Unit 1
Introduction

Process: a series of actions or steps taken to achieve an end result
Processor: a machine that completes process
IC: multifunction circuit are combined in a single chip

Microprocessor:

→ It is a multipurpose, programmable, clock-driven, register-based electronic device that reads binary instruction from a storage device (memory), accepts binary as input and processes data according to those instructions and provides result as output.

→ Each MP communicates and operates in the binary number 0 and 1, called bits.

→ Each MP has fixed sets of instructions in the form of binary pattern called a machine language.

Applications of MP

The applications of microprocessors are not bound. They can be used virtually anywhere and in any field. However, the applications are sorted as follows:

Test Instruments

Microprocessors are widely used in devices such as signal generators, oscilloscopes, counters, digital multi-meters, x-ray analyzers, blood group analyzers, baby incubator, frequency synthesizers, data acquisition systems, spectrum analyzers etc. For example fluke 6010A synthesized signal generator uses 4004 microprocessor.

Communications

Communication today requires tens of thousands of circuits to be managed. Data should be received, checked for errors and further analysis should also be performed. The speed at which the microprocessor can take decisions and compute errors is truly substantial.

Computer

The microprocessor is a central processing unit (CPU) of the microcomputers. It can perform arithmetic and logic functions as well as control function. The control unit of microprocessor sends signals to input, output units, memory, ALU and arrange the sequence of their controlling operation.

Industries

The microprocessor is widely used in data monitoring systems, smart cameras for quality control, automatic weighing, batching systems, assembly machine control, torque certification systems, machine tool controller etc.

Evolution of MP (Intel Series)

Intel 4004

- Year of introduction 1970
- 4-bit MP
- 4 KB memory
- Speed: 108 KHz
- World's first MP

Intel 8008

- Year of introduction 1972
- 8-bit version of 4004
- 16 KB memory
- Slow

Intel 8080

- Year of introduction 1974
- 8-bit MP
- Speed: 2 MHz
- First general purpose MP used as CPU of computer
- 64 KB memory

Intel 8085

- Year of introduction 1975
- 8-bit MP
- 64 KB memory
- 8-bit data bus

Intel 8086

- Year of introduction 1976
- 16-bit MP
- 1 MB memory
- 6-byte instruction queue (cache)
- 16-bit data bus
- Speed: 4.77 MHz

Intel 8088

- Year of introduction 1979
- First MP used in the original IBM PC
- 8-bit data bus
- 1 MB memory
- Speed: 4.77 MHz
- 4-byte instruction queue (cache)

Intel 80286

- Year of introduction 1982/1983
- 16-bit MP with memory and protection
- 16 MB memory
- Speed: 8 MHz
- Multitasking feature implemented

Intel 80386

- Year of introduction 1986
- First practical 32-bit MP
- 4 GB memory

Intel 80486

- Year of introduction 1989
- 32-bit high performance MP
- 4 GB memory

Pentium

- — Year of introduction 1993
- — 32-bit MP
- — 64-bit external data bus
- — 4 GB memory
- — 16 KB cache

Microcomputer

→ It is a computer with a CPU as a MP designed for personal use.
→ It contains MP, memory and I/O unit.
→ It is smaller than mainframe and minicomputer.

Microcontroller

→ It is a small single chip computer or single IC containing MP, memory and programmable I/O peripherals.

MP	Input
Memory	Output

Von Neumann Architecture

→ Program can be saved like data in the memory unit and can be accessed when needed. This approach is called 'Stored Program Concept' and was first adopted by John von Neumann.

