

Last NAME: Zhang

First Name: Chue

## 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:

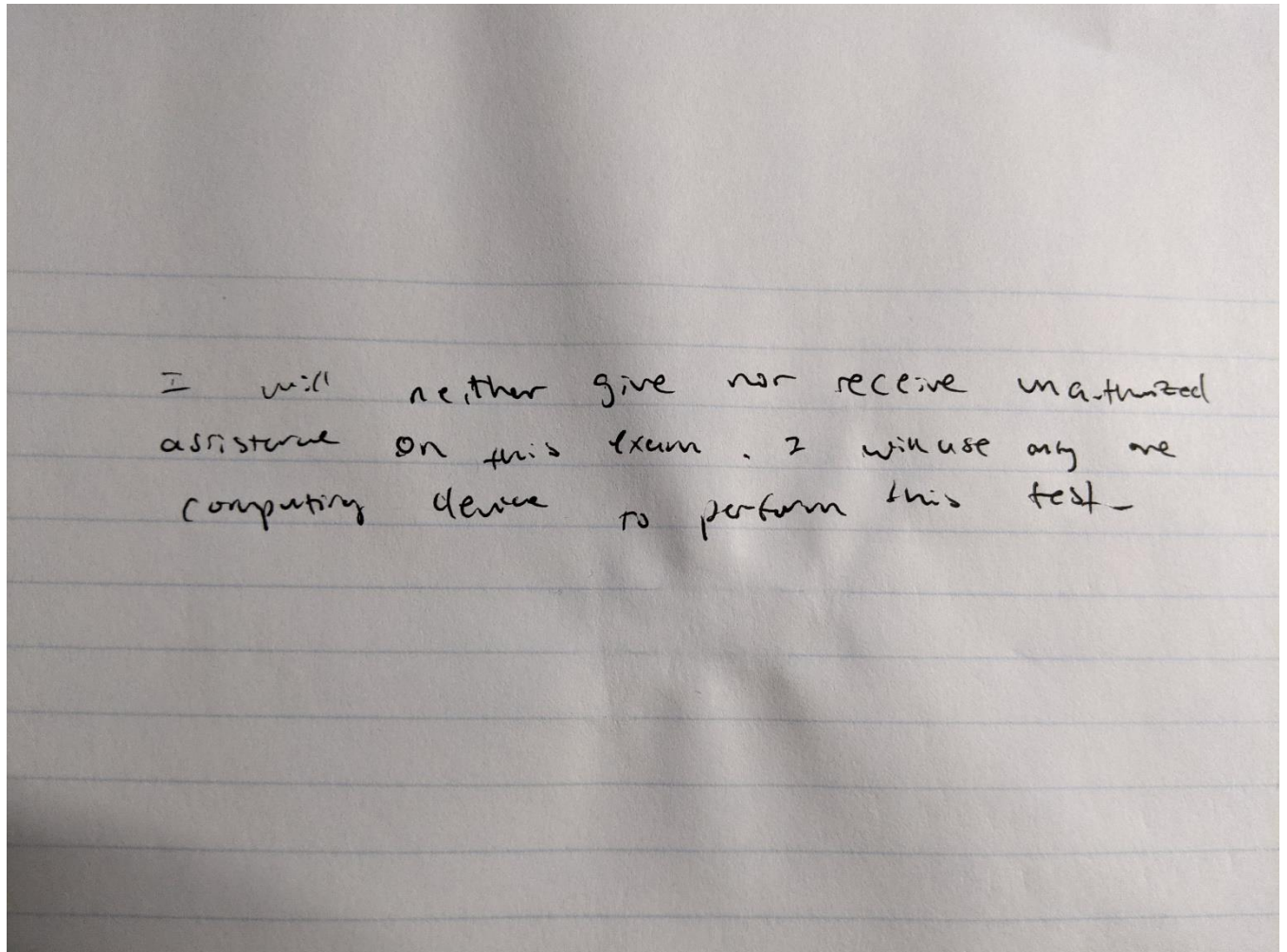
**NO CORRECTIONS ARE ALLOWED IN ANSWER CELLS!!!!**

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"*

Please **hand write and sign** here:



Last NAME: Zhang

First Name: Chue

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. 10 points**

76543210	UNSIGNED INT	SIGNED INT	UNSIGNED Fixed Point	SIGNED Fixed Point
10000000	128	-128	$32 + 0 = 32$	$-32 + 0 = -32$
10000011	131	-125	$32 + \frac{1}{2} + \frac{1}{4} = 131/4$	$-32 + \frac{1}{2} + \frac{1}{4} = -125/4$
10000001	129	-127	$32 + \frac{1}{4} = 129/4$	$-32 + \frac{1}{4} = -127/4$
01000001	65	65	$16 + \frac{1}{4} = 65/4$	$16 + \frac{1}{4} = 65/4$
01111111	127	127	$31 + \frac{1}{2} + \frac{1}{4} = 127/4$	$31 + \frac{1}{2} + \frac{1}{4} = 127/4$
11111111	255	-1	$63 + \frac{1}{2} + \frac{1}{4} = 255/4$	$-1 + \frac{1}{2} + \frac{1}{4} = -1/4$
11111100	252	-4	$63 + 0 = 63$	-1
00000000	0	0	0	0
01111110	126	126	$31 + \frac{1}{2} = 63/2$	$32 + \frac{1}{2} = 63/2$
10001110	142	-114	$35 + \frac{1}{2} = 71/2$	$-28 - \frac{1}{2} = -57/2$
00010011	19	+19	$\frac{3}{4} + \frac{16}{4} + \frac{3}{4} = \frac{22}{4}$	$\frac{3}{4} + \frac{19}{4} = \frac{22}{4}$

