

Quiz-1

ACOL 216: Introduction to Computer Architecture

IIT Delhi - Abu Dhabi · Semester II, 2025-26

Total Marks: 20

Time: 40 minutes

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1. Consider the equality $(43)_x = (y3)_8$ where x and y are unknown. What are the possible solutions of (x, y) ? **(2 marks)**
 2. Consider the IEEE-754 single precision floating point numbers $P=0xC1800000$ and $Q=0x3F5C2EF4$. What is the product of these numbers (i.e., $P \times Q$), represented in the IEEE-754 single precision format? **(3 marks)**
 3. Prove each of the following Boolean expression using Boolean algebraic laws. **($2 \times 2 = 4$ marks)**
 - (i) $\overline{(A + \bar{B} + \bar{D})(C + D)(\bar{A} + C + D)(A + B + \bar{D})} = \bar{A}\bar{D} + \bar{C}\bar{D}$
 - (ii) $(A + C)(\bar{A} + B) = AB + \bar{A}C$
 4. Perform the following subtraction operations using the *r*'s complement method. For each case, explicitly show the calculation of the complement for the subtrahend and the subsequent addition step. **(3+4 = 7 marks)**
 - (i) $(101.101)_2 - (11.011)_2$ [Use 2's complement; Express your final answer in **base-2**]
 - (ii) $(256.34)_7 - (143.56)_7$ [Use 7's complement; Express your final answer in **base-7**]
 5. What is the base of the number system in which the following equation holds: $\frac{312}{20} = 13.1$? **(2 marks)**
 6. Consider a hypothetical ISA where each instruction is exactly 4 bytes long. Conditional and unconditional branch instructions in this ISA use PC-relative addressing mode with *Offset* specified in bytes to the target location of the branch instruction. Further, the *Offset* is always with respect to the address of the next instruction in the program sequence. Also, the **add** and **sub** instructions follow similar definitions and syntax as SimpleRISC, while the **cmp** and **beq** instructions are defined as:
 - **cmp R1, R2, R3:** This instruction compares the values stored in registers R2 and R3. The result of this comparison is stored in register R1, which acts as a condition register for subsequent control flow.
 - **beq R1, Offset:** This is a Branch if Equal instruction. It examines the comparison result stored in register R1; if the condition for equality is met, the program execution jumps to the target address calculated using PC-relative addressing with the *Offset* specified in the instruction.

Now consider the following instruction sequence:

Instr. No.	Instruction
$i:$	add R2, R3, R4
$i + 1:$	sub R5, R6, R7
$i + 2:$	cmp R1, R9, R10
$i + 3:$	beq R1, Offset

If the target of the branch instruction is i , then what is the decimal value of the *Offset*? **(2 marks)**