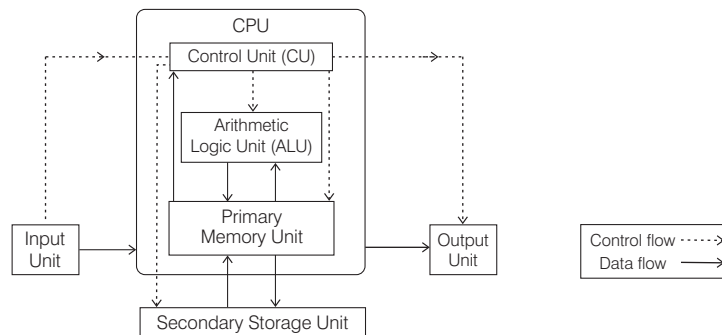


CHAPTER 02

COMPUTER ARCHITECTURE

Computer architecture deals with the functional behaviour of a computer system as viewed by a programmer. It can also be described as the logical structure of the system unit that housed electronic components. The first computer architecture was introduced in 1970, by John Von Neumann.



Computer Architecture

Components of Computer

1. Input Unit
2. Output Unit
3. Central Processing Unit
4. Memory Unit

Note System unit is a metal or plastic case that holds all the physical parts of the computer. The components that process data are located in it.

Input Unit

The computer accepts coded information through input unit by the user. This unit is used to give required information to the computer. *For example*, keyboard, mouse, etc.

An input unit performs the following functions

- It accepts the instructions and data from the user.
- It converts these instructions and data to computer acceptable format.
- It supplies the converted instructions and data to the computer system for further processing.

Output Unit

This unit sends the processed results to the user. It is mainly used to display the desired result to the user as per input instructions.

For example, monitor, printer, plotter, etc.

The following functions are performed by an output unit

- It accepts the results produced by the computer which are in coded form and hence cannot be easily understood by user.
- It converts these coded results to readable form which convenient to users.
- It produces the converted results to the user.

Central Processing Unit (CPU)

Central Processing Unit is often called the **brain of computer**. The CPU is fabricated as a single Integrated Circuit (IC) and is also known as **microprocessor**.

It consists a set of registers, arithmetic logic unit and control unit, which together interpret and execute instructions in assembly language.

The primary functions of the CPU are as follows

- The CPU transfers instructions and input data from main memory to registers.
- The CPU executes the instructions in the stored sequence.
- When necessary, CPU transfers output data from registers to main memory.

A CPU controls all the internal and external devices and performs arithmetic and logic operations.

The CPU consists of following main sub-systems

Arithmetic Logic Unit (ALU)

ALU contains the electronic circuitry that executes all arithmetic and logical operations on the available data. ALU uses **registers** to hold the data that is being processed.

Most ALUs can perform the following operations

- (i) Logical operations (AND, NOT, OR, XOR).
- (ii) Arithmetic operations (addition, subtraction, multiplication and division).

(iii) Bit-shifting operations (shifting or rotating a word by a specified number of bit to the left or right with or without sign extension).

(iv) Comparison operations ($=$, $<$, $<=$, $>$, $>=$)

Registers

These are used to quickly accept, store and transfer data and instructions that are being used immediately by the CPU. These registers are the top of the memory hierarchy and are the fastest way for the system to manipulate data. The number and size of registers vary from processor-to-processor.

Control Unit (CU)

CU coordinates with the input and output devices of a computer. It directs the computer to carry out stored program instructions by communicating with the ALU and the registers. It organises the processing of data and instructions.

The basic function of control unit is to fetch the instruction stored in the main memory, identify the operations and the devices involved in it and accordingly generate control signals.

Memory Unit

This unit is responsible to store programs or data on a temporary or permanent basis. It has primary memory (main memory) and secondary memory (auxiliary memory).

The input data which is to be processed is brought into main memory before processing.

Another kind of memory is referred to as secondary memory of a computer system. This unit is used to permanently store data, programs and output. This unit does not deal directly with the CPU.

Microprocessor

It is the controlling element in a computer system and is sometimes referred to as the chip. Microprocessor is the main hardware that drives the computer.

It is a large **Printed Circuit Board (PCB)**, which is used in all electronic systems such as computer, calculator, digital system, etc. The speed of CPU depends upon the type of microprocessor used.

Intel 4004 was the first microprocessor made by Intel in 1971 by scientist Ted Hoff and engineer Federico Faggin.

Some of the popular microprocessors are Intel, Intel Core i7, Intel Core i9, Dual Core, Pentium IV, etc.

Motherboard

The main circuit board contained in any computer is called a motherboard. It is also known as the main board or logic board or system board or planar board.