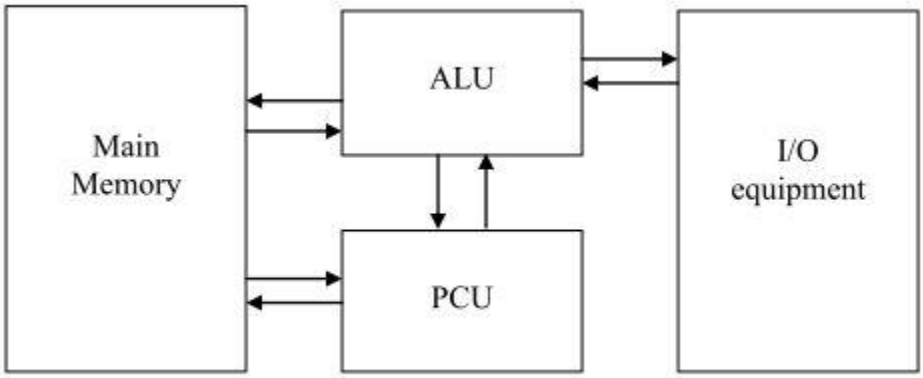
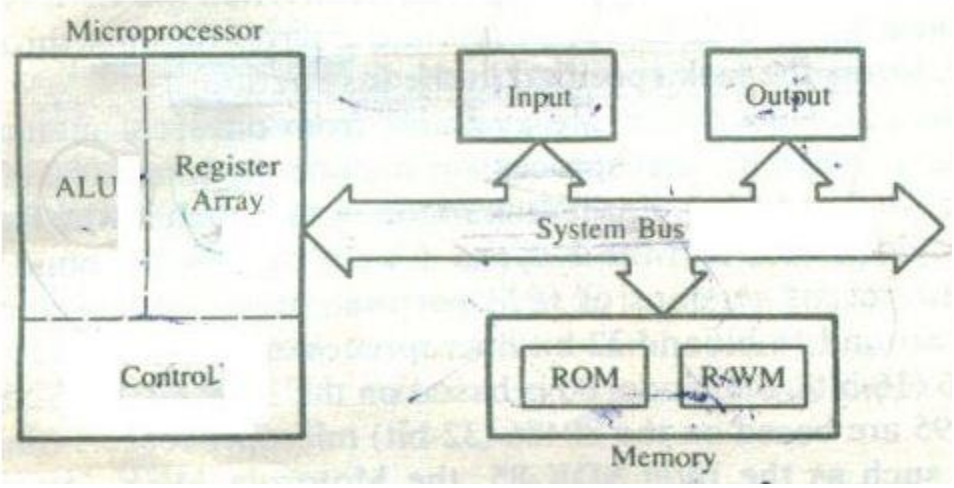


Figure: Von Neumann architecture

→ In this architecture, data and instructions are stored in a single set of main memory.
→ Instruction fetch and data operation cannot occur at the same time because they share a common bus.
→ The program control unit (PCU) reads program instruction, decodes instruction for ALU and determines the sequence of instruction to be executed.
→ The ALU performs arithmetic and logical operations.
→ It is a basic architecture of today's computer.
→ The another architecture like this is Harvard architecture in which instruction and data have separate memory space; and data & instruction can be accessed at the same time. This is newer approach to von Neumann architecture.

Basic Organization of Microcomputer



1. **MP**
   i. **ALU**
      — This unit executes all arithmetic and logical operations as specified by instruction set; and produces output.
      — The results of addition, subtraction, and logical operations (AND, OR, XOR) are stored in the registers or in memory unit or sent to output unit.
   ii. **Register unit**
      — Consists of various registers.
      — Used for temporary storage of data during execution of data.
   iii. **CU**
      — Controls the operations of different instructions.
      — Provides necessary timing and control signals to all the operations in the MP and peripherals including memory.

2. **Memory**

→ Stores binary information such as instruction and data, and provide these information to MP when required.
→ To execute programs, the MP reads data and instructions from memory and performs the computing operations.

3. **System bus**

→ The system bus is a communication path between MP and peripherals.
→ It is used to carry data, address and control signals.
→ It consists:
   — Data bus: carries data
   — Address bus: carries address
   — Control bus: carries control signals

4. **I/O bus**

→ Input unit is used to input instruction or data to the MP externally.
→ Output unit is used to carry out the information from the MP unit.