## UNIT-I
## Overview and Instructions

### PART-A

**1. What are the eight ideas in computer architecture?**

1. Design for Moore's Law
2. Use abstraction to simplify design
3. Make the common case fast
4. Performance via Parallelism
5. Performance via Pipelining
6. Performance via Prediction
7. Hierarchy of Memory
8. Dependability via Redundancy

**2. Define power wall.**

1. Old conventional wisdom
2. Power is free
3. Transistors are expensive
4. New conventional wisdom: "Power wall"
5. Power expensive
6. Transistors"free" (Can put more on chip than can afford to turn on)

**3. What is uniprocessor?**

A uniprocessor system is defined as a computer system that has a single central processing unit that is used to execute computer tasks. As more and more modern software is able to make use of multiprocessing architectures, such as SMP and MPP, the term uniprocessor is therefore used to distinguish the class of computers where all processing tasks share a single CPU. Most desktop computers are now shipped with multiprocessing architectures

**4. What is multicore processor?**

A multi-core processor is a single computing component with two or more independent actual central processing units (called "cores"), which are the units that read and execute program instructions. The instructions are ordinary CPU instructions such as add, move data, and branch, but the multiple cores can run multiple instructions at the same time, increasing overall speed for programs amenable to parallel computing.

**5. Write the basic functional units of computer?**

The basic functional units of a computer are input unit, output unit, memory unit, ALU unit and control unit.

**6. What is motherboard?**

A plastic board containing packages of integrated circuits or chips, including processor, cache, memory, and connectors for I/O devices such as networks and disks.

**7. What is mainframe computer?**

It is the large computer system containing thousands of IC's. It is a room- sized machine placed in special computer centers and not directly accessible to average users. It serves as a central computing facility for an organization such as university, factory or bank.

**8. What is minicomputer?**

Minicomputers are small and low cost computers are characterized by:

1. Short word size i.e. CPU word sizes of 8 or 16 bits.
2. Limited hardware and software facilities.
3. Physically smaller in size.

**9. Define microcomputer.**

Microcomputer is a smaller, slower and cheaper computer packing all the electronics of the computer in to a handful of IC's, including the CPU and memory and IO chips.

**10. What is workstation?**

The more powerful desktop computers intended for scientific and engineering applications are referred as workstations.

**11. What is instruction register?**

The instruction register (IR) holds the instruction that is currently being executed. Its Output is available to the control circuits which generate the timing signals that control the various processing elements involved in executing the instruction.

**12. What is program counter?**

The program counter (PC) keeps track of the execution of a program. It contains the memory address of the next instruction to be fetched and executed.

**13. What is processor time?**

The sum of the periods during which the processor is active is called the processor time.

**14. What are clock and clock cycles?**

The timing signals that control the processor circuits are called as clocks. The clock defines regular time intervals called clock cycles.

**15. Give the CPU performance equation.**

CPU execution time for a program = CPU clock cycle for a program **x** clock cycle time

**16. Define Spilling registers:**

The process of putting less commonly used variables (or those needed later) into memory is called spilling registers.

**17. Define Stored Program Concepts**

Computers are built on two key principles: Instructions are represented as numbers. Programs are stored in memory to be read or written, just like data. These principles lead to the stored-program concept. The instructions and data of many types can be stored in memory as numbers; it is called the **stored program concept.**

**18. List out the methods used to improve system performance.**

The methods used to improve system performance are

1. Processor clock
2. Basic Performance Equation
3. Pipelining
4. Clock rate
5. Instruction set
6. Compiler

**19. Define Response Time**

Response time is also called execution time. The total time required for the computer to complete a task, including disk accesses, memory accesses, I/O activities, operating system overhead, CPU execution time, and so on is called response time.

