UNIT – I

1. What is a Computer ?
Ans: Computer is an electronic device that takes inputs from the input devices and processes that Inputs and produces output by the output devices.

2. What are different types of computers ?
Ans: Embedded computers, Personal computers, Book computers, Work stations, Servers and Enterprise systems, Super computers.

3. What is a Bit and Fliflop ?
Ans: **BIT:**
A bit is a binary digit that is either 0 or 1
FLIP FLOP:
A flip flop is a memory device that stores one bit of binary information(i.e., it can store either a binary 0 or binary 1)

4. What is register ?
Ans: A register is a group of flip flops that is used to store binary information. It is denoted by 'R'
Example: program counter(PC),
memory address register(MAR),
memory data register(MDR),
instruction register(IR),
memory buffer register(MBR),
accumulator(AC) register.

5. Define Computer Architecture and Computer Organization.
Ans: Computer architecture is a set of rules and methods that describe the functionality, organization, and implementation of computer systems
The computer organization is concerned with the structure and behavior of digital computers. Computer Organization is realization of what is specified by the computer architecture.

6. What is Program ?
Ans: The list of instructions that performs a task, taken by the computer is called a Program.

7. What is instruction sequencing.
Ans: Instruction sequencing is the order in which the instructions in a program are carried out.

8. List the basic operations of a computer. (OR) What are the basic functional units in a computer.
Ans: Inputting; (Input unit)
Storing; (Memory unit)
Processing; (ALU)

Outputting; (Output unit)
Controlling. (Control unit)

9. What is Memory Access Time ?
Ans: Memory access time is how long it takes for a character in RAM to be transferred to or from the CPU.

10. List any three data transfer instructions
Ans: 1. MOV: Move instruction copies the data from the source to the destination.
2. POP: Pop instruction is used to get the data from the stack.
3. PUSH: Push instruction is used to push data into the stack.

11. Write any two memory operations.
Ans: Read: Transfers content of a specific memory location to processor.
Write: Transfers item of information from processor to a specific memory location.

12. Write the Basic Performance Equation.
Ans: **Basic Performance Equation**

- **CPU Time = I * CPI * T**
  - I = number of instructions in program
  - CPI = average cycles per instruction
  - T = clock cycle time
- **CPU Time = I * CPI / R**
  - R = 1/T the clock rate

13. How the numbers are represented in computer memory ?
Ans:

- **Signed Integers**
  - 1's complement
  - 2's complement
- **Unsigned Integers**

14. What is Program Counter (PC) ?
Ans: This is another specialized register that keeps track of execution of a program. It contains the memory address of the next instruction to be fetched and executed. Besides IR and PC, there are n-general purpose registers R0 through Rn-1.

15. What is Instruction Register (IR) ?
Ans: Holds the instructions that is currently being executed. Its output is available for the control circuits which generates the timing signals that control the various processing elements in one execution of instruction.

16. What is the characteristic of RAM memory makes it not suitable for permanent storage ?
Ans: The characteristic of ram memory makes it is not suitable for permanent storage is that it is not volatile.

(More about RAM, ROM, Cache memory and their differences will be discussed in Unit 4)

17. What is Perfomance and Parallelism and what are different types of parallelism?

Ans: Performance of a computer is how quickly it can execute programs.
Parallelism refers to techniques to make programs faster by performing several computations at the same time.
Types: Instruction level parallelism, multicore processors, multi processors.

18. What is ISA ?
Ans: Instruction Set Architecture is an interface between hardware and software.

19. What is Byte Addressability and explain its types.
Ans: Byte Addressability:

- Byte addressing in hardware architectures supports accessing individual bytes.
- If each byte has a unique address, we have byte addressing.
- There are two ways that byte addresses can be assigned across words.
- The name big-endian is used when lower byte addresses are used for the more significant bytes (the leftmost bytes) of the word.
- The name little-endian is used for the opposite ordering, where the lower byte addresses are used for the less significant bytes (the rightmost bytes) of the word.