All the other electronic devices and circuits of computer system are attached to this board like, ROM, RAM, expansion slots, PCI slots and USB ports. It also includes controllers for devices like the hard drive, DVD drive, keyboard and mouse.

Components on Motherboard

- | | |
|----------------------|---------------------|
| (i) CMOS battery | (ii) BIOS chip |
| (iii) Fan | (iv) Expansion slot |
| (v) SMPS | (vi) PCI slot |
| (vii) Processor chip | (viii) Buses |

Interconnection of Units

CPU sends data, instructions and information to the components inside the computer as well as to the peripheral devices attached to it.

A **bus** is a set of wires used for interconnection, where each wire can carry one bit of data.

In other words, bus is a set of electronic signal pathways that allows information and signals to travel between components inside or outside of a computer.

A computer bus can be divided into two types

1. **Internal Bus** The internal bus connects components inside the motherboard like CPU and system memory. It is also called the **system bus**.

Internal bus includes following buses

- (i) The command to access the memory or the I/O devices is carried by the **control bus**.

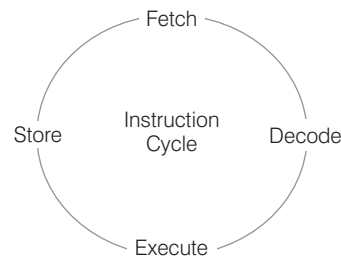
- (ii) The address of I/O devices or memory is carried by the **address bus**.

- (iii) The data to be transferred is carried by the **data bus**.

2. **External Bus** It connects the different external devices; peripherals, expansion slots, I/O ports and drive connections to the rest of computer. It is also referred to as the **expansion bus**.

Instruction Cycle

It represents the sequence of events that takes place as an instruction is read from memory and executed.



A simple instruction cycle consists of the following steps

1. **Fetching** the instruction from the memory.
2. **Decoding** the instruction for operation.
3. **Executing** the instruction.
4. **Storing** in memory.

In above steps, steps 1 and 2 instructions are same and known as fetch cycle and steps 3 and 4 instructions are different and known as execute cycle.



Tit-Bits

- **UPS** (Uninterruptible Power Supply) is an electrical apparatus that provides emergency power to a load when the input power source or mains power fails.
- **Power strip** is an electrical device that is used to expand the capacity of a wall outlet in terms of the number of devices it can accommodate.
- **Instruction code** is a group of bits that instruct the computer to perform a specific operation.

QUESTION BANK

1. forms the backbone for building successful computer system.
(1) Computer architecture
(2) Computer model
(3) Computer instructions
(4) None of the above
2. The first computer architecture was introduced in
(1) 1970 (2) 1968 (3) 1971 (4) 1973
3. Which circuit board is used in all electronic systems such as computer, calculators, digital system?
(1) Architecture (2) Printer
(3) Value (4) Register
4. The system unit
(1) coordinates input and output devices
(2) is the container that houses electronic components
(3) is a combination of hardware and software
(4) controls and manipulates data
5. Which of the following is metal or plastic case that holds all the physical parts of the computer? **[IBPS Clerk Mains 2017]**
(1) System unit (2) CPU
(3) Mainframe (4) Platform
(5) Microprocessor
6. The components that process data are located in which of the following? **[IBPS Clerk Mains 2017]**
(1) Input devices (2) Output devices
(3) System unit (4) Storage component
(5) Expansion board
7. Which of the following is not responsible for the performance of the computer? **[IBPS Clerk Mains 2017]**
(1) Number of keys in the keyboard
(2) Format of the video/graphics word
(3) Memory in the video/graphics word
(4) The clock speed of the processor
(5) Number of cores available in the processor
8. A(n) device is any device that provides information, which is sent to the CPU.
(1) input (2) output
(3) CPU (4) memory
9. Which of the following includes as a type of input?
(1) Data (2) Programs
(3) Commands (4) User response
(5) All of these
10. Information that comes from external source and fed into computer software is called **[IBPS RRB PO Mains 2017]**
(1) output (2) input
(3) throughout (4) reports
(5) process
11. Input unit converts data in computer in form.
(1) suitable (2) acceptable
(3) understandable (4) rejectable
12. This unit sends the processed results to the user.
(1) Input (2) Output
(3) Memory (4) CPU
13. Output unit includes
(1) plotter (2) printer
(3) monitor (4) All of these
14. This component is required to process data into information and consists of integrated circuits.
(1) Hard disk (2) RAM
(3) CPU (4) ROM
15. The Central Processing Unit (CPU) in a computer consists of
(1) input, output and processing
(2) control unit, primary storage and secondary storage
(3) control unit, arithmetic logic unit, memory unit
(4) All of the above

