Draw and explain the memory hierarchy in a digital computer. What are advantages of cache memory over main memory?

The memory hierarchy in a digital computer refers to the different types of memory that are used to store data and instructions. The memory hierarchy is organized in a hierarchical manner, with each level of memory providing faster access but lower capacity than the level below it.

## The memory hierarchy typically includes the following levels:

- Registers: These are small, high-speed memory cells that are part of the CPU. Registers are used to hold data that is being processed by the CPU. Registers have the fastest access time but the smallest capacity.
- 2. Cache memory: Cache memory is a type of memory that is used to store frequently accessed data and instructions. Cache memory is located between the CPU and main memory and is designed to provide faster access to frequently used data. Cache memory has a larger capacity than registers but a slower access time than registers.
- 3. Main memory: Main memory is the primary memory in a computer system. It is used to store data and instructions that are currently being used by the CPU. Main memory has a larger capacity than cache memory but a slower access time.
- 4. Secondary storage: Secondary storage devices, such as hard disk drives and solidstate drives, are used to store data and instructions that are not currently being used by the CPU. Secondary storage has the largest capacity but the slowest access time.

## The advantages of cache memory over main memory are as follows:

1. Speed: Cache memory has a faster access time than main memory. This is because cache memory is located closer to the CPU than main memory, which means that data can be accessed more quickly.

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- Efficiency: Cache memory is designed to store frequently used data and instructions. This means that the CPU can access the data it needs more quickly, which can improve overall system performance.
- 3. Cost: Cache memory is more expensive than main memory, but it is less expensive than registers. This means that cache memory provides a good balance between speed and cost.
- 4. Power consumption: Cache memory consumes less power than main memory. This is because cache memory is smaller than main memory, which means that it requires less power to operate.

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- 40. What is Associative memory? Explain the concept of address space and memory space in Virtual memory.
- 41. What is Paging? Explain how paging can be implemented in CPU to access virtual memory.
- 42. Explain SIMD array processor along with its architectural diagram ?
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