**1. What is computer architecture?**

Computer architecture refers to hardware instructions, software standards and technology infrastructure that define how computer platforms, systems and programs operate.

This means that computer architecture outlines the system's functionality, design and compatibility.

**2. What are the three categories of computer architecture?**

Computer architecture has three categories. These include:

System design

This includes all the hardware components in the system such as the data processors, direct memory access and graphics processing unit. It also includes data paths, memory controllers and miscellaneous things such as virtualization and multiprocessing.

Instruction Set Architecture

This is a part of the central processing unit that is visible to the compiler writer and programmer. It defines the CPU's capabilities and functions based on what programming it can process and perform. This includes the data formats, memory addressing modes, processor register types, word size and the instruction set that programmers use.

Microarchitecture

Also known as "computer organization," this kind of architecture defines storage elements, data processing and data paths, as well as how they should be implemented in the ISA.

**3. What are some of the components of a microprocessor ?**

Some of the components of a microprocessor include the arithmetic and logic unit, which performs math computations such as division, addition and subtraction and Boolean functions; registers, which act as the temporary data holding places of microprocessors; control units, which receive signals from the CPU and move data from one microprocessor to another; and memory caches, which accelerate the computing process, as the CPU doesn't have to use the slower RAM to retrieve data.

**4. What is MESI ?**

MESI stands for the four states of the cache blocks, which are **Modified, Exclusive, Shared and Invalid.** It's also known as the "Illinois protocol". It's used to maintain cache coherency in hierarchical memory systems. MESI is the most common protocol that supports write-back cache. Its use in personal computers became common with the introduction of Intel's Pentium processor.

**5. What are the different hazards?**

Hazards have three classes.

These include the **structural hazards**, which occur from resource conflicts when the hardware can't support all possible combinations of instructions in synchronized overlapped execution; **data hazards**, which occur when instructions that manifest data dependence change data in different stages of a pipeline; and **control hazards**, which occur from the pipelining of branches and other instructions that modify the PC.

**6. What is pipelining?**

Pipelining, also known as "pipeline processing", is the process of collecting instruction from the processor through a pipeline. It stores and executes instructions in an orderly process.

**7. What is a cache?**

A cache is a small amount of memory, which is a part of the CPU. It's placed closer to the CPU than the RAM. It temporarily holds data and instructions that the CPU is likely to reuse.

**8. Why we use 3 types of cache mapping ?**

3 type of cache mapping is –

1) Direct mapping,

2)Associative mapping,

3) Set-associative mapping

Associative memory donot have cache lining. Only two field word-offset and tag.

RAM data is saved in cache. For reference we use 3 types of mapping for getting different hit ratio result.

Like increasing set associating will decrease conflict miss. As same line will be invade less. (Set-associative)

Increasing cache size i.e. no of line decrease capacity miss. (Direct mapping)

Increasing block size will decrease compulsory miss.

**9. What is difference between direct mapping, associative mapping and set-associative mapping ?**

direct mapping – tag,line no.,block

tag will go to tag of ram, then it will have line no. then to block

associative mapping – tag, word

simply go to ram tag to find word there is no lining for that tag

set- associative – tag+set,line,block

go to tag then next bit is setno. then line then to block

**10. What are the different types of interrupts in a microprocessor system?**

Example: "Interrupts can either be internal or external. Internal interrupts, which are also referred to as "software interrupts", are caused by software instruction and operate similar to a branch or jump instruction. An external interrupt, which is also referred to as a "hardware interrupt," is caused by an external hardware module."

**11. What is the easiest way to determine cache locations in which to store memory blocks?**

Example: "Direct mapping is the easiest way to define cache locations in which to store memory blocks. It maps each block of the main memory into only one possible cache line. The cache in a direct-mapped cache structure is organized into several sets, with a single line per set. Based on the memory block's address, it can only use a single cache line. The cache can be framed as a column matrix."

**12. What is a virtual memory on a computer?**

Example: "A virtual memory is an operating systems' memory management feature that uses software and hardware to allow computers to compensate for the shortages of physical memory by temporarily moving data from RAM to disk storage."

**13. Can you state some of the common rules of assembly language?**

Example: "Some of the common rules of assembly language include the following:

In assembly language, the label field can either be empty or may define a symbolic address.

Instruction fields can specify machine pseudo instructions.

Comment fields can be commented with or left empty.

In the case of symbolic addresses, up to four characters are only allowed.

The comment field begins with a forward slash while the symbolic addresses field is terminated by a comma."

**14. What is the RAID system?**

RAID, which stands for Redundant Array of Independent Disks, refers to the hard drives connected and set up in ways to help accelerate or protect the performance of a computer's disk storage. It is typically used on servers and high-performance computers.

**22) What is RAID? What are the different RAID levels?**

RAID stands for Redundant Array of Independent Disks. It is used to store the same data redundantly to improve the overall performance.

Following are the different RAID levels:

RAID 0 - Stripped Disk Array without fault tolerance

RAID 1 - Mirroring and duplexing

RAID 2 - Memory-style error-correcting codes

RAID 3 - Bit-interleaved Parity

RAID 4 - Block-interleaved Parity

RAID 5 - Block-interleaved distributed Parity

RAID 6 - P+Q Redundancy

**15. What are the two hardware methods to establish a priority? Explain each method.**

Example: "The two different ways to establish hardware priority are the parallel priority and daisy-chaining. Daisy-chaining is a method that involves connecting all the devices that can request an interrupt in a serial manner. This setting is governed by the priority of the devices, in which the device with the highest priority is placed first.

