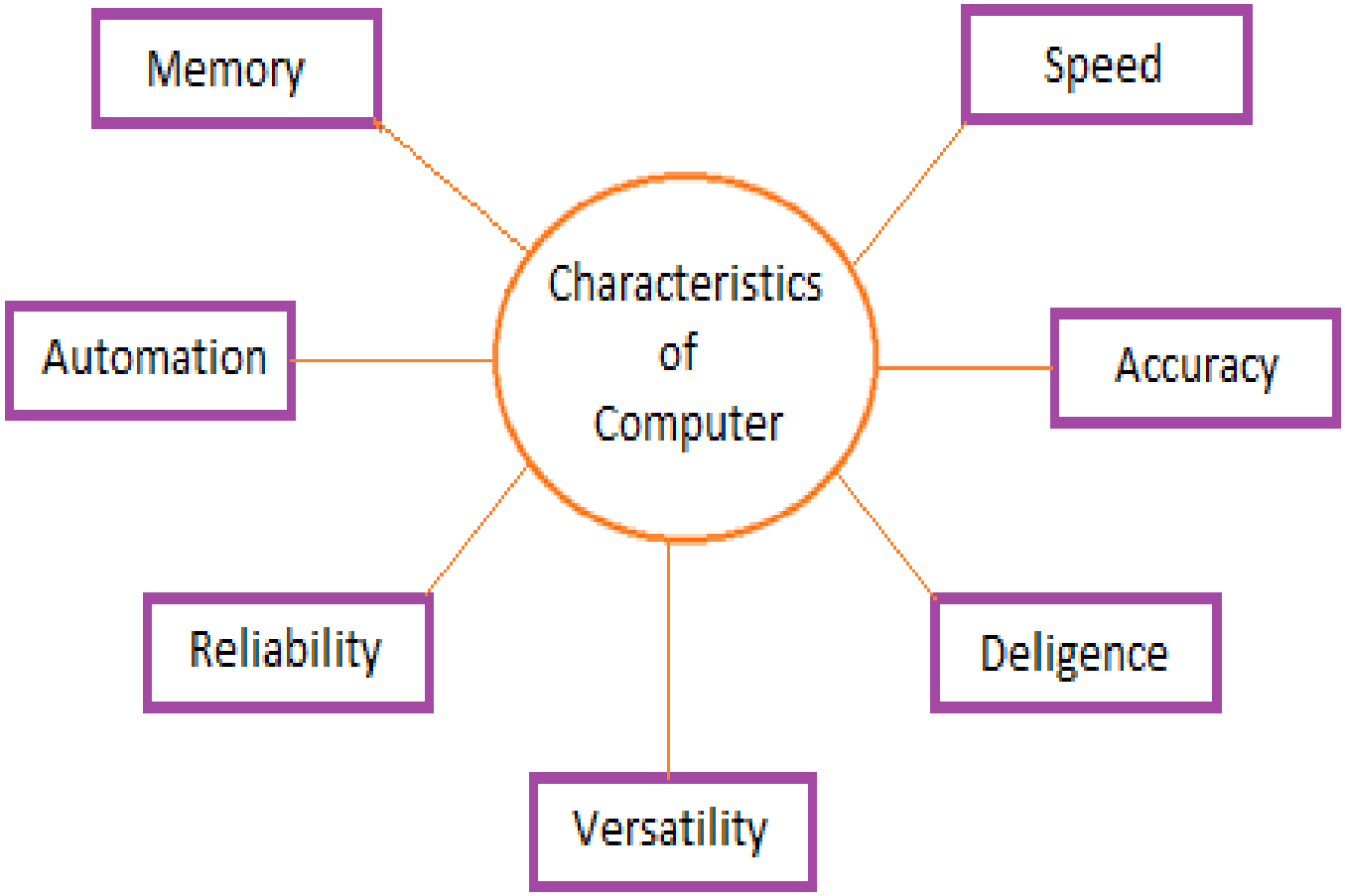
UNIT-5

Logic gates, Combinational circuits, Data Processing circuit
Logic gates - AND, OR, NOT, NAND, NOR, Exclusive-OR, Exclusive-NOR
Combinational circuits - Half adder, Full adder, Half subtractor, Full subtractor
Data Processing circuit - Decoder, Encoder

Digital & Analog systems

Analog and **digital** signals are used to transmit information, usually through electric signals. In both these technologies, the information, such as any audio or video, is transformed into electric signals. The **difference between analog and digital** technologies is that in analog technology, information is translated into electric pulses of varying amplitude. In digital technology, translation of information is into binary format (zero or one) where each bit is representative of two distinct amplitudes.

