Akram_10_4_2021_Quiz_1

Last NAME: Akram First Name: Ismail

Computer Science

CSc 342 Performance time 12:00-1:40 PM Oct 4, 2021

Please submit as DM to instructor by 1:40 PM on Slack

Quiz No.1

October 4, 2021

Please write your Last Name on every page:

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

You may use the back page for computations. YOU DO NOT NEED TO SIGN IN ON ZOOM FOR THIS QUIZ

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" 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: Ismail Akram

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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	128	-128	32	-32
10000011	131	-125	$32+\frac{3}{4}=\frac{131}{4}$	$-32+\frac{3}{4}=-31.25$
10000001	129	-127	$32+\frac{1}{4}=\frac{129}{4}$	$-32+\frac{1}{4}=-31.75$
01000001	65	65	$16+\frac{1}{4}=\frac{65}{4}$	$16+\frac{1}{4}=\frac{65}{4}$
01111111	127	127	$31+\frac{3}{4}=\frac{127}{4}$	$31+\frac{3}{4}=\frac{127}{4}$
11111111	255	-1	$63+\frac{3}{4}=\frac{255}{4}$	$-1+\frac{3}{4}=-\frac{1}{4}$
11111100	252	-4	63	-1
00000000	0	0	0	0
01111110	126	126	$31+\frac{1}{2}=\frac{63}{2}$	$31+\frac{1}{2}=\frac{63}{2}$
10001110	142	-114	$35+\frac{1}{2}=\frac{71}{2}$	$-29+\frac{1}{2}=-28.5$
00010011	19	+19	$4+\frac{3}{4}=\frac{16+3}{4}$	$+4+\frac{3}{4}=+\frac{19}{4}$

Fixed Point

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2. [10 points] 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 -(2^15) = -32,768

0

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.

0x0E	0000 1110	14
-	-	-
0xFF	1111 1111	-1

Result: 0x 0F 0000 0000b 0000 1111b dec: 15

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4. [20 points] 8 (bits) * 7 (chars)

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

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.

1	0	0	0	0	0	0	0	0	1

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.

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

$= -2^9 + 1 = -511.00$

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 $-1 + \frac{1}{256} = -\frac{255}{256} = -0.996$

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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
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**	**0**

Formula: $(-1)^s * (1 + \text{binary faction}) * 2^{(\text{exp} - \text{BIAS})}$
$= (-1)^0 * (1 + 1/2 + 1/4) * 2^{(129 - 127)} = 1 * 1.75 * 2^2 = 7$ ... valid number

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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.***

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**	**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**	**0**

Formula: $(-1)^s * (1 + \text{binary faction}) * 2^{(\text{exp} - \text{BIAS})}$
$= (-1)^1 * (1 + \frac{1}{2} + \frac{1}{4} + \ldots + \frac{1}{256}) * 2^{(133 - 127)} = -127.75 = -1.2775 * 10^2$

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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**

Formula: $(-1)^s * (1 + \text{binary faction}) * 2^{(\text{exp} - \text{BIAS})}$

$= (-1)^0 * (1 + 0) * 2^{(0 - 127)} = 2^{-127}$ … virtually zero

5

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**

Formula: $(-1)^s * (1 + \text{binary faction}) * 2^{(\text{exp} - \text{BIAS})}$

$= (-1)^1 * (1 + \frac{1}{2} + \frac{1}{4} + \ldots + \frac{1}{2^{23}}) * 2^{(255 - 127)} = -6.8 * 10^{39}$ … NAN

Floating point number in question is in the form:
s111 1111 1xxx xxxx xxxx xxxx xxxx xxxx.

s is the sign bit, x sequence is a non-zero number. This is NAN.

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***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'.**

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

```
  0x0000000E
+
  0xFFFFFFFF
```

No overflow 14 0000 0000 0000 0000 0000 0000 0000 1110
- 1 - 0000 0000 0000 0000 0000 0000 0000 0001

HEX: 0x 0000000D Decimal: +13 Binary: 0000 0000 0000 0000 0000 0000 0000 1101

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

```
  0x7FFFFFFF
–
  0xFFFFFFFF
```

Overflow $2^{31} - 1$ 0111 1111 1111 1111 1111 1111 1111 1111
$-(-1)$ -1111 1111 1111 1111 1111 1111 1111 1111

HEX: 0x 80000000 Decimal: $+2^{31}$ Binary:
1000 0000 0000 0000 0000 0000 0000 0000

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

```
  0x80000000
–
  0xFFFFFFFF
```

No overflow -2^{31} 1000 0000 0000 0000 0000 0000 0000 0000
$-(-1)$ -1111 1111 1111 1111 1111 1111 1111 1111

HEX: 0x 80000001 Decimal: $-2^{31}+1$ Binary: 1000 0000 0000 0000 0000 0000 0000 0001

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

```
  0X7FFFFFFF
+
  0XFFFFFFFF
```

No overflow $2^{31} - 1$ 0111 1111 1111 1111 1111 1111 1111 1111
-1 +1111 1111 1111 1111 1111 1111 1111 1111

HEX: 0X 7FFFFFE Decimal: $+2^{31} - 2$ Binary
0111 1111 1111 1111 1111 1111 1111 1110

Please write your result in the following form:

```
  0x80000000
+
  0xFFFFFFFF
```

OVEREFLOW

HEX: 0x7FFFFFFF Decimal: $+2^{31}-1$ Binary: **01111111111111111111111111111111**