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 5 points**

**$-2^{(16-1)} = -2^{15} = -32768$  therefore -32768 only.**

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. **10 points**

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

**Result: 0x0F                      0000 1111b                      dec: 15**

**0 = 0000, E = 1110, F = 1111**

**FF = 1111 1111 = 2's complement = 0000 0001 = -1**

**0E = 0000 1110 = 14**

**14 = 0000 1111 = 0F**

4. [20 points]

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

**4.1 (5 points) ASCII code**

56 bits

(please write the number of bits in the cell)

**Each character is represented as an 8 bit character therefore  $7 \times 8 = 56$  bits 5 points**

**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 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0


**5 points**

Last NAME: Zhang

First Name: Chue

$$(1 \cdot 2^7) + (0 \cdot 2^6) + (0 \cdot 2^5) + (0 \cdot 2^4) + (0 \cdot 2^3) + (0 \cdot 2^2) + (0 \cdot 2^1) + (0 \cdot 2^0) + 0/2 + 1/4 = -127.5$$

**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	0	0	1		0	0					0
---	---	--	---	---	---	---	---	---	---	---	--	---	---	--	--	--	--	---

$$(1 \cdot 2^{-9}) + (1 \cdot 2^0) = -511$$

5 points

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	0	1
---	---	---	---	---	---	---	---	---	---

Fixed Point:

$$1.00000001 \text{ so } 1 \cdot 2^0 + 2^{-8} = 257/256$$

0 points

Reference for Q5 – Q8

$$(-1)^s \times (1 + F) \times 2^{E-Bias}$$

With Bias = 127

40/50 so far

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.

3	3	2	2	2	2	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	9	8	7	6	5	4	3	2	1	0
1	0	9	8	7	6	5	4	3	2	1	0	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

$$E = 1000\ 0001 = 129$$

$$(-1)^0 \times \left(1 + \frac{1}{2} + \frac{1}{4}\right) \times 2^{129-127} = 7.0$$

10 points

Last NAME: Zhang

First Name: Chue

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	25	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

$$E = 10000101 = 131$$

$$(-1)^1 \times \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64} + \frac{1}{128} + \frac{1}{256}\right) \times 2^{133-127} = -127.75$$

10 points

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	25	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

All values are 0 therefore this is zero. There is no E and there is no mantissa

5 points

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	25	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

The value is NaN as NaN maintains a form S111 1111.....1111 and above showcases this

5 points

70/80 so far

Last NAME: Zhang

First Name: Chue

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 = 0000 1110 = 14

+

0xFFFFFFFF = 1111 1111... 1111 (2's complement) = -1

HEX: 0x0000000D      Decimal: +13      Binary: 0000 0000 0000 0000 0000 0000 0000 1101

**No overflow, 13 IS WITHIN BOUNDS OF  $2^{32}-1$       5 points**

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

0x7FFFFFFF = 0111 1111 1111 1111 1111 1111 1111 1111 = 2147483647

-

0xFFFFFFFF = 0000 0001 (2's complement) = -1

HEX: 0x80000000      Decimal: -2147483648      Binary: 0000 0000 0000 0000 0000 0000 0000 0001

**Yes Overflow because this number exceeds the bounds of  $2^{31}-1$  ( $2^{31}-1 = +2147483647$  and  $2147483647 + 1 = 2147483648$  which is 1 above)**

**0 points**

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

0x80000000 = 1000 0000 0000 0000 0000 0000 0000 0000 = -2147483648

-

0xFFFFFFFF = 1111 1111 1111 1111 1111 1111 1111 1111 = -1

HEX: 0x80000001      Decimal: -2147483647      Binary: 1000 0000 0000 0000 0000 0000 0000 0001

**No overflow, NUMBER IS THE LARGEST NEGATIVE NUMBER IN  $2^{31}-1$**

**0 points**

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

0x7FFFFFFF = 0111 1111 1111 1111 1111 1111 1111 1111 = 2147483647

+

0xFFFFFFFF = 0000 0001 (2's complement) = -1

**0 points**

HEX: 0X7FFFFFFFE      Decimal: 2147483646      Binary: 0111 1111 1111 1111 1111 1111 1111 1110

**NO OVERFLOW BECAUSE WITHIN BOUNDS OF  $2^{31}-1$**

*Last NAME: Zhang*

*First Name: Chue*

Please write your result in the following form:

	0x80000000		OVERFLOW
	0xFFFFFFFF	+	
HEX:	0x7FFFFFFF		

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