

- (1) How to identify whether a processor uses memory-mapped I/O or isolated I/O? Which kind of I/O do Intel 80X86 series CPUs and Motorola 68K series CPUs use? List the advantages and disadvantages of memory-mapped I/O, compared to isolated I/O. (10%)
- (2) Why address buses on PCs are unidirectional while data buses are bidirectional? Why the CPU chip uses some pins for both data and address? (8%)
- (3) Explain why DMA I/O is faster than CPU controlled I/O for the PC. (7%)
- (4) For vectored interrupts, where does the I/O module place the interrupt vector on?(4%)
- (5) Identify three applications of ROMs in computers (i.e. why and where need ROMs). (7%)
- (5) Given reasons why the page size in a virtual memory system should be neither very small nor very large. (7%)
- (6) If the speed of the primary memory were to exceed the speed of the CPU, then cache memory would be useless. True or False? Justify your answer.(7%)
- (7) A set-associative cache consists of 128 slots divided into 4-slot sets. Main memory contains 8K blocks of 128 words each. Show the format of main memory address.(6%)
- (8) What is the functionality of Translation Lookaside Buffer(TLB) in Memory-Management Unit (MMU).(7%)
- (10) Explain how a microprogrammed control unit can handle invalid op codes. (8%)
- (11) Two important methods for improving the speed of processor are (1) using a large number of general-purpose registers and (2) using a cache memory. Consider a shared-memory multiprocessor where the processors have either
  - a. 1024 registers, or
  - b. an equivalent amount of cache.compare these organizations relative to the following issues:
  1. context-switching overhead;
  2. instruction format and size;
  3. coherence.(12%)
- (12) Implement a full-adder circuit with a decoder and two OR gates.(7%)
- (13) Using D type Flip-Flop to design a sequential circuit with four flip-flops, A, B, C, and D. The next states of B, C, and D are equal to the present states of A, B, and C, respectively. The next state of A is equal to the exclusive-OR of the present states of C and D. (10%)