Sl. No.

C0-R4.B4 : COMPUTER SYSTEM ARCHITECTURE

NOTE :
1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time : 3 Hours   **Total Marks : 100**

1. (a) Why is RISC important, and how is it different from CISC ?
   (b) What is the Von Neumann bottleneck, and what MIPS instructions does it most adversely impact ?
   (c) What are three MIPS instruction formats ?
   (d) What are different types of registers ? What type of data/ instruction is stored in these registers ?
   (e) When does data hazards occur ? Let there be two instructions I and J, such that J is followed by I. Identify the type of data hazards that occur in the following set of instructions :

   i.   I: R2 <- R1 + R3
        J: R4 <- R2 + R3
   ii. I: R2 <- R1 + R3
        J: R3 <- R4 + R5
   iii. I: R2 <- R1 + R3
        J: R2 <- R4 + R5
   (f) Differentiate between serial and parallel data transfer.
   (g) What are the advantages and disadvantages of having Direct Memory Access (DMA) controller ?

   (7x4)

2. (a) Explain 5 stages of RISC pipeline with their respective operations.
   (b) What kind of dependency does arise due to the resource conflict in the pipeliner ? Explain dependency situation with an example. How this problem can be avoided ? Explain.
   (c) How the negative numbers are stored in memory ? How will the following fragment of code will be stored in memory according to storage of *int* in C for a 32 bit representation ?

                   int a = -2056;   **(6+8+4)**

3. (a) Define Direct and Indirect Addressing Modes. Differentiate between the two.
   (b) Explain Booth's algorithm for two complements multiplication. Multiply (-6) and (2) using Booth's algorithm.

   (7+11)

4. (a) What is the principle of an array multiplier ? Explain the implementation of array multiplier with a combinational circuit, consider the multiplication of two 2-bit numbers, where multiplicand bits are b_1 and b_0, the multiplier bits are a_1 and a_0, and the product is $c_3 c_2 c_1 c_0$.
   (b) What is a priority interrupt system ? Explain the working of a Daisy Chain method of implementing a priority interrupt system.
   (c) Differentiate between CALL and JUMP instructions.   **(8+6+4)**

5. (a) What is the difference between programmed I/O and interrupt-driven I/O ? Explain with examples.

(b) Consider a fully associative cache with 8 cache blocks (0-7). The memory block requests are in the order-

4, 3, 25, 8, 19, 6, 25, 8, 16, 35, 45, 22, 8, 3, 16, 25, 7

If LRU replacement policy is used, which cache block will have memory block 7 ? Also, calculate the hit ratio and miss ratio.

(c) What is the difference between Virtual memory and Cache memory ?

(6+6+6)

6. (a) How is MIMD different from SIMD ?

(b) Discuss different stages of a generic CPU instruction cycle. Explain the full instruction cycle to execute the following instruction.

mul x, y, product

(8+10)

7. (a) Write an assembly language program to add two 8 bit numbers stored at address 2050 and address 2051. The starting address of the program is taken as 2000.

(b) Explain transfer of Data in Computer by DMA Controller with diagram.

(10+8)

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