	Analog	Digital
Signal	Analog signal is a continuous signal which represents physical measurements.	Digital signals are discrete time signals generated by digital modulation.
Waves	Denoted by sine waves	Denoted by square waves
Representation	Uses continuous range of values to represent information	Uses discrete or discontinuous values to represent information
Example	Human voice in air, analog electronic devices.	Computers, CDs, DVDs, and other digital electronic devices.
Technology	Analog technology records waveforms as they are.	Samples analog waveforms into a limited set of numbers and records them.
Data transmissions	Subjected to deterioration by noise during transmission and write/read cycle.	Can be noise-immune without deterioration during transmission and write/read cycle.
Response to Noise	More likely to get affected reducing accuracy	Less affected since noise response are analog in nature
Flexibility	Analog hardware is not flexible.	Digital hardware is flexible in implementation.
Uses	Can be used in analog devices only. Best suited for audio and video transmission.	Best suited for Computing and digital electronics.
Applications	Thermometer	PCs, PDAs
Bandwidth	Analog signal processing can be done in real time and consumes less bandwidth.	There is no guarantee that digital signal processing can be done in real time and consumes more bandwidth to carry out the same information.
Memory	Stored in the form of wave signal	Stored in the form of binary bit
Power	Analog instrument draws large power	Digital instrument drawS only negligible power
Cost	Low cost and portable	Cost is high and not easily portable


Characteristics of Computer
Memory
Speed
Automation
Accuracy
Reliability
Deligence
Versatility

Characteristics of a Computer

- **SPEED** : A Computer can perform tasks very fast In general, no human being can compete to solving the complex computation, faster than computer.
- **ACCURACY** : Since Computer is programmed, so what ever input we give it gives result with accurately.
- **DILIGENCE :** Computer can work for hours without any break and creating error.
- **VERSATILITY : :** We can use computer to perform completely different type of work at the same time.
- **POWER OF REMEMBERING** : Every piece of Information that a user stores on a Computer can be retained as long as is needed.
- **NO FEELING** : Computers are devoid of emotions, they have no feelings and no instincts because they are machines.

