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| No. of Pages | **6** |
| No. of Questions | **15** |

**Department of Computer Science and Engineering**

**FINAL EXAMINATION**

**Fall 2015**

**CSE 340: Computer Architecture**

**Total Marks: 75 Time Allowed: 3 Hours**

* Return the question paper with your answer script
* Answer ***Section 1*** in the space provided in the question paper
* Answer ***Section 2 and 3*** in the answer script provided
* At the end of the exam return both your answer scripts along with your question

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ID:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Section:\_\_\_\_\_\_

**Section 1 (35 Marks)**

1. What are the advantages of using a standard (such IEEE754) for representing floating point numbers? 2
2. What are the functions of the registers $ra, $0, $lo and $hi? 4
3. Compare between pipeline, single cycle datapath and multicycle datapath. 4
4. Calculate the memory address the given instruction will fetch value from: lw $10, 40($11). Assume $11 has a value of 0x1040. 3
5. How can we overcome data hazard without using stall(s). 2
6. Draw the truth table for the expression = · (A · B + A · C) 5
7. Design a PLA for the expression: 5
8. Define Execution Time, CPU Time and Throughput. 3
9. A Program is running on a specific machine (CPU) with the following parameters:

Total executed instruction count: 10,100,000 instructions. Average CPI for the program: 2.7 cycles/instruction. CPU clock rate: 240 MHz (1 MHz = 1 \* 10^6 cycles/sec). What is the execution time for this program? 3

1. Design a register file for a 64-bit processor of having 32 registers. 4

**Section 2(Answer any Three) (30 Marks)**

###### Question No.11

1. Convert -39.743 into IEEE754 single precision floating point representation. Also show the equivalent Hex representation. 5
2. Multiply 0.371 and 0.215 using IEEE754 single precision representation. 5

###### Question No.12

1. Convert the below C code into equivalent MIPS representation: 5

int x[50], y[50];

for (i=1;i<50;i++){

x[i] =x[i+1]+y[i+2];

}

1. How would you implement in the assembler a logical-shift-right (srl) pseudo-operation for a machine that doesn’t have this instruction? Be sure your instruction can shift up to W bits where W is the machine word size in bits. (Logical shift right corresponds to division by 2). (Hint: Use div $t1,$s1,$s2 pseudo-instruction) 5

srl $s1,$s2,n # logical-shift-right by n bits

Question No. 13

1. Give a specific example of a sequence of MIPS assembly instructions that include a data dependency (hazard) that cannot be resolved by forwarding alone. 3
2. Identify all the data hazards in the following sequence of instructions. For each hazard, identify the dependent and independent instructions (only write the line numbers). Is it possible to overcome the hazards without using forwarding? If yes, explain how using diagram and what impact this hazard overcoming can have in the overall execution of the instruction set. 7

1 lw $t0, 0($s5)

2 addi $s5, $s5, 4

3 add $t0, $s3, $t0

4 sw $t0, 0($s5)

5 xor $t3, $t2, $s5

6 add $t2, $t3, $t2

## Question No. 14

1. Draw a complete single cycle datapath having control unit and control signals. 6
2. Give data forwarding control conditions for EX/MEM hazard. 4

**Section 3 (10 Marks)**

## Question No. 15

1. Let’s assume you have a four (4) inputs system having one (1) output. Output is high when the decimal equivalent has a reminder of one (1) when divided by two (3). Draw the truth table for this system. Design the circuit using logic gates without simplifying the sum of product form of the Boolean equation. 8
2. When do you need D-FF in place of D-latch? 2

THE END