20. Difference between CISC and RISC.
Ans: CISC:

- The CISC approach attempts to minimize the number of instructions per program, sacrificing the number of cycles per instruction.
- Computers based on the CISC architecture are designed to decrease the memory cost.

RISC:

- RISC does the opposite, reducing the cycles per instruction at the cost of the number of instructions per program Pipelining is one of the unique feature of RISC.
- Computers based on the RISC architecture are designed to increase the memory cost.

21. What are addressing modes explain its types ?
Ans: The different ways of specifying the location of an operand in an instruction are called as addressing modes.**(Learn Addressing modes LAQ to answer 1 mark questions in this topic)**

22. What is Stack ?
Ans: Stack is a storage structure that stores information in such a way that the last item stored is the first item retrieved. It is based on the principle of LIFO (Last-in-first-out). It can be implemented in two ways: register stack and memory stack
Register Stack: A stack can be organized as a collection of finite number of registers that are used to store temporary information during the execution of a program. The stack pointer (SP) is a register that holds the address of top of element of the stack.
Memory Stack: A stack can be implemented in a random access memory (RAM) attached to a CPU. The implementation of a stack in the CPU is done by assigning a portion of memory to a stack operation and using a processor register as a stack pointer.

23. Difference between Stack Pointer and Frame Pointer ?
Ans: The compiler passes parameters and return variables in a block of memory known as a frame. The frame is also used to allocate local variables. The stack elements are frames. A stack pointer (sp) defines the end of the current frame, while a frame pointer (fp) defines the end of the last frame.

24. What is Subroutine, Parameter passing and Subroutine linkage method ?
Ans: A block of instructions is usually called **Subroutine.** The simplest **subroutine linkage method** is to save the return address in a specific location, which may be a register dedicated to this function. Such a register is called the link register. This exchange of information between a calling program and a subroutine is referred to as **parameter passing.**

25. How machine instructions are encoded in a processor ?
Ans:
▪ To be executed in a processor, an instruction must be encoded in a binary-pattern. Such encoded instructions are referred to as Machine Instructions.
▪ The instructions that use symbolic-names and acronyms are called assembly language instructions.
▪ We have seen instructions that perform operations such as add, subtract, move, shift, rotate, and branch. These instructions may use operands of different sizes, such as 32-bit and 8-bit numbers.

26. Calculate the effective address of Load(R1), 10(R2), if the value of R2 is 200.
Ans: Effective address=10+200=210

UNIT – II

1. What are Hardware components ?
Ans: Register file and ALU

2. What are 6 fundamental phases of instruction cycle ?
Ans: Fetch, decode, execute, memory access, writeback in register file, writeback in PC.

3. The pipelining process is also called _____ and why?
Ans: It is also called assembly-line operation because it performs operations in assembly language.

4. To increase the speed of memory access in pipelining, what we make use ?
Ans: We make use of cache because by using the cache we can reduce the speed of memory access by a factor of 10.

5. Define instruction pipeline.
Ans: An instruction pipeline reads consecutive instructions from memory while in the other segments the previous instructions are being implemented

6. What is pipelining?
Ans: The processor hardware in such a way that multiple instructions can be processed at the same time. This approach is called pipelining.

7. What are the types of pipeline hazards ?
Ans: Data hazard, Instruction hazard, Structural hazard.

8. Define branch delays in Pipelining.
Ans: The branch delay slot is a side effect of pipelined architectures due to the branch hazard, i.e. the fact that the branch would not be resolved until the instruction has worked its way through the pipeline.

9. What is called Memory Function Complete(MFC) ?
Ans: Memory function complete or MFC is just a signal that tells the cpu that the current operation involving the memory is complete.

10. What is data hazard?
Ans: Data hazard is a pipeline hazard which occurs when any condition in which either the source or the destination operands of an instruction are not available, when needed in the pipeline.