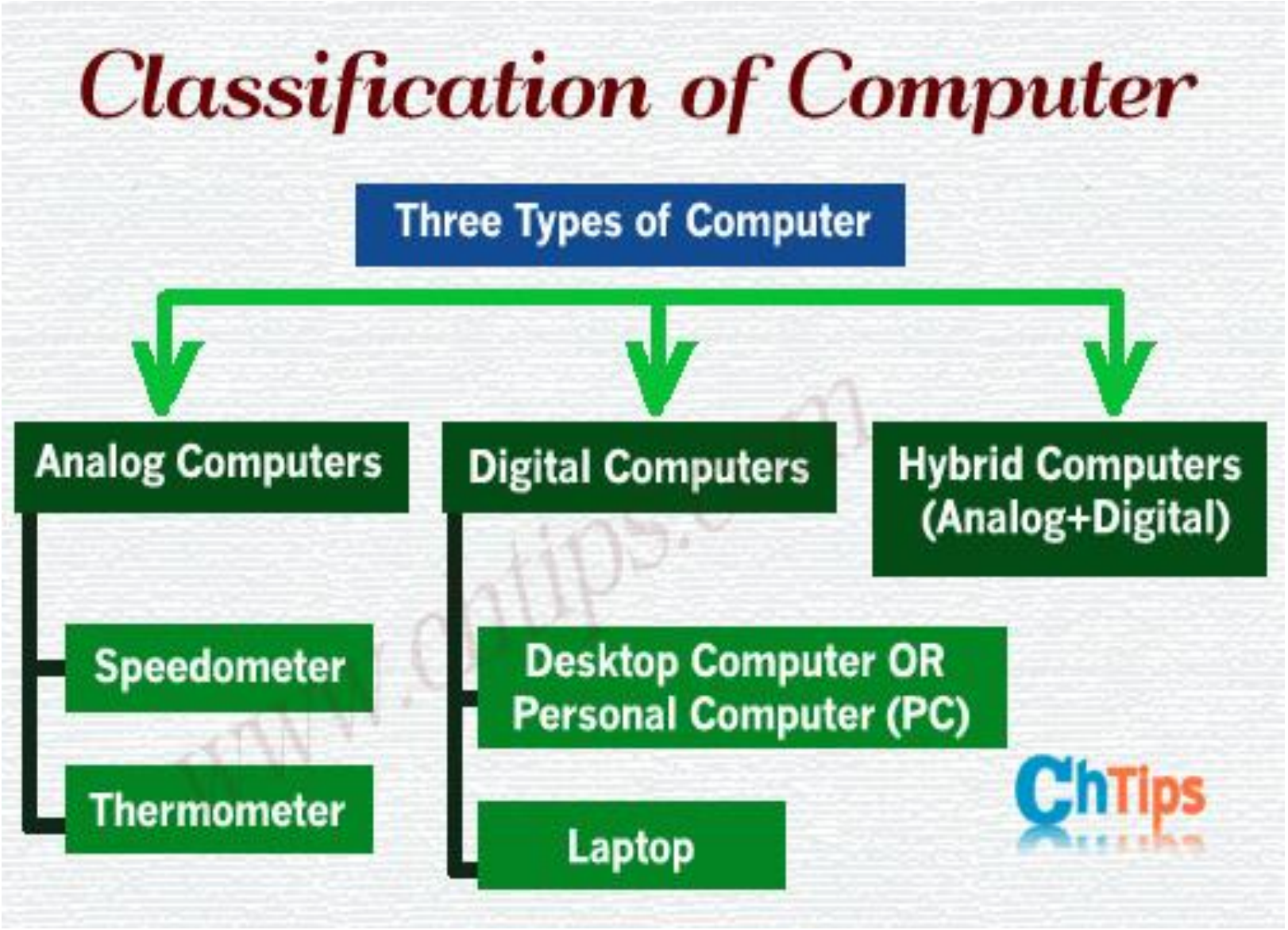
Characteristics of Computers

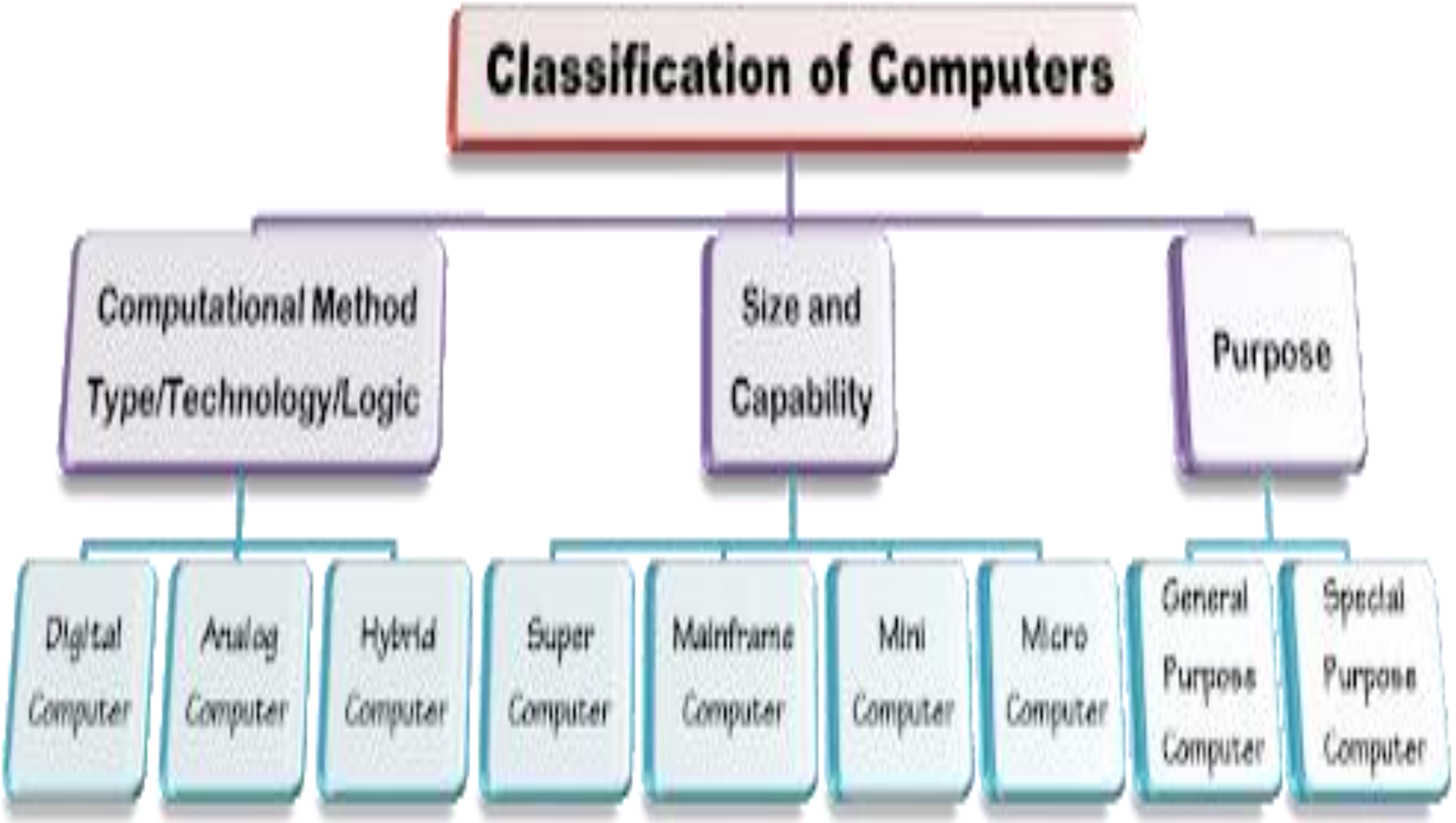
1. **Speed:** today the speed is over 80,000 MIPS.
2. **Accuracy:** All computer systems besides having amazing speeds have nearly 100% accuracy.
3. **Reliability:** Reliability of any computer system is typically as high as 99.99%.
4. **Memory:** is the electronic holding place for data and instructions.
5. **Storage:** various computer media can hold billions of bytes of data.

