Midsem Solutions
CSE 112 - Computer Organization

Q1:

a) $13_{10} = 01101_2$ **[1.5 marks for correct 2's complement notation]**
$-10_{10} = 10110_2$ **[1.5 marks for correct 2's complement notation]**
$13_{10} - 10_{10} = 01101_2 + 10110_2 = 00011_2 = 3_{10}$ **[3 marks for correct computation]**

b) $9_{10} = 01001_2$ **[1.5 marks for correct 2's complement notation]**
$-14_{10} = 10010_2$ **[1.5 marks for correct 2's complement notation]**
$9_{10} - 14_{10} = 01001_2 + 10010_2 = 11011_2 = -5_{10}$ **[3 marks for correct computation]**

Case 1: Notation for a single operand is correct
Marks: 1.5 marks

Case 2: Both notations are correct but the computation is wrong
Marks: 1.5 + 1.5

Case 3: Notations are wrong
Marks: 0 mark

Case 3: Both notations and the computation are correct
Marks: 1.5 + 1.5 + 3

Q2:

a.) -0 **[2 marks for correct answer.]**

b.) -infinity **[2 marks for correct answer.]**

c.) Sign = +ve
Exponent = $1000\_0011_2 = 131 = 127 + 4$
Mantissa = 011_1100_0000_0000_0000_0000
Number = $1.0111\_1 \times 2^4 = 10111.1_2 = 23.5$

[0.5 for correct sign + 0.5 for correct exponent + 0.5 for correct mantissa + 0.5 for correct final answer.]

Q3:

```
mov R3, #1
mov R1, #1
bz R0, loop_end:
loop_start:     mul R3, R3, R0
                sub R0, R0, R1
                bnz R0, loop_start
loop_end:
```

[10 marks total. Give partial marks in proportion to how much of the code is correct.]

Partial Marking criteria:

- If correct initialization is performed: +1.5
- If there is a loop: +1.5
- If the loop performs correct number of iterations (neither extra iterations nor missing iterations, no infinite loops): +1.5
- If the code works for R0 = 0: +1.5
- If the code works for R0 > 0: +1.5

Q4a:

Instruction Address **Instruction**

```
1       mov R0, #0
2       mov R1, #2
3       mov R2, #10
4       mov R3, #1
5       loop:   add R0, R0, R2
6               sub R1, R1, R3
7               bnz R1, loop
        loop_end:
```

Instruction Address	R0	R1	R2	R3
1	0	-	-	-
2	0	2	-	-
3	0	2	10	-
4	0	2	10	1
5	10	2	10	1
6	10	1	10	1
7	10	1	10	1
5	20	1	10	1

6	20	0	10	1
7	20	0	10	1
END	END	END	END	END

[10 marks total. Give partial marks in proportion to how many values in the table are correct. First row is not graded.**]**

Q4b:

1 mov R0, #0
2 mov R1, #2
3 mov R2, #10
4 mov R3, #1
5 mul R0, R2, R1

OR

1 mov R0, #0
2 mov R1, #2
3 mov R2, #10
4 mov R3, #1
5 add R0, R2, R2

[0.5 marks for copying instructions 1, 2, 3 and 4]
[1.5 marks for instruction 5.]