- 16.** Which instruction is used for loading data into CPU accumulator register from memory?
(1) Load (2) Storage
(3) Machine (4) Access
- 17.** Where does computer add and compare data?
(1) Hard disc (2) Floppy disc
(3) CPU (4) Memory chip
- 18.** In computer, which of the following unit is responsible for processing and also known as brain of computer? [SSC CGL 2019]
(1) CPU (2) Keyboard
(3) Hard disk (4) RAM
- 19.** The main job of a CPU is to
(1) carry out program instructions
(2) store data/information for further use
(3) process data and information
(4) Both (1) and (3)
- 20.** The main purpose of time-sharing techniques used in computers is to make the best use of the
(1) CPU (2) peripherals
(3) secondary storage (4) floppy discs
- 21.** The CPU is made up of two smaller components
(1) ALU and CU (2) ALU and RAM
(3) RAM and ROM (4) RAM and CU
- 22.** The CPU comprises of control, memory and units.
(1) microprocessor (2) arithmetic/logic
(3) output (4) ROM
- 23.** What is the responsibility of the logical unit in the CPU of a computer? [IBPS Clerk 2015]
(1) To produce result
(2) To compare numbers
(3) To control flow of information
(4) To do maths work
(5) None of the above
- 24.** Which unit of computer helps in communication between the memory and the arithmetic logical unit?
[IBPS RRB PO Mains 2017]
(1) CMU (2) CCU
(3) UPS (4) CPU
(5) ALU
- 25.** Which part of the computer is used for calculating and comparing?
(1) ALU (2) Control unit
(3) Disc unit (4) Modem
- 26.** Pick the one that is used for logical operations or comparisons such as less than, equal to or greater than etc.
(1) ALU (2) CU (3) Input unit (4) MU
- 27.** What does ALU in computing denote? [UPSSSC 2016, IBPS Clerk 2014]
(1) Application and Logic Unit
(2) Algorithm Logic Unit
(3) Arithmetic Layered Unit
(4) Arithmetic Legal Unit
(5) Arithmetic Logic Unit
- 28.** How many types of arithmetic operations does the ALU of computer perform?
(1) 4 (2) 2 (3) 5 (4) 8
- 29.** Processors contain a control unit and a/an [SSC CGL 2016]
(1) Control unit
(2) Primary storage unit
(3) Input unit
(4) Arithmetic logic unit
- 30.** Which of the following executes the computer commands?
(1) Arithmetic unit (2) Logic unit
(3) Both (1) and (2) (4) Control unit
- 31.** Which unit is a combinational digital electronic circuit that performs arithmetic and bitwise operations on integer binary numbers? [IBPS RRB PO Mains 2017]
(1) BOU (2) AEU (3) CPU (4) ALU
(5) UPS
- 32.** Internal memory in a CPU is nothing but
(1) a set of registers (2) a set of ALU
(3) microprocessor (4) bus
- 33.** Which among the following is a small set of data holding place that is a part of the computer processor and may hold an instruction, a storage address, or any kind of data? [IBPS RRB PO Mains 2017]
(1) Register (2) WAN
(3) Bus (4) Address
(5) Processor