Characteristics of a Good Computer Program

- Portability
- Maintainability
- Efficient
- Reliable
- Machine Independence
- Cost Effectiveness
- Flexible

Classification of Computer




Classification of Computers
Computational Method Type/Technology/Logic
Size and Capability
Purpose
Digital Computer
Analog Computer
Hybrid Computer
Super Computer
Mainframe Computer
Mini Computer
Micro Computer
General Purpose Computer
Special Purpose Computer

Classifications of Computers.

Computer scan is broadly classified by their speed and computing power

Sr.N	Type	Specifications
1	PC (Personal Computer) or Micro-Computers	It is a single user computer system having a moderately powerful microprocessor. It is termed as a computer that is equipped microprocessor as its CPU.
2	Workstation	It is also a single user computer system, similar to the personal computer, however, has a more powerful microprocessor.
3	Mini-Computer	It is a multi-user computer system, capable of supporting hundreds of users simultaneously.
4	Main Frame	It is a multi-user computer system, capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer.
5	Super-Computer	It is an extremely fast computer, which can execute hundreds of millions of instructions per second.

PC (Personal Computer)

A PC can be defined as a small, relatively inexpensive computer designed for an individual user. PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is playing games and surfing the Internet.

Although personal computers are designed as single-user systems, these systems are normally linked together to form a network. In terms of power, nowadays high-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and Dell.

Workstation

- The workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high-quality graphics capabilities.
- Workstations generally come with a large, high-resolution graphics screen, a large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have mass storage device such as a disk drive, but a special type of workstation, called diskless workstations, comes without a disk drive.
- Common operating systems for workstations are UNIX and Windows NT. Like PC, workstations are also single-user computers like PC but are typically linked together to form a local area network, although they can also be used as stand-alone systems.

Minicomputer

It is a midsize multi-processing system capable of supporting up to 250 users simultaneously.

Mainframe

- The mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. Mainframe executes many programs concurrently and supports much simultaneous execution of programs

Supercomputer

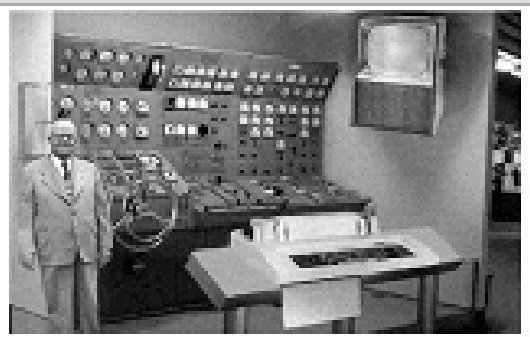
- Supercomputers are one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized applications that require an immense amount of mathematical calculations (number-crunching).
- For example, weather forecasting, scientific simulations, (animated)graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical prospecting)

Generation in computer

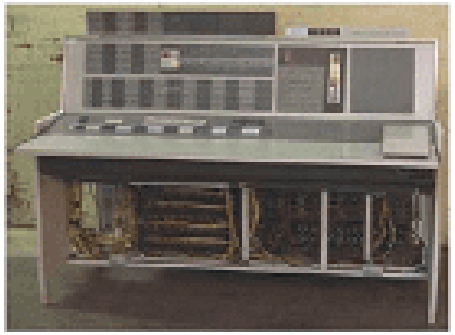
- Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. Nowadays, generation includes both hardware and software, which together make up an entire computer system.
- There are five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. In the following table, approximate dates against each generation has been mentioned, which are normally accepted.

- Following are the main five generations of computers.
- First GenerationThe period of first generation: 1946-1959. Vacuum tube based.
- Second GenerationThe period of second generation: 1959-1965. Transistor based.
- Third GenerationThe period of third generation: 1965-1971. Integrated Circuit based.
- Fourth GenerationThe period of fourth generation: 1971-1980. VLSI microprocessor based.
- Fifth GenerationThe period of fifth generation: 1980-onwards. ULSI microprocessor based.