Parallel priority, on the other hand, uses a register for which bits are configured separately by the interrupt signal from each device. It may also come with a mask register, which is used to control the status of each interrupt request."

**16. What**

**17. What's the difference between interrupt service routine and subroutine?**

Example: "Subroutine is a part of code within a larger program, which performs a specific task and is relatively independent of the remaining code. Interrupt service routines deal with hardware interrupts. They are not independent threads, but more like signals. They are used if an interrupt suspends any thread. Unlike subroutine, which runs when we call it, ISR runs whenever there's a signal from either the software or hardware. The big difference is we can determine where the subroutine runs while we can't determine when the ISR will be executed."

**18. What are the different types of fields that are part of instruction?**

Example: "An instruction is like a command to a computer to perform a particular operation. The instruction format is composed of various fields in them such as:

**Operation code field.** Also called the "op-code field", this field is used to specify the operation to be performed for the instruction.

**Address field.** As the term implies, this field is used to designate the various addresses, such as memory address and register address.

**Mode field.** This field specifies as to how an operand performs or how effective an address is."

**19. What are the steps involved in an instruction cycle?**

Example: "A program that resides in the memory contains a set of instructions that the computer needs to perform sequentially. The cycle for every instruction is called the instruction cycle, which consists of the following steps:

Fetch instruction. The CPU fetches the instruction from the memory. The computer gets loaded with the address of the instruction.

Decode. This allows the CPU to determine what instruction must be performed and how many operands are needed to fetch to perform an instruction.

Execute. At this step, the instruction is performed. If the instruction has logic or arithmetic, the ALU is utilized. This is the only step of the instruction cycle that's useful from the end user's perspective."

**20. What are the five stages in a DLX pipeline?**

Example: "Each DLX instruction has five stages. These include:

Instruction fetch

Instruction decode and register fetch

Execution

Memory access

Writeback"

**21. What are the types of micro-operations?**

Example: "Micro-operations are executed on data stored in registers. They are basic math operations performed on the information stored in one or more registers. The types of micro-operations are:

Shift micro-operations: They perform shift operations on data stored in registers.

Logic micro-operations: They execute bit manipulation operations on nonnumerical data saved in registers.

Arithmetic micro-operations: They perform arithmetic operations, such as subtractions and additions, on digital data stored in registers.

Register transfer micro-operations: They transfer binary information between registers."

**22. What is the write-through and write-back method ?**

Example: "Write-through is the preferred method of data storage in many applications, especially in banking and medical device control, as it's good at preventing data loss. In less critical applications, and especially when the volume of data is large, an alternative method known as "write-back" speeds up system performance because updates are typically written exclusively to the cache and are saved in the main memory only under certain conditions or at specified intervals."

**23. What is associative mapping ?**

Example: "The associative mapping technique uses several mapping functions to transfer data from the main memory to the cache memory. This means that any main memory is mapped into any line of the cache. As a result, the cache memory address is not in use. The associative cache controller processes and interprets the request by utilizing the main memory address format."

**24. What does wait state mean ?**

Example: "A wait state means that the computer processor experiences a delay when accessing a device or an external memory that is slow in its response. Wait states are considered wasteful in processor performance, which is why modern-day designs try to either minimize or eliminate wait states. These include pipelines, instruction pre-fetch and pipelines, caches, branch prediction and simultaneous multithreading. While these techniques can't eliminate wait states, they can significantly minimize the problem when they work together."

**25. What is DMA ?**

Example: "DMA, which stands for Direct Memory Access, is a feature of computer systems that allows an input/output device to receive or send data directly from or to the main memory, bypassing the CPU to boost memory operations. The process is performed by a chip known as the DMA controller."

**26. What is a horizontal microcode?**

Example: "Horizontal microcode, which is usually contained in a fairly wide control store, comes with several discrete micro-operations that are combined into one micro-instruction for simultaneous operation."

**27. What is locality of reference ?**

Since size of cache memory is less as compared to main memory. So to check which part of main memory should be given priority and loaded in cache is decided based on locality of reference.

2 types of Locality of reference.

Spatial Locality of reference

This says that there is a chance that element will be present in the close proximity to the reference point and next time if again searched then more close proximity to the point of reference.

Temporal Locality of reference

In this Least recently used algorithm will be used. Whenever there is page fault occurs within a word will not only load word in main memory but complete page fault will be loaded because spatial locality of reference rule says that if you are referring any word next word will be referred in its register that’s why we load complete page table so the complete block will be loaded.

**28. I/O interface in computer organization.**

Input-Output Interface is used as an method which helps in transferring of information between the internal storage devices i.e. memory and the external peripheral device .

Mode of Transfer :

1. Programmed I/O.
2. Interrupt- initiated I/O.
3. Direct memory access( DMA).

**29. Conflict vs capacity miss vs compulsory miss**

conflict miss- when there are empty lines in cache, clock of main memory is conflicting with the already filled line of cache, it is called conflict miss.

capacity miss – miss occurred when all lines of cache are filled

compulsory miss – when a block of main memory is trying to occupy fresh empty line of cache, it is cumpulosry miss

8. What is a snooping protocol?

Example: "A snooping protocol, also referred to as a "bus-snooping protocol," maintains cache coherency in symmetric multiprocessing environments. All caches on the bus snoop or monitor the bus to determine if they have a copy of the block of data that is requested on the bus. Each cache holds a copy of the sharing status of every block of physical memory it has. Typically, several copies of a file in a multiprocessing environment can be read without any problem of coherence. However, a processor should have exclusive access to the bus to write."