11. What is Structural hazard ?
Ans: Structural hazard is a pipeline hazard which occurs when a situation where two (or more) instructions require the use of a given hardware resource at the same time.

12. What is Instruction or control hazard?
Ans: Instruction hazard is a pipeline hazard which occurs when there is a delay in the availability of an instruction or the memory address needed to fetch the instruction.

13. Define memory delays in pipelining.
Ans: Delays arising from memory accesses are called Memory delays.

14. Define branch delay slot.
Ans: The location that follows a branch instruction is called the branch delay slot.

15. What is branch prediction and what are its types.
Ans: Branch prediction is an approach to computer architecture that attempts to mitigate the costs of branching. It has two types: Static and Dynamic branch prediction.

16. What are different steps in instruction execution?
Ans: Load instruction, ALU, Store instructions.

17. What is a Register file?
Ans: A register file is an array of processor registers in a central processing unit (CPU).

18. Define Datapath.
Ans: Datapath is a combination of register read, back-end stages and inter-stage registers

19. What are control signals?
Ans: Control signals are signals that govern the operation of processor's hardware component.

20. Difference between hardwired and microprocessor control units.
Ans:

Hardwired Control Unit	Microprogrammed Control Unit
Hardwired control unit generates the control signals needed for the processor using logic circuits	Microprogrammed control unit generates the control signals with the help of micro instructions stored in control memory

Hardwired Control Unit	Microprogrammed Control Unit
Hardwired control unit is faster when compared to microprogrammed control unit as the required control signals are generated with the help of hardwares	This is slower than the other as micro instructions are used for generating signals here
Difficult to modify as the control signals that need to be generated are hard wired	Easy to modify as the modification need to be done only at the instruction level
More costlier as everything has to be realized in terms of logic gates	Less costlier than hardwired control as only micro instructions are used for generating control signals
It cannot handle complex instructions as the circuit design for it becomes complex	It can handle complex instructions

21. Define Branch penalty.
Ans: The branch penalty is analyzed as a function of the relative number of branch instructions executed and the probability that a branch is taken.

UNIT – III & IV

Memory access time:
Time elapsed between the initiation of an operation to transfer data from/to memory and the completion of that operation

Memory cycle time:
Time required between initiation of two successive memory accesses

Random Access Memory (RAM):
A memory unit is called a random-access memory (RAM), if the access time to any location is the same, independent of the location's address

Cache memory:
Cache memory is a chip-based computer component that makes retrieving data from the computer's memory more efficient

Virtual memory:

Virtual memory is a logical memory. It is a memory management technique handled by the operating system. Virtual memory allows the programmer to use more memory for a program than the available main memory.

Semiconductor RAM Memories
Semiconductor memories are the volatile memory storages that store the program and data until the power supply to the system is ON.
Semiconductor memories are used for storing digital data as they can be accessed faster.

Static Memories:
In static RAM memories or SRAM, the content of the memory cell retains as long as the power supply to the memory chip is ON.

CMOS Cell:
CMOS SRAMs i.e. complementary metal-oxide-semiconductor memory consumes very low memory as the power is supplied through the cells only when the cell is being accessed. A major advantage of CMOS SRAMs is their very low power consumption, because current flows in the cell only when the cell is being accessed

What is ROM?
ROM, which stands for read only memory, is a memory device or storage medium that stores information permanently.

Programmable Read Only Memory (PROM):
PROM is a blank version of ROM. It is manufactured as blank memory and programmed after manufacturing
Uses: It is used in cell phones, video game consoles, medical devices, RFID tags, and more.

Erasable and Programmable Read Only Memory (EPROM):
EPROM is a type of ROM that can be reprogramed and erased many times
Uses: It is used in some micro-controllers to store program

EEPROM:
Type of erasable PROM can be programmed, erased, and reprogrammed electrically. Such a chip is called an electrically erasable PROM, or EEPROM
Uses: The BIOS of a computer is stored in this memory.

Direct Memory Access
Direct Memory Access (DMA) transfers the block of data between the memory and peripheral devices of the system, without the participation of the processor.