Generations of Computers and Their Characteristics



First Generation

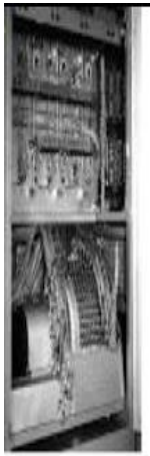


Second Generation

Third Generation

Fourth Generation

Fifth Generation



Generations of Computers

First, Second, Third, Fourth & Fifth

From 1940 to 2020

Second Generation Computers

From 1956 – 1963

Transistors

First Generation Computers

From 1940 – 1956

Vacuum Tubes

Fifth Generation Computers

From 2010

Artificial Intelligence

Third Generation Computers

From 1964 – 1971

Integrated Circuits

Fourth Generation Computers

From 1972 – 2010

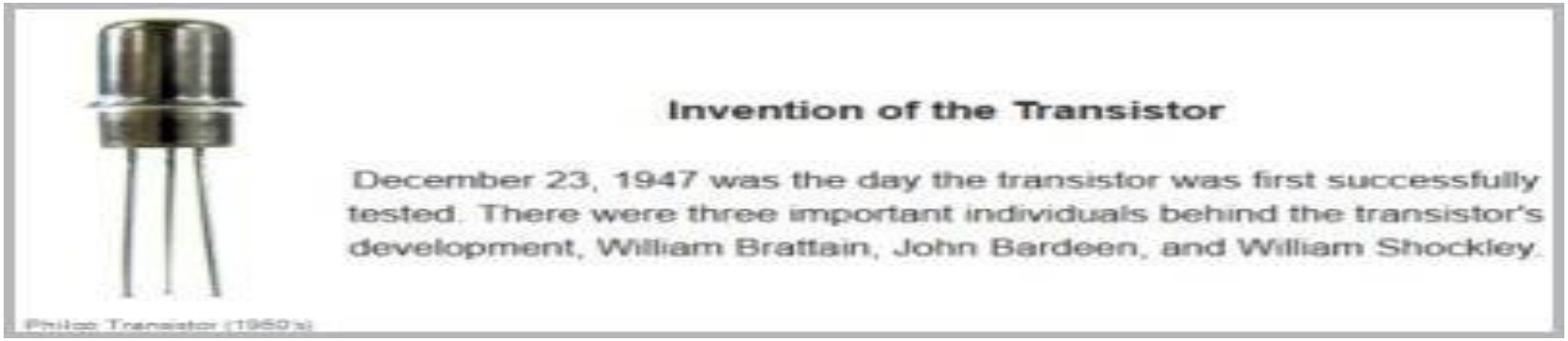
Micro Processors

First Generation: Vacuum Tubes (1940-1956)

- The first computer systems used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. These computers were very expensive to operate and in addition to using a great deal of electricity, the first computers generated a lot of heat, which was often the cause of malfunctions.
- First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve one problem at a time. It would take operators days or even weeks to set-up a new problem. Input was based on punched cards and paper tape, and output was displayed on printouts.
- The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.

- ***Second Generation: Transistors (1956-1963)***
- The world would see transistors replace vacuum tubes in the second generation of computers. The transistor was invented at Bell Labs in 1947 but did not see widespread use in computers until the late 1950s.
- The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

- **From Binary to Assembly**
- Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.
- The first computers of this generation were developed for the atomic energy industry.



- ***Third Generation: Integrated Circuits (1964-1971)***
- The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.
- Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

- ***Fourth Generation: Microprocessors (1971-Present)***
- The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip.
- In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors.
- As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

- ***Fifth Generation: Artificial Intelligence (Present and Beyond)***
- Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality.
- Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

