

E 265

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2003.

Third Semester

Information Technology

IF 245 — COMPUTER ARCHITECTURE

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A machine is being enhanced by adding a vector mode of computation that is 30 times faster than the normal mode of execution. What percentage of vectorization is required to achieve an overall speed-up of 3?
2. Discuss the following addressing modes with an example : Relative, Register indirect.
3. Discuss the principle of operation of a carry-look-ahead adder.
4. Distinguish between horizontal and vertical microprogramming organisations.
5. What is meant by interleaved memory organisation?
6. Discuss the typical features of an IO processor.
7. Point out two ways by which parallelism is brought in uniprocessor systems.
8. What are the limits on how much a processor's performance can be improved using pipelining?
9. List down the typical features of a RISC architecture.
10. What are the different ways by which redundancy can be introduced in order to provide fault tolerance?

PART B -- ($5 \times 16 = 80$ marks)

11. (i) A program accesses two cache lines, one that begins at address 0×1000 , and one that begins at address 0×2000 . Memory accesses alternate between the two lines, and each line is accessed 100 times. If the program is run on a system with a 1 KB direct mapped data cache with 32 byte lines. How many data cache misses will occur? (6)
- (ii) Give the organisation of a floating point adder/subtractor unit handling IEEE standard floating point representations and explain the sequence of operations done here. (10)
12. (a) (i) While executing a program, computer A is found to have a MIPS rating of 100 and computer B 80. However, computer A takes 50 ns to execute the program and computer B takes only 40 ns. Is this possible? Comment on this. (4)
- (ii) What is a stack based machine? What are its advantages and disadvantages? (4)
- (iii) Discuss any five addressing modes that are commonly found in RISC architectures. (8)
- Or
- (b) (i) Give the organisation of a binary multiplier and explain its operation.
- (ii) Give a typical single bus organisation connecting the various parts of the CPU and show how an instruction like SUB R0, R1, (R2) gets executed here. Assume that the instruction is a one word instruction and R0, R1 are source operands where (R2) is the destination operand.
13. (a) (i) Discuss the Booth's multiplication algorithm. Simulate the same for $25 \times (-16)$. (10)
- (ii) What is meant by microprogrammed control? What are the basic blocks of such a control? How is it advantageous over hardwired control? (6)

Or

- (b) (i) What is meant by virtual memory? Discuss the implementation of any one virtual memory management system. (10)
- (ii) A system has 48-bit virtual addresses : 36 bit physical addresses and 128 MB of main memory. If the system uses 4096-byte pages, how many virtual and physical pages can the address spaces support? How many page frames of main memory are there? (6)
14. (a) (i) Discuss the different read/write policies used in cache memories bringing the relative advantages and disadvantages of each of them. (6)
- (ii) What is an associative memory? How is it different from the conventional memory? (4)
- (iii) An eight-way set-associative cache is used in a computer in which the real memory size is 2^{32} bytes. The line size is 16 bytes, and there are 2^{10} lines per set. Calculate the cache size and tag length. (6)

Or

- (b) (i) What are the different ways in which data can be transferred between the processor and the peripheral devices? Point out the relative merits and demerits of each of these schemes. (6)
- (ii) What is a DMA controller? Show how a typical DMA transfer is accomplished. (10)
15. (a) (i) What is ideal speedup of a pipelined machine with k pipeline stages? What are the factors that prevent us from achieving this ideal speed up? Discuss. (10)
- (ii) What should be the basic features supported by a vector processor? Discuss. (6)

Or

- (b) (i) A certain computer part is assumed to follow the exponential failure law. The probability that it does not survive more than 50 days is 0.92? How often can one expect to have to replace this particular part? (4)
- (ii) What is meant by a dataflow machine? Discuss with an example pointing out its salient features. (12)