Computer Architecture ECE314
Winter 2004 Test 3

1. Identify the following terms or abbreviations (2 points each)

   (a) DMA

   (b) MODEM

   (c) RISC

   (d) USB

   (e) TLB

2. Write the expression $(X+Y)*(W-Z)$ using Reverse Polish notation (stack oriented)? (5 points)

3. Explain the difference between a big-endian and a little-endian system. (3 points)

4. Name three different input devices (other than a mouse) used for rapid screen position location (pointing). (3 points)

5. Rank the following devices in order of data rate (bits/sec). (5 points)

   (a) Laser printer

   (b) Keyboard

   (c) Hard Disk

   (d) Video/graphics display

   (e) Modem

   (f) Mouse

6. Explain the terms latency and throughput as applied to a computer pipeline. (4 points)

7. Explain how handshaking works in a I/O process. (4 points)

8. Describe how interrupts are implemented as part of the fetch-execute cycle. (4 points)

9. Describe how interrupt I/O operates. (4 points)

10. Name the other two I/O techniques (2 points)

11. Explain the principle of *locality* (spatial and temporal) with respect to cache memory. (3 points)

12. What is L1 and L2 cache?(3 points)

13. Explain the basic operation of an associative cache compared to a direct-mapping cache. (4 points)

14. Given a hard disk with 512-byte sectors, 1024 sectors per track, 5000 tracks per surface, and 16 platter-surfaces, find the unformatted disk capacity. (4 points)

15. If the disk above rotates at 10,000 rpm, find the rotational latency (in microseconds) (2 points)

16. Explain the terms thrashing and fragmentation as applied to a virtual memory system. (4 points)

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17. Explain the following virtual memory concepts (3 points each)

    (a) overlays

    (b) partitions

    (c) paging

    (d) segmentation

18. A program consisting of a sequence of 10 instructions without branch or jump instructions is to be executed in a five-stage pipelined computer with a clock period of 1.6 ns. Determine the following (2 points each)

    (a) the latency time for the pipeline

    (b) maximum throughput for the pipelie

    (c) time required for executing the program

19. The program in a computer program compares two signed 2's complement numbers A and B by performing subtraction $A - B$ and updating the status bits. Let $A = 11011110$ and $B = 11010110$. Find the values of status bits N (sign), Z (zero), and V (overflow) (3 points)

20. A cache memory has an assess time from the CPU of 4 ns, and the main memory has an access time from the CPU of 40 ns. What is the effective access time for the cache main memory if the hit ratio is 0.85? (3 points)

21. How many characters per second can be transmitted over a 57,600-baud line for asynchronous serial transmission with one stop bit? Assume a character code of eight bits. (3 points)

22. Estimate the time required to transfer a block of 1 MB (2^{20} B) from disk to memory given the following disk parameters: seek time, 8.5 ms; rotational latency, 4.2 ms; controller time, negligible; transfer rate 100 MB/s (3 points)

23. A computer has a 32-bit word length, and all instructions are one word in length. The register file of the computer has 16 registers. For a format with two register fields, one memory field, and a maximum of 100 opcodes, what is the maximum number of memory address bits available? (3 points)

24. A computer has a 32-bit instruction word broken into fields as follows: opcode 6-bits; two register fields, 6 bit each; and one immediate operand/register field, 14 bits. Find (1 point each)

    (a) the maximum number of operations that can be specified.

    (b) how many registers can be addressed

    (c) the range of unsigned immediate operands that can be provided.

25. Draw a diagram (with labels) showing the basic organization of a datapath (4 points)