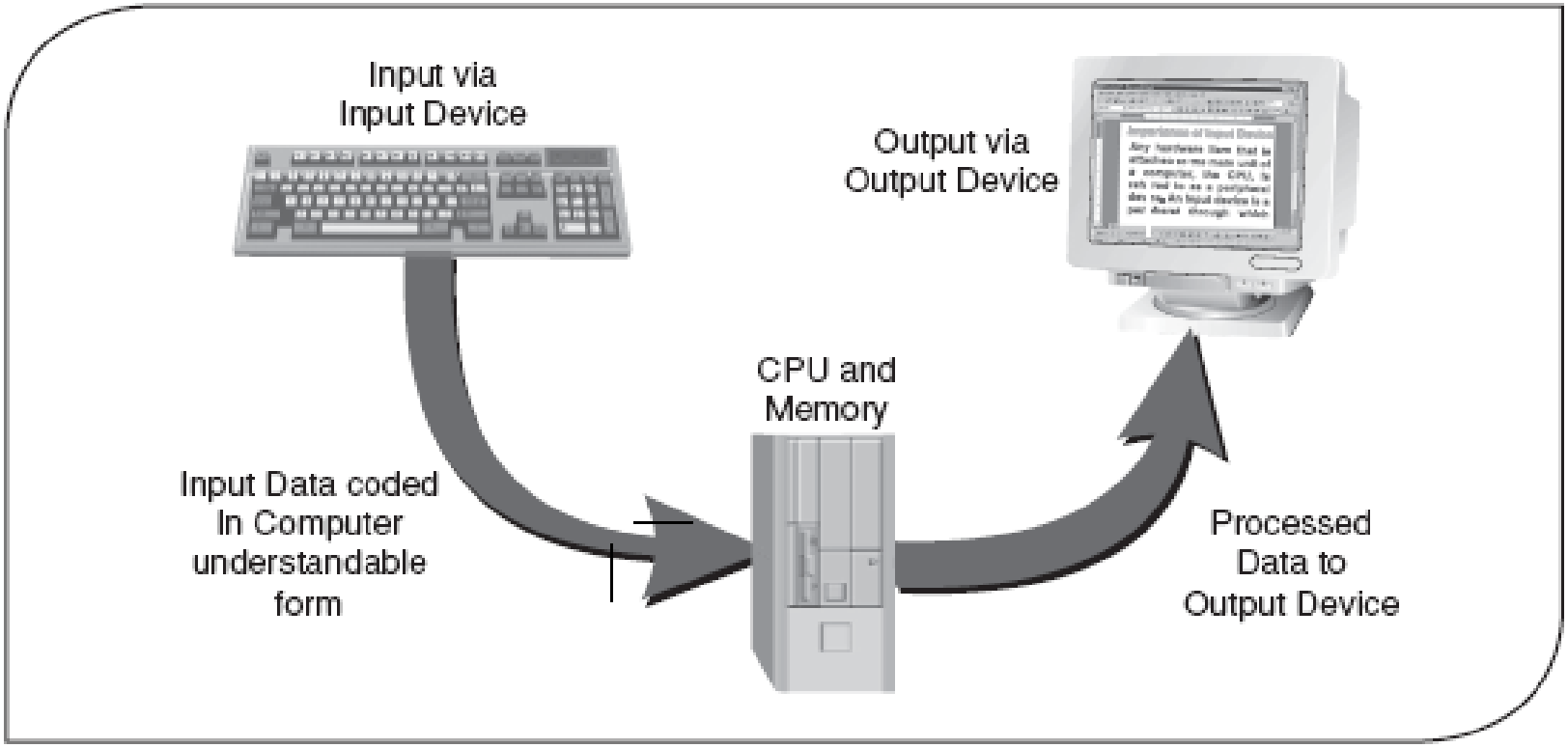
INPUT DEVICES

INTRODUCTION

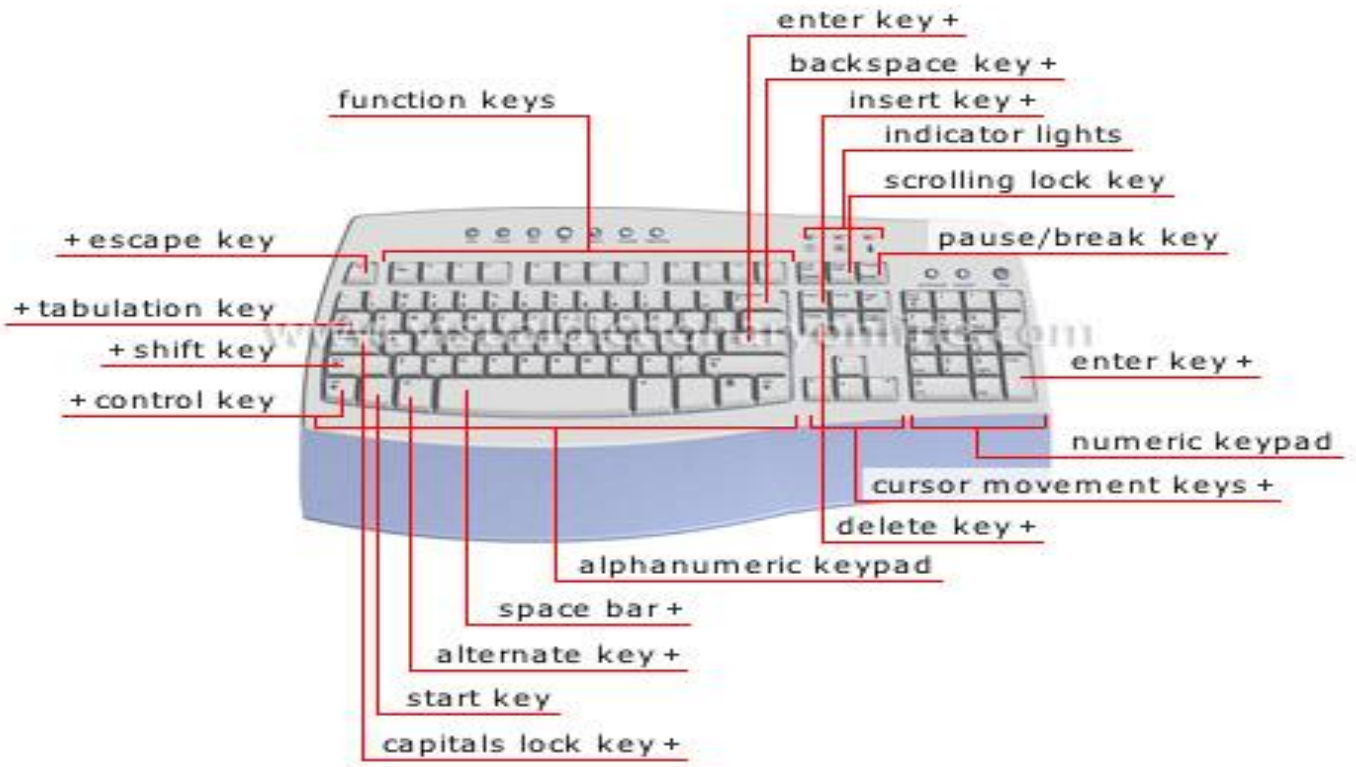
- When we work with computer we need to enter data and insructions to the computer using some devices.
- These devices are called input devices
- These devices convert data and instructions to a form that can be recognized by the computer.
- Some of the commonly ised input devices are:
  - ◄ Keyboard
  - ◄ Mouse
  - ◄ Scanner
  - ◄ Joystick
  - ◄ Microphone
  - ◄ Digital camera