Hit Ratio:
The performance of Cache memory is frequently measured in terms of quality is called Hit Ratio

Mapping Process:
Transfer of data from main memory to Cache memory is referred as mapping process

Memory Mapped I/O:
The I/O devices and the memory share the same address space, this arrangement is called memory-mapped I/O. It is used in most computers.

I/O Device Interface
An I/O device is connected to the interconnection network by using a circuit, called the device interface.

Programmed I/O:
In program-controlled I/O, the processor program controls the complete data transfer

Interrupt Signal:
When a device is ready to communicate with the CPU for data transfer, it generates an signal called interrupt signal.

Interrupt Service Routine:
An ISR (also called an interrupt handler) is a software process invoked by an interrupt request from a hardware device.

Interrupt acknowledge:
The processor must inform the device that its request has been recognized so that it may remove its interrupt-request signal. This can be accomplished by means of special control signal, called interrupt acknowledge

Interrupt latency:
Interrupt latency is the time between the occurrence of an interrupt, and the time the system has properly responded to that interrupt(ISR).

Shadow registers:
A different set of registers can be used by the interrupt-service routine, thus eliminating the need to save and restore registers. The duplicate registers are sometimes called the shadow registers.

Process control register(PCR):
A control register is a processor register which changes or controls the general behaviour of CPU. To deal with interrupts it is useful to have some other control registers. These are called as PCR

Bus Structure
The bus is a simple structure that implements a high-speed internal connection. Buses are used to send control signals and data between the processor and other components.

Bus Clock or Control Line
Timing information for all devices is generated by “Control Line” called “Bus Clock”.

Clock Cycle
The signal on this line has two phases: a high level followed by a low level These 2 phases called Clock Cycle

Clock Pulse:
The first half of the cycle between the low-to-high and high-to-low transitions is often referred to as a clock pulse.

Asynchronous Bus:
A handshake is an exchange of command and response signals between the master and the slave

Arbitration
The process of determining which competing bus master will be allowed access to the bus is called Bus Arbitration.

Interface Circuits
The interface circuit is a mediator between the I/O device and the system to which this I/O has to be connected.

PCI Bus
The PCI (Peripheral Component Interconnect) bus was developed as a low-cost, processor independent bus. It is housed on the motherboard of a computer and used to connect I/O interfaces for a wide variety of device

Data transfer signals on PCI bus:
1.DEVSEL#
2.IDSEL#
3.IRDY#

SCSI Bus:
The acronym SCSI stands for Small Computer System Interface.The SCSI bus may be used to connect a variety of devices to a computer. It is particularly wellsuited for use with disk drives

What is the size of the mantissa in single &double precision number format?
Ans:Single-23, Double-52

Biased exponent?
In floating arthimetic a baised exponent is the result of adding some constant to the exponent chosen to make the range of exponent non-ve

The SCSI BUS is used to connect the video devices to a processor by providing a parallel BUS.

The usual BUS structure used to connect the I/O device is _____
Single bus structure

How is Cache memory implemented.
The Cache memory is implemented using the SRAM chips

Cache Hit:
When data is found in cache memory, this is called a cache hit.

Write the factors considered in designing an io subsystem?
– I/O device characteristics (input, output, storage, etc.)
/Performance.
– I/O Connection Structure (degree of separation from.
memory operations).
– I/O interface (the utilization of dedicated I/O and bus.

controllers).
– Types of buses/system interconnects (processor-memory vs.
I/O buses/interconnects).

In floating point numbers when do you say that an underflow or overflow has occurred?
Overflow: is said to occur when the true result of an arithmetic operation is finite but larger in magnitude than the largest floating point number which can be stored using the given precision.
Underflow: is said to occur when the true result of an arithmetic operation is smaller in magnitude (infinitesimal) than the smallest normalized floating point number which can be stored. Overflow can't be ignored in calculations whereas underflow can effectively be replaced by zero.