

1. What purpose does the datapath in a CPU serve?
2. What does the control unit in a CPU do?
3. How does the ALU know which function to perform?
4. Explain the relation between clock cycle time and clock frequency.
5. What are the main roles of operating Systems (OS)?
6. Consider a hypothetical microprocessor generating a 16-bit address (for example, assume that the program counter and the address registers are 16 bits wide) and having a 16-bit data bus.
 - a. What is the maximum memory address space that the processor can access directly if it is connected to a "16-bit memory"?
 - b. What is the maximum memory address space that the processor can access directly if it is connected to an "8-bit memory"?
 - c. What architectural features will allow this microprocessor to access a separate "I/O space"?
 - d. If an input and an output instruction can specify an 8-bit I/O port number, how many 8-bit I/O ports can the microprocessor support? How many 16-bit I/O ports? Explain.
7. What are the differences among sequential access, direct access, and random access?
8. The general relationship among access time, memory cost, and capacity?
9. The general relationship among access time, memory cost, and capacity?
 1. List I/O Module Function
 2. Is it true that All peripherals are slower than CPU and RAM? Elaborate on what is needed to deal with that? (2 points)
10. Consider a hypothetical 32-bit microprocessor having 32-bit instructions composed of two fields: the first byte contains the opcode and the remainder the immediate operand or an operand address.
 - a. What is the maximum directly addressable memory capacity (in bytes)?
 - b. Discuss the impact on the system speed if the microprocessor bus has
 1. a 32-bit local address bus and a 16-bit local data bus, or
 2. a 16-bit local address bus and a 16-bit local data bus.
 - c. How many bits are needed for the program counter and the instruction register?
11. Consider a computer system that contains an I/O module controlling a simple keyboard/printer teletype. The following registers are contained in the processor and connected directly to the system bus:

INPR: Input Register, 8 bits

OUTR: Output Register, 8 bits

FGI: Input Flag, 1 bit

FGO: Output Flag, 1 bit

IEN: Interrupt Enable, 1 bit

Keystroke input from the teletype and printer output to the teletype are controlled by the I/O module. The teletype is able to encode an alphanumeric symbol to an 8-bit word and decode an 8-bit word into an alphanumeric symbol.

a. Describe how the processor, using the first four registers listed in this problem, can achieve I/O with the teletype.

b. Describe how the function can be performed more efficiently by also employing IEN.

12. For a synchronous read operation (Figure 3.19), the memory module must place the data on the bus sufficiently ahead of the falling edge of the Read signal to allow for signal settling. Assume a microprocessor bus is clocked at 10 MHz and that the Read signal begins to fall in the middle of the second half of T3.

a. Determine the length of the memory read instruction cycle.

b. When, at the latest, should memory data be placed on the bus? Allow 20 ns for the settling of data lines.