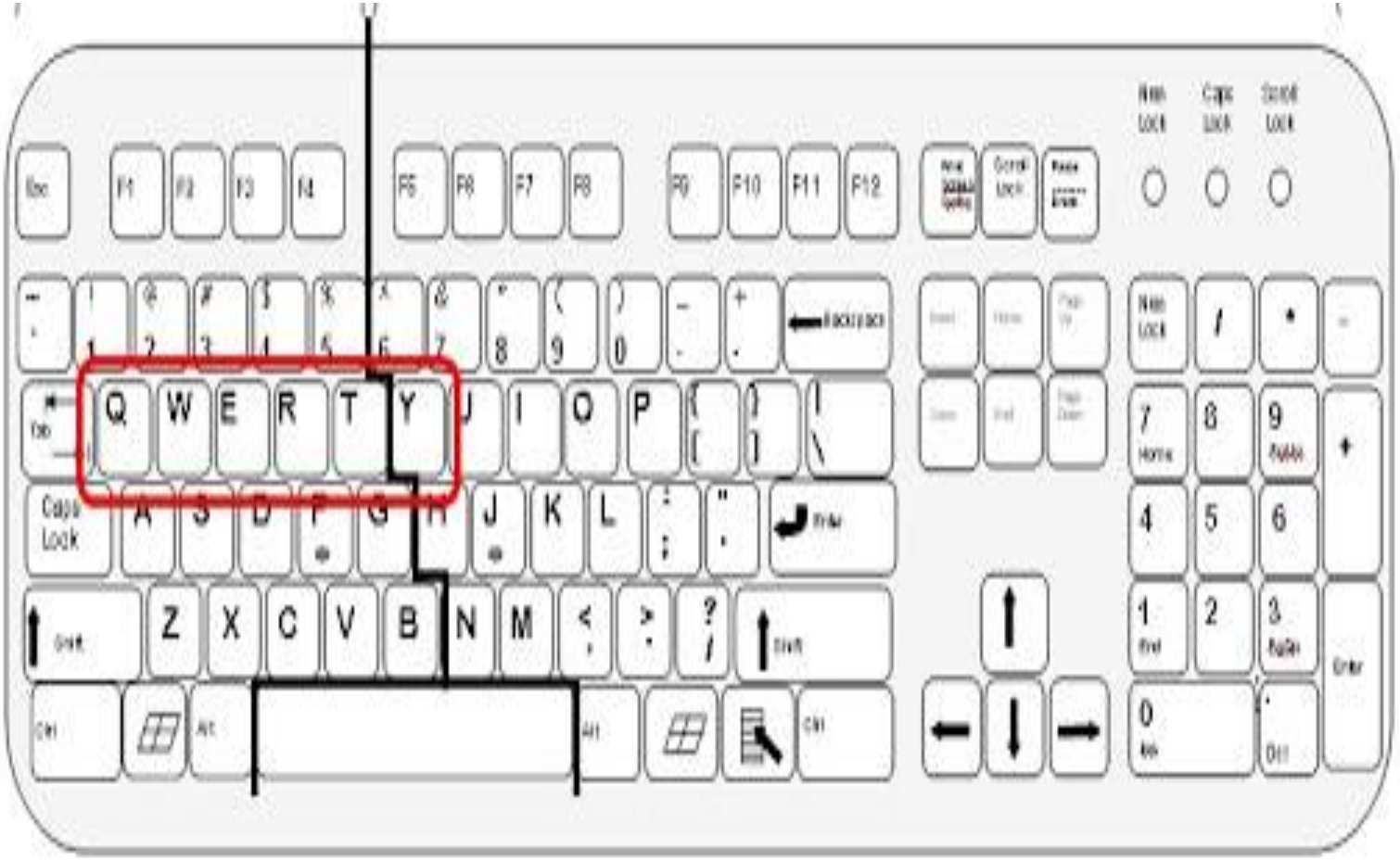
Input Devices

	Keyboard	for the input of text and characters and also to control the operation of a computer
	Mouse	a pointing device by detecting two-dimensional motion relative to its supporting surface.
	Scanner	a device that analyzes images, printed text, or handwriting, or an object and converts it to a digital image


