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Final Assessment Test – November/December 2023

Course: **CSI1004 - Computer Organization and Architecture**

Class NBR(s): **4086/4089/4092** Slot: **F2+TF2**

Time: **Three Hours** Max. Marks: **100**

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN "OFF" POSITION, IS TREATED AS EXAM MALPRACTICE

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Identify the actions taken by the IAS processor to carry out the following instruction. Assume the program is stored in main memory.

$$Y = \frac{(M * N)}{O}$$

Where M, N, O, and Y are the memory locations like 1000, 1001, 1002, and 1003.

2. Let's assume the following values are stored in memory, R1 stores 3000, PC stores 100, index register stores 500 and Base register stores 100.

Location	Value
2999	800
3000	3300
3001	4000
3100	3200
3300	3200
3500	1800

Write the instruction and calculate the effective address and the value that is loaded into the AC for each of the subsequent addressing modes using the instruction **Load 3000**.

i) Immediate

ii) Direct

iii) Indirect

iv) Register

v) Register indirect

vi) Auto Post Decrement

vii) Auto Post Increment

viii) Relative

ix) Base register

x) Indexed

3. a) Apply the following logical operations and identify the value of R. Starting from an initial value of **R = 11011101**, determine the sequence of binary values in R after each operation in the sequence: **[5]**

   i) A logical shift-left

   ii) Followed by an arithmetic shift-right

   iii) Followed by another arithmetic shift-right

   iv) Followed by logical shift-right

   v) Followed, finally, by a rotate left.

   b) Solve and show the step-by-step multiplication process using the signed magnitude algorithm when subsequent numbers are multiplied. **[5]**

   Multiplicand = 63

   Multiplier = -17

   Show the contents of the registers A and Q, flip-flop E and SC during the multiplication process. Use 7-bit register to accommodate the value.

4. Divide -153 by 8 by using a signed magnitude division algorithm and find out the value of the quotient and remainder with the correct sign. Use the 5-bit register to store the values.

   i) Show the contents of the flip-flop E and registers A, Q & SC during the process of a division using restoring algorithm with comments.

   ii) Identify the possibility of overflow.

5. Consider a 16-way set-associative cache

   - Data words are 64 bits long
   - Data addresses are to the word
   - The cache holds 2 Mbytes of data
   - Each block holds 16 data words
   - Physical addresses are 64 bits long

   How many bits of tag, index, and offset are needed to support references to this cache?

6. Consider a simple system running a single process. The size of physical frame and logical page is 16 bytes. The RAM can hold 3 physical frames. The program generates the following 20-page references as it runs on the CPU: 1 2 3 4 1 2 5 1 2 3 4 5 1 2 3 4 2 5 1 3. Assume that the physical frames in RAM are initially empty and do not map to any logical page.

   i) Calculate the number of page faults generated by the accesses above, assuming a FIFO page replacement algorithm. You must also correctly point out which page accesses in the reference string are responsible for the page faults. [4]

   ii) Repeat (i) above for the Optimal page replacement algorithm. [5]

   iii) What would be the lowest number of page faults achievable in this case? [1]

7. List out the drawbacks of strobe control method and spectacle the method how to overcome those drawbacks with neat sketch.

8. Identify the drawbacks of programmed I/O technique and identify and describe the techniques used to overcome the disadvantages.

9. With a neat diagram, explain the concept of magnetic disk.

10. a) Differentiate between SIMD and MIMD. [4]

    b) Describe in detail about pipeline processing. [6]

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