

16 Lecture - CS501

Important Subjective

1. **What is the purpose of the control unit in a CPU?**

Answer: The purpose of the control unit in a CPU is to manage the flow of instructions and data between the CPU and other components of the computer system.

What are the key components of a control unit?

Answer: The key components of a control unit are the instruction register, program counter, instruction decoder, and timing and control circuits.

What is instruction pipelining, and how does it improve CPU performance?

Answer: Instruction pipelining is a technique used in CPU design to improve performance by allowing multiple instructions to be processed simultaneously. This is achieved by dividing the instruction processing into smaller stages and overlapping them to reduce the time required to execute instructions.

How does branch prediction improve CPU performance?

Answer: Branch prediction is a technique used in CPU design to improve performance by predicting the outcome of conditional instructions (such as if-else statements) and executing the predicted instruction path. This can save time compared to waiting for the branch condition to be evaluated.

What is clock speed, and how does it affect CPU performance?

Answer: Clock speed is the rate at which a CPU's clock generates pulses that synchronize the internal operations of the CPU. A higher clock speed generally means that the CPU can process instructions faster, leading to improved performance.

What is an instruction set architecture (ISA), and why is it important in control unit design?

Answer: An instruction set architecture (ISA) is the set of instructions that a CPU can execute. The ISA is an important factor in control unit design because it determines the types of instructions the control unit must be able to process.

What is virtual memory, and how does it impact control unit design?

Answer: Virtual memory is a technique used in computer systems to simulate more memory than is physically available. Virtual memory impacts control unit design because it requires additional hardware and software to manage the mapping of virtual memory addresses to physical memory locations.

How do power consumption and heat dissipation impact control unit design?

Answer: Power consumption and heat dissipation are important considerations in control unit design because they can impact the performance, reliability, and lifespan of the CPU. Control unit designers must balance performance and power consumption to ensure optimal operation.

What is the role of the instruction decoder in a control unit, and how does it work?

Answer: The instruction decoder is responsible for interpreting the instruction codes received

from the instruction register and translating them into control signals that direct the CPU's operations. The decoder works by examining the instruction code and generating the appropriate control signals to execute the instruction.

How do cache memory and register renaming improve CPU performance, and what are their limitations?

Answer: Cache memory and register renaming are techniques used in CPU design to improve performance by reducing the time required to access data and instructions. Cache memory works by storing frequently used data and instructions in a small, high-speed memory, while register renaming allows the CPU to reuse registers without waiting for their contents to be stored in memory. However, these techniques have limitations, such as limited cache size and increased power consumption.