Input via
Input Device
Output via
Output Device
CPU and
Memory
Input Data coded
In Computer
understandable
form
Processed
Data to
Output Device

keyboard and pictograms




Q W E R T Y
A S D F G H J K L
Z X C V B N M
Caps Lock

Input Devices

Keyboard -- input device containing numerous keys that can be used to input letters, numbers, and other symbols

Mouse -- common pointing device that user slides along a flat surface to move pointer

Electronic pen -- input device that is used to write electronically on the display screen

Scanner -- input device that reads printed text and graphics and transfers them to a computer in digital form

Examples: Flatbed Scanner, Handheld Scanner, Integrated Scanner

Touch Screen– display device that is touched with finger to issue commands

Keyboard

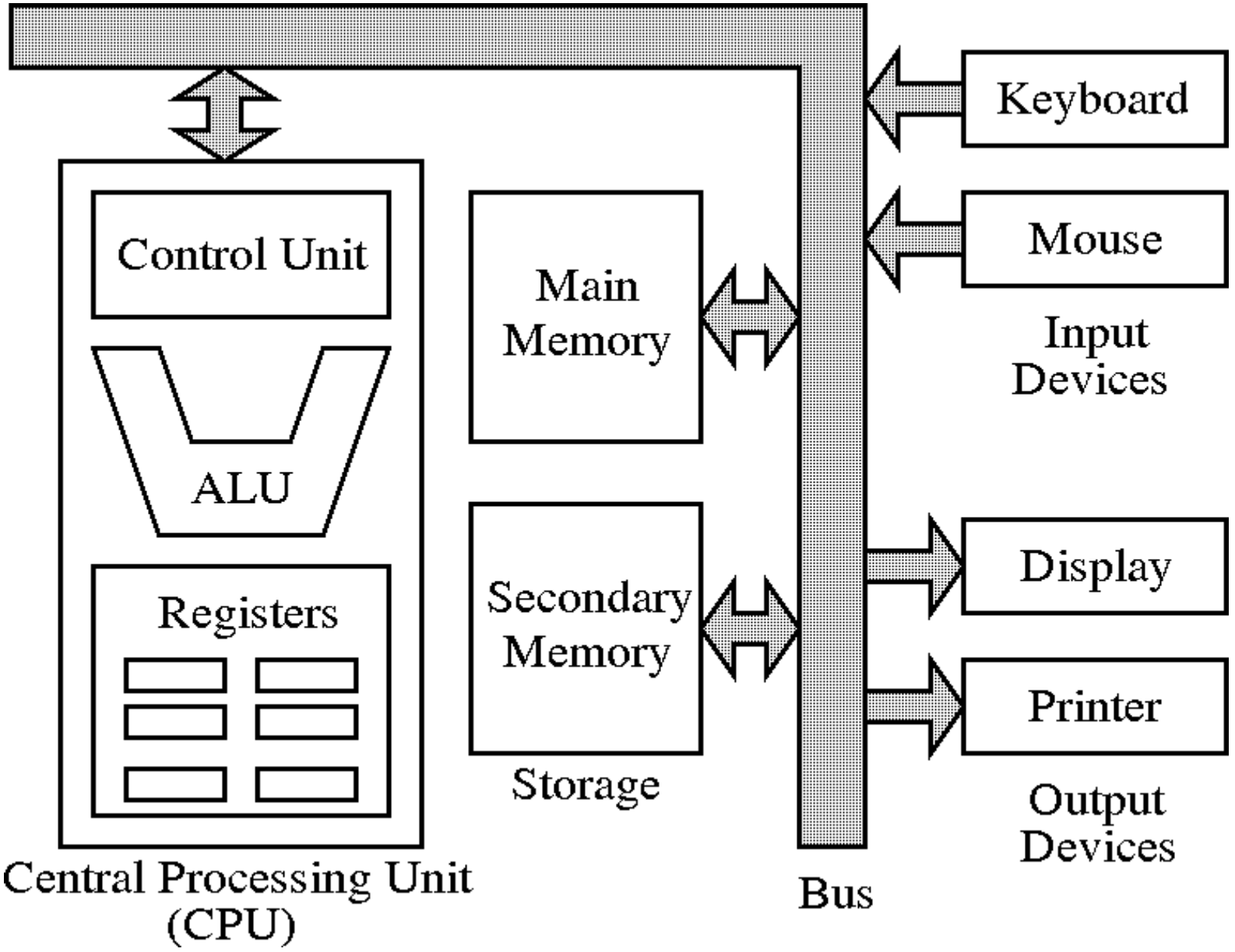
Mouse

Keypad

Scanner

Microphone

Joystick


Keyboard
Mouse
Input Devices
Control Unit
ALU
Registers
Central Processing Unit (CPU)
Main Memory
Secondary Memory
Storage
Bus
Display
Printer
Output Devices