Last NAME: EMDAD First Name: MDSHAHID

Computer Science
C.Sc. 342

Quiz No.1

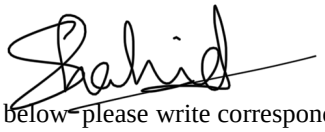
Time of performance 5:00-6:15 PM on February 23, 2022 **Please write your Last Name on every page:**

NO CORRECTIONS ARE ALLOWED IN ANSWER CELLS!!!!!

You may use the back page for computations.
Please answer all questions. **Not all questions are of equal difficulty. Please review the entire quiz first and then budget your time carefully.**

Please **HAND WRITE** and sign statements affirming that you will not cheat:

"I will neither give nor receive unauthorized assistance on this exam. I will use only one computing device to perform this test"

Please HAND WRITE and sign here: 

1. [10 points] For **each 8 BIT** binary pattern shown in the table below please write corresponding values of the following interpretations: **UNSIGNED INT, SIGNED INT, UNSIGNED Fixed Point, SIGNED Fixed Point.**

Each correctly answered column is **2.5** points. ***FIXED POINT IS LOCATED TWO POSITIONS FROM THE RIGHT!***

MOST SIGNIFICANT BIT IS 7. LEAST SIGNIFICANT BIT IS 0.

76543210	**UNSIGNED INT**	**SIGNED INT**	**UNSIGNED Fixed Point**	**SIGNED Fixed Point**
10000000	10000000 – [1 × 2^7 + 0 × 2^6 + 0 × 2^5 + 0 × 2^4 + 0 × 2^3 + 0 × 2^2 + 0 × 2^1 + 0 × 2^0 = 128] 128	10000000 =01111111 + 1 =10000000 10000000	100000 = 1 × 2^5+0 ×2^4+ 0×2^3 + 0 × 2^2 + 0 × 2^1 + 0 × 2^0 = 32 32	-2^5 = -32 **-32**
10000011	10000011 = 128 +2 +1 = 131 131	-128 +3 = -125	32+1/2+1/4 = 32 + ¾ = 131/4	-32+1/2+1/4 = -125/4
10000001	10000001 = 128+1=129	-128+1=-127	32 +1/4 = 129/4 -	32+1/4=-127/4
01000001	0100 0001 = [0 × 2^7 + 1 × 2^6 + 0 × 2^5 + 0 × 2^4 + 0 × 2^3 + 0 × 2^2 + 0 × 2^1 + 1 × 2^0 = 65] 65	**+65**	010000 = 0 × 2^5 + 1 × 2^4 + 0 × 2^3 + 0 × 2^2 + 0 × 2^1 + 0 × 2^0 = 16 16 + ¼ = 65/4	16 + ¼ = +65/4
01111111	01111111 – [0 × 2^7 + 1 × 2^6 + 1 × 2^5 + 1 × 2^4 + 1 × 2^3 + 1 × 2^2 + 1 × 2^1 + 1 × 2^0 = 127]	**+127**	31 + ½ + ¼ = 127/4	31 + ½ + ¼ = +127/4
11111111	11111111 – [1 × 2^7 + 1 × 2^6 + 1 × 2^5 + 1 × 2^4 + 1 × 2^3 + 1 × 2^2 + 1 × 2^1 + 1 × 2^0 = 255]	11111111 – 00000000 + 1 = 00000001	111111 = 1 × 2^5 + 1 × 2^4 + 1 × 2^3 + 1 × 2^2 + 1 × 2^1 + 1 × 2^0 = 63 63+1/2+1/4 = 255/4	-1 +1/2+1/4= -1/4

Last NAME: EMDAD *First Name: MDSHAHID*

11111100	11111100 – [1 × 2^7 + 1 × 2^6 + 1 × 2^5 + 1 × 2^4 + 1 × 2^3 + 1 × 2^2 + 0 × 2^1 + 0 × 2^0 = 252]	11111100 – 00000011 + 1 = 00000100	111111 = 1 × 2^5 + 1 × 2^4 + 1 × 2^3 + 1 × 2^2 + 1 × 2^1 + 1 × 2^0 = 63	111111 000000 +1 000001 -1
00000000	**0**	**0**	**0**	**0**
01111110	01111110 – [0 × 2^7 + 1 × 2^6 + 1 × 2^5 + 1 × 2^4 + 1 × 2^3 + 1 × 2^2 + 1 × 2^1 + 0 × 2^0 = 126]	**+126**	31 + ½ = 63/2	31 + ½ = +63/2
10001110	10001110 – [1 × 2^7 + 0 × 2^6 + 0 × 2^5 + 0 × 2^4 + 1 × 2^3 + 1 × 2^2 + 1 × 2^1 + 0 × 2^0 = 142]	10001110 – 01110001 + 1 = 01110010	100011 = 1 × 2^5 + 0 × 2^4) + 0 × 2^3 + 0 × 2^2 + 1 × 2^1 + 1 × 2^0 = 35 35+1/2 = 71/2	57/2
00010011	19	+19	$\frac{3}{4}+4 = 1$	$\frac{3}{4}+4+4=+\frac{19}{4}$

Fixed Point

2. [10 po ints] What is the most negative number (largest absolute value negative) that can be represented using 16 bit signed integer representation? Please CIRCLE AROUND over all the correct ones:

-32768, -65536, -16384, -32767, NONE

-2^n-1 = -2^16-1=-2^15 = **-32768**

3. [10 points]Please subtract two number in Hex. Then convert each operand to binary and perform the same operation in binary, then repeat BASE 10. The signed integers are represented using two's complement.