- 34.** The portion of the CPU that coordinates the activities of all the other computer components is the [SBI PO 2015]
 (1) motherboard (2) coordination board
 (3) control unit (4) arithmetic logic unit
 (5) None of these
- 35.** Which among the following is an important circuitry in a computer system that directs the operation of the processor? [IBPS PO 2016]
 (1) Memory (2) Address Bus
 (3) Accumulator (4) ALU
 (5) Control unit
- 36.** The part of a computer that coordinates all its functions, is called [IBPS Clerk Mains 2017]
 (1) ROM program (2) System board
 (3) Arithmetic logic unit (4) Control unit
 (5) None of these
- 37.** The control unit controls other units by generating
 (1) control signal (2) timing signal
 (3) transfer signal (4) command signal
- 38.** Control unit of a digital computer is often called the
 (1) clock (2) nerve centre
 (3) Both (1) and (2) (4) IC
- 39.** Memory unit that communicates directly with the CPU is called the
 (1) main memory (2) secondary memory
 (3) auxiliary memory (4) register
- 40.** CPU retrieves its data and instructions from
 (1) secondary memory (2) auxiliary memory
 (3) main memory (4) All of these
- 41.** Which computer memory is used for storing programs and data currently being processed by the CPU?
 (1) Mass memory (2) Internal memory
 (3) Non-volatile memory (4) PROM
- 42.** The I/O processor has a direct access to and contains a number of independent data channels.
 (1) main memory (2) secondary memory
 (3) cache (4) flash memory
- 43.** The word 'computer' usually refers to the central processing unit plus
 (1) external memory (2) internal memory
 (3) input devices (4) output devices
- 44.** Who invent the first microprocessor?
 (1) Vint Cerf (2) Terence Percival
 (3) John Mauchly (4) Ted Hoff
- 45.** A microprocessor is the brain of the computer and is also called a [RBI Grade B 2014]
 (1) microchip (2) macrochip
 (3) macroprocessor (4) calculator
 (5) software
- 46.** Microprocessors can be used to make
 (1) computer (2) digital system
 (3) calculators (4) All of these
- 47.** High power microprocessor is [UPSSSC 2019]
 (1) Pentium, Pentium pro
 (2) Pentium II and III
 (3) Pentium II
 (4) All of the above
- 48.** The microprocessor of a computer
 (1) does not understand machine language
 (2) understands machine language and high level language
 (3) understands only machine language
 (4) understands only high level languages
- 49.** The CPU and memory are located in which of the following devices? [IBPS Clerk Mains 2017]
 (1) Motherboard (2) Expansion board
 (3) Storage device (4) Output device
 (5) System unit
- 50.** Personal computers use a number of chips mounted on a main circuit board. What is the common name for such boards?
 (1) Daughterboard
 (2) Motherboard
 (3) Broadboard
 (4) None of the above
- 51.** Which of the following are the components that reside on motherboard?
 (1) CMOS battery (2) Fan
 (3) PCI slot (4) All of these

- 52.** A is the main Printed Circuit Board (PCB) in a computer. [SSC CGL 2018]
 (1) ROM (Read Only Memory)
 (2) CPU (Central Processing Unit)
 (3) RAM (Random Access Memory)
 (4) Motherboard
- 53.** Which one among the following is a main system board of a computer? [SSC CGL 2017]
 (1) CPU (2) Keyboard
 (3) Microchip (4) Motherboard
- 54.** The communication line between CPU, memory and peripherals is called a
 (1) bus (2) line (3) media (4) All of these
- 55.** A physical connection between the microprocessor memory and other parts of the micro computer is known as
 (1) path (2) address bus
 (3) route (4) All of these
- 56.** The read/write line belongs to
 (1) the data bus (2) the control bus
 (3) the address bus (4) CPU bus
- 57.** The name of the location of a particular piece of data is its
 (1) address (2) memory name
 (3) storage (4) data location
- 58.** Which of the following is used to connect the different external devices?
 (1) Address bus (2) Data bus
 (3) Control bus (4) External bus
- 59.** A computer executes program in the sequence of [RRB NTPC 2016]
 A. Execute, Fetch, Decode
 B. Store, Fetch, Execute
 C. Fetch, Decode, Execute
 D. Decode, Fetch, Execute
 (1) D (2) A
 (3) C (4) B
- 60.** Which is not an integral part of computer? [SBI Clerk 2012]
 (1) CPU (2) Mouse
 (3) Monitor (4) UPS
 (5) None of these
- 61.** A device that not only provides surge protection, but also furnishes the computer with battery backup power during a power outage is [IBPS RRB PO Mains 2017]
 (1) battery strip
 (2) UPS
 (3) surge strip
 (4) USB
 (5) memory
- 62.** What is a power strip? [UPSSSC 2019]
 (1) It is an electrical device that is used to expand the capacity of a wall outlet which can accommodate the devices.
 (2) It plugs multiple components into one power outlet.
 (3) It provides power supply for electronic devices.
 (4) It is used to increase the magnitude of voltage/current/power of an input signal.

ANSWERS

1. (1)	2. (1)	3. (1)	4. (2)	5. (1)	6. (3)	7. (1)	8. (1)	9. (5)	10. (2)
11. (2)	12. (3)	13. (4)	14. (3)	15. (3)	16. (1)	17. (3)	18. (1)	19. (4)	20. (1)
21. (1)	22. (2)	23. (2)	24. (4)	25. (1)	26. (1)	27. (5)	28. (1)	29. (4)	30. (3)
31. (4)	32. (1)	33. (1)	34. (3)	35. (5)	36. (4)	37. (1)	38. (2)	39. (1)	40. (3)
41. (2)	42. (1)	43. (1)	44. (4)	45. (1)	46. (4)	47. (4)	48. (3)	49. (1)	50. (2)
51. (4)	52. (4)	53. (4)	54. (1)	55. (2)	56. (2)	57. (1)	58. (4)	59. (3)	60. (4)
61. (2)	62. (1)								