QUESTIONS

1. What is a stored program computer?
2. List and briefly define the main structural components of a computer.
3. List and briefly define the main structural components of a processor.
4. The relative performance of the IBM 360 Model 75 is 50 times that of the 360 Model 30, yet the instruction cycle time is only 5 times as fast. How do you account for this discrepancy?
5. While browsing at Billy Bob's computer store, you overhear a customer asking Billy Bob what the fastest computer in the store is that he can buy. Billy Bob replies, "You're looking at our Macintoshes. The fastest Mac we have runs at a clock speed of 1.2 GHz. If you really want the fastest machine, you should buy our 2.4-GHz Intel Pentium IV instead." Is Billy Bob correct? What would you say to help this customer?
6. On the IAS, describe in English the process that the CPU must undertake to read a value from memory and to write a value to memory in terms of what is put into the MAR, MBR, address bus, data bus, and control bus.
7. Explain the concept of performance balance.
8. List and define three methods for calculating a mean value of a set of data values.
9. What are the differences among base metric, peak metric, speed metric, and rate metric?
10. List the desirable characteristics of a benchmark program.
11. Consider the example in Section 2.5 for the calculation of average CPI and MIPS rate, which yielded the result of CPI = 2.24 and MIPS rate = 178. Now assume that the program can be executed in eight parallel tasks or threads with roughly equal number of instructions executed in each task. Execution is on an 8-core system with each core (processor) having the same performance as the single processor originally used. Coordination and synchronization between the parts adds an extra 25,000 instruction executions to each task. Assume the same instruction mix as in the example for each task but increase the CPI for memory reference with cache miss to 12 cycles due to contention for memory. Determine the average CPI and calculate the speedup factor.
12. The owner of a shop observes that on average 18 customers per hour arrive and there are typically 8 customers in the shop. What is the average length of time each customer spends in the shop?
13. What general categories of functions are specified by computer instructions?
14. What types of transfers must a computer's interconnection structure (e.g., bus) support?
15. List and briefly define two approaches to dealing with multiple interrupts
16. List and briefly define the possible states that define an instruction execution.
17. 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. What is the maximum directly addressable memory capacity (in bytes)?
18. Consider a 32-bit microprocessor, with a 16-bit external data bus, driven by an 8-MHz input clock. Assume that this microprocessor has a bus cycle whose minimum duration equals four input clock cycles. What is the maximum data transfer rate across the bus that this microprocessor can sustain, in bytes/sec? To increase its performance, would it be better to make its external data bus 32 bits or to double the external clock frequency supplied to the microprocessor? State any other assumptions you make and explain. Hint: Determine the number of bytes that can be transferred per bus cycle.
19. What is the difference between an arithmetic shift and a logical shift?
20. List three possible places for storing the return address for a procedure return.
21. What is the difference between big endian and little endian?
22. What types of locations can hold source and destination operands?

23. Many processors provide logic for performing arithmetic on packed decimal numbers. Although the rules for decimal arithmetic are similar to those for binary operations, the decimal results may require some corrections to the individual digits if binary logic is used. Consider the decimal addition of two unsigned numbers. If each number consists of N digits, then there are 4N bits in each number. The two numbers are to be added using a binary adder. Suggest a simple rule for correcting the result. Perform addition in this fashion on the numbers 1698 and 1786.

24. A given microprocessor has words of 1 byte. What is the smallest and largest integer that can be represented in the following representations: Unsigned, Sign-magnitude, Ones complement, and Twos complement?