

12 Lecture - CS501

Important Subjective

1. **What is pipelining in CPU design, and how does it improve performance?**

Answer: Pipelining is a technique used in CPU design to execute multiple instructions simultaneously by breaking them down into smaller stages that can be processed in parallel. Each stage of the pipeline performs a specific task, such as instruction fetching, decoding, execution, and write-back. Pipelining improves performance by increasing the throughput of the CPU, allowing it to process more instructions in less time.

How does cache memory work in CPU design, and what are its advantages?

Answer: Cache memory is a type of memory used in CPU design to temporarily store data that the CPU needs to access frequently. It is faster than main memory and is located closer to the CPU to reduce access time. When the CPU needs to access data, it first checks the cache memory. If the data is found in the cache, it can be accessed quickly without having to access main memory. The advantages of cache memory are faster access times, improved performance, and reduced power consumption.

What is branch prediction in CPU design, and why is it necessary?

Answer: Branch prediction is a technique used in CPU design to reduce the impact of branch instructions on performance by predicting the outcome of a branch and speculatively executing the predicted path. Branch prediction is necessary because branch instructions can cause pipeline stalls when the CPU has to wait for the outcome of the branch before continuing execution. By predicting the outcome of the branch, the CPU can continue executing instructions speculatively and reduce the impact of pipeline stalls.

What is clock frequency in CPU design, and how does it affect performance?

Answer: Clock frequency is the rate at which a CPU's clock signal oscillates, measured in hertz (Hz). It determines the maximum number of instructions the CPU can execute per second. A higher clock frequency generally results in faster performance, as the CPU can execute more instructions in less time. However, increasing the clock frequency also increases the power consumption and heat dissipation of the CPU, which can lead to stability and reliability issues.

What is the difference between RISC and CISC CPU architectures?

Answer: RISC (Reduced Instruction Set Computing) and CISC (Complex Instruction Set Computing) are two different CPU architectures. RISC CPUs have a simplified instruction set with fewer instructions that are executed in a single clock cycle, whereas CISC CPUs have a more complex instruction set with instructions that can take multiple clock cycles to execute. RISC CPUs are generally faster and more power-efficient, while CISC CPUs are more flexible and can perform complex operations with fewer instructions.

What is the role of the control unit in CPU design?

Answer: The control unit is a component of the CPU that is responsible for directing the flow of data and instructions between different parts of the CPU. It generates control signals that coordinate the operation of the datapath, arithmetic logic unit, and memory units. The control unit also fetches instructions from memory, decodes them, and directs the datapath to execute

them.

What is virtual memory in CPU design, and how does it work?

Answer: Virtual memory is a technique used in CPU design to allow a computer to use more memory than it physically has. It does this by temporarily transferring data from main memory to disk storage when it is not in use. When the CPU needs to access the data, it is transferred back to main memory. This allows the CPU to access more data than would be possible with only the physical memory installed in the system.

What is the purpose of the register file in CPU design?

Answer: The register file is a component of the CPU that is used to temporarily store data that the CPU needs to access. It contains a set of registers that are used to store operands, intermediate results,