Answer:

0x0E = 00001110 = 14

0xFF = 1111 1111 = 0000 0000 +1 = 0000 0001 = -1

HEX	Binary	Decimal
0x0E	0000 1110	14
-	-	-
0xFF	1111 1111	-1

Result: 0xF 0000 111b dec: 15

4. [20 points]

Determine the **MINIMAL** number of **bit**s required to represent ***-127.75*** *using:*

Last NAME: EMDAD First Name: MDSHAHID

4.1 (5 points) ASCII code | 56 bits | *(please write the number of bits in the cell)*

4.2 (5 points) Binary Fixed Point representation | 10 bits | *(please write the number of bits in the cell)* And the corresponding binary Fixed Point representation here.

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

Please specify with arrow Fixed Point position.

4.3 (5 points) Take the result from you answer in 4.2 and shift fixed point by 2 positions to the RIGHT. Please write down the resulting signed decimal value,

And the corresponding binary Fixed Point representation here. Please use arrow to indicate fixed point position .

0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0

1111111111.00 = 511, 1111111111= -511

4. 4**(5 points)** Please write down the signed rational number stored in the 9-bit word below:

1	0	0	0	0	0	0	0	1

Fixed Point

Answer:

-1+(1/2)^8 = 255/256

5. [10 points] Please determine if single precision floating point representation given below is ***NAN,or +Infinity,Infinity, or a valid number*** floating point : The top row shows the bit index. ***PLEASE JUSTIFY your ANSWER and SHOW your*** work! Just the final result will not count as a correct answer.

31	30	29	28	27	26	35	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
0	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

Explanation:

10000001 = 129

129 – 127 = 2

(-1)^0 * 2^2 * 1.11000000000000000000000 = 7

Hence, it is a valid number

6. [10 points] Please determine the decimal value (scientific notation) of the single precision floating point representation given below: The top row shows the bit index. ***PLEASE SHOW your*** work! Just the final result will not count as correct answer. ***If it represents NAN, or Infinity, or zero please state this and justify.***

Last NAME: EMDAD *First Name: MDSHAHID*

31	30	29	28	27	26	35	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Explanation:
10000101 = 131 = 131-127 = 6
(-1) ^1*2^6 * (1+.11111111000000000000000) = 127.75 = -127.75
Hence, it is a valid number

7. [5 points] Please determine the decimal value (scientific notation) of the single precision floating point representation given below: The top row shows the bit index. ***PLEASE SHOW your*** work! Just the final result will not count as correct answer. ***If it represents NAN, or Infinity, or zero please state this and justify.***

31	30	29	28	27	26	35	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Explanation:
If we look closely, we can see all the bits are turned off and it is reversed number. So, the answer is 0.

8. [5 points] Please determine the decimal value (scientific notation) of the single precision floating point representation given below: The top row shows the bit index. ***PLEASE SHOW your*** work! Just the final result will not count as correct answer. If it represents NAN, or Infinity, or zero please state this and justify.

31	30	29	28	27	26	35	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Explanation:

11111111 = 255
Mantisa bits
.11111111111111111111111 = .99
255 -127 = 128
(-1)^1*2^(129)= -6.8*10^38
Hence, the answer is NAN.

Last NAME: EMDAD First Name: MDSHAHID

In EACH Questions 10.1-10.4 you are given SIGNED Integers stored in 32 BIT Registers. (Not 33-BIT Register). Please write decimal, and binary operands and the results. For each question you have to write the result and **overflow or No overflow. You may override '0' with '1'.**

10.1 (5 points) What is the result (hexadecimal, decimal and binary) of the following addition:

0x0000000E

\+

0xFFFFFFFF

NO OVEREFLOW

HEX: 0x00000000 Decimal: 13 Binary:0000 0000 0000 0000 0000 0000 0000 1101

10.2 (5 points) What is the result (hexadecimal, decimal and binary) of the following subtraction:

0x7FFFFFFF

\–

0xFFFFFFFF

OVEREFLOW

HEX: 0x8000000000 Decimal**: 2^31=2147483648** Binary: 10000000000000000000000000000000

10.3 (5 points) What is the result(hexadecimal, decimal and binary) of the following subtraction:

0x80000000

\–

0xFFFFFFFF

OVEREFLOW

HEX: 0x80000001 Decimal: **2^31+1 = 2147483649** Binary: 10000000000000000000000000000001

10.4 (5 points) What is the result(hexadecimal, decimal and binary) of the following addition:

0X7FFFFFFF

\+

0XFFFFFFFF

NO OVEREFLOW

HEX: **0X7FFF FFFE** **Decimal: 2^31-2 =2147483646** **Binary: 01111111111111111111111111111110**

Please write your result in the following form:

0x80000000

0xFFFFFFFF

+

OVEREFLOW

HEX: 0x7FFFFFFF

Decimal:+2^{31}-1 Binary: **01111111111111111111111111111111**