**20. Define addressing modes and its various types.**

The different ways in which the location of a operand is specified in an instruction is referred to as addressing modes: Immediate addressing. Register addressing, Base or displacement addressing, PC-relative addressing, Pseudo direct addressing

**21. Write the formula for CPU execution time for a program.**

$$\text{CPU time} = \text{Instruction count} \times \text{CPI} \times \text{Clock cycle time}$$

or, since the clock rate is the inverse of clock cycle time:

$$\text{CPU time} = \frac{\text{Instruction count} \times \text{CPI}}{\text{Clock rate}}$$

**22.Define ISA**

The instruction set architecture, or simply architecture of a computer is the interface between the hardware and the lowest-level software. It includes anything programmers need to know to make a binary machine language program work correctly, including instructions, I/O devices, and so on.

**23. If computer A runs a program in 10 seconds, and computer B runs the same program in 15 seconds, how much faster is A over B. 10.**

We know that A is $n$ times as fast as B if

$$\frac{\text{Performance}_A}{\text{Performance}_B} = \frac{\text{Execution time}_B}{\text{Execution time}_A} = n$$

Thus the performance ratio is

$$\frac{15}{10} = 1.5$$

and A is therefore 1.5 times as fast as B.

**24. Define MIPS**

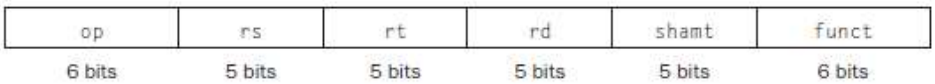
Million Instructions Per Second (MIPS) is a measurement of program execution speed based on the number of millions of instructions. MIPS is computed as:

$$\text{MIPS} = \frac{\text{Instruction count}}{\text{Execution time} \times 10^6}$$

**25. What are the fields in an MIPS instruction?**

- MIPS fields are A MIPS field has two kinds of format such as:
    3. R-type or R-format (for register)
    4. I-type or I-format (for immediate)

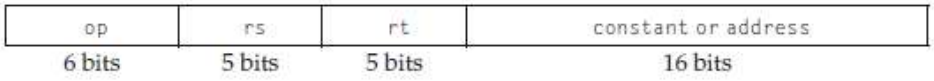
**R-format:**




The fields in MIPS instructions are: *op:* Basic operation of the instruction, traditionally called the opcode. opcode denotes the operation and format of an instruction. rs: The first register source operand. rt: The second register source operand. rd: The register destination operand. It gets the result of the operation. shamt: Shift amount. funct: Function. This field selects the specific variant of the operation in the op field and is sometimes called the function code.

**I-format:**

It is used by the immediate and data transfer instructions. This constant is used to select elements from arrays or data structures.




**26. Write an example for immediate operand.**

The quick add instruction with one constant operand is called add immediate or addi. To add 4 to register $s3, we just write addi $s3,$s3,4 # $s3 = $s3 + 4

**27. Which metric is the right one for comparing processors: energy or power?**

Power is energy per unit time. **1 watt = 1 joule per second.** Energy is a better metric because it is tied to a specific task and the time required for that task. Power consumption will be a useful measure if the workload is fixed.

**PART-B**

**1.** Explain in detail about the eight ideas of computer architecture.
2. Explain in detail the different Instruction types.Compare their merits and demerits.
3. Explain the different types of Addressing modes with suitable examples.
4. Explain the various components of computer System with neat diagram.
5. Explain various performance measures of a computer.
6. Explain operations and operands of computer Hardware in detail
7. i)Discuss the Logical operations and control operations of computer
   ii)Write short notes on Power wall
8. Explain in detail about the instructions for control operation.
9. Briefly discuss about Uniprocessor and Multiprocessor.
10. Explain Branching operations with example

**UNIT-II**

**Arithmetic Operations**

**PART-A**

**1. Define Full Adder (FA) with logic diagram**

A full adder adds binary numbers and accounts for values carried in as well as out. A one-bit full adder adds three one-bit numbers, often written as *A*, *B*, and *C*in; *A* and*B* are the operands, and *C*in is a bit carried in (in theory from a past addition). The full-adder is usually a component in a cascade of adders, which add 8, 16, 32, etc.