CSE 112: Computer Organisation
Mid-Semester Examination Rubric
Set A

Ans 1. (No partial marks in Q1)

a. (For details, please refer to the last question in the practice sheet)
   i. 7.25
   ii. -233

b. 63.25 = 111111.01 = 1.1111101×2^5
   Exp = 127 + 5 = 132 (10000100)
   0100 0010 0111 1101
   4 2 7 D

   Answer = 427D0000

c. **Solution 1:**
   Adding 8 (2^3) means adding 3 to the exponent bits
   401 = 0100 0000 0001
   \+ 01 1
   = 0100 0001 1001
   = 419
   Answer: **41900000**

   Solution 2:

   40100000 in decimal = 2.25
   Multiplying by 8 = 18
   Converting to IEEE 754 representation: **41900000**

Ans 2.

a.

```
        bge R1, R2 next
Up:     add R0, R0, R1
        Addi R3, #1
        bge R2, R3 Up
        beg R1, R1 exit
next:   add R0, R0, R2
        addi R3, #1
        bge R1, R3 next
exit:   nop
```

Note: The above assembler code is one case; multiple possible answers might exist. TAs are advised to give marks if the logic remains the same for such cases.

b. **Solution in binary:** (gaps added for reader's convenience, not needed in the answer)
000 001 0000000000
001 010 101 110 0000
010 001 010 0000111
011 001 011 0001010
001 100 111 010 0000
000 010 0000000011

Solution in hexadecimal: 0400, 2AE0, 4507, 658A, 33A0, 0803 **(1*6 = 6 Marks)**

Ans 3. **(1*3 = 3 Marks)**

a) Unsigned range: 0 to $2^{16} - 1$
b) Signed magnitude range: $\pm(2^{15} - 1)$
c) 2' complement range: $-(2^{15})$ to $(2^{15} - 1)$

Ans 4.

Note that the carry chain propagation takes the largest time. Hence, the time to compute the final result depends on it. **(2*2 = 4 Marks)**

a. Time taken = 2 + 3*5 = 17 ns
b. Time taken = 2 + 2*5 = 12 ns

Set B

Ans 1. (No partial marks in Q1)

a. (For details, please refer to the last question in the practice sheet)
   i. 14.5625
   ii. -62

b. 64.75 = 1000000.11= 1.00000011×2^6
Exp = 127 + 6 = 133 (10000101)
0100 0010 1000 0001 1000
4 2 8 1 8

Answer = 42818000

c. **Solution 1:**

Adding 16 (2^4) means adding 4 to the exponent bits
402 = 0100 0000 0010
+ 10 0
= 0100 0010 0010
= 422
Answer: 42200000

Solution 2:

40200000 in decimal = 2.5
Multiplying by 16 = 20
Converting to IEEE 754 representation: 42200000

Ans 2.

a.

```
        bge R1, R2 next
Up:     add R0, R0, R1
        Addi R3, #1
        bge R2, R3 Up
        beg R1, R1 exit
next:   add R0, R0, R2
        addi R3, #1
        bge R1, R3 next
exit:   nop
```

Note: The above assembler code is one case; multiple possible answers might exist. TAs are advised to give marks if the logic remains the same for such cases.

b. **Solution in binary:** (gaps added for reader's convenience, not needed in the answer)
100 001 0000000000
101 010 101 110 0000

110 001 010 0000111
111 001 011 0001010
101 100 111 010 0000
100 010 0000000011

Solution in hexadecimal: 8400, AAE0, C507, E58A, B3A0, 8803 **(1*6 = 6 Marks)**

Ans 3. **(1*3 = 3 Marks)**

a. Unsigned range: 0 to $2^{32} - 1$
b. Signed magnitude range: $\pm(2^{31} - 1)$
c. 2' complement range: $-(2^{31})$ to $(2^{31} - 1)$

Ans 4.

Note that the carry chain propagation takes the largest time. Hence, the time to compute the final result depends on it. **(2*2 = 4 Marks)**

a. Time taken = 3 + 3*6 = 21 ns
b. Time taken = 3 + 2*6 = 15 ns