CSE 351 Spring 2021 – Unit Summary #1 – Task 3
Due Fri 4/23/21 11:59pm to Gradescope

Your Name:_____

UWNet ID (email):_____

Academic Integrity Statement_____
All work on these questions in my own. I have not shared or discussed my answers with anyone else. (please sign) (1 point)

- To complete Task 3, please either:
  - print these THREE pages, fill them out and then scan and convert into a pdf
  - use digital ink or otherwise annotate the pdf electronically

- Gradescope requires you to upload a pdf

- Fill in your name and UW NetID above, then read the Academic Integrity Statement and sign your name indicating that you understand and will comply with the statement. If you are not printing this out or do not have access to digital ink, just type your full name.

- You may show scratch work for potential partial credit but showing work is not required. Be sure your final answer is placed in the blanks, boxes, or spaces provided.

- You may use your study guide from Task 1, course lecture slides and Ed Lessons, and course textbooks while completing this task.

- Use of reference materials external to those listed above is not allowed (e.g., Stack Overflow, web searches, communicating with anyone other than the course staff, etc.)

- If you have questions, please ask on the Ed Board. A private post is fine! Questions about the unit summaries will not be answered in office hours.

- Refer to the Unit Summary webpage for additional information:
  https://courses.cs.washington.edu/courses/cse351/21sp/unit_summaries/

Good Luck!

1. Integers and Floats (12 points total)

a) (1 pt) If we have only 13 bits and are using **two's complement representation**, how many **positive, non-zero** numbers can we represent?
Give an exact number, not a formula.

b) (1 pt) If we have only 13 bits and are using **sign-magnitude representation**, how many **positive, non-zero** numbers can we represent?
Give an exact number, not a formula.

c) (6 pt) Given the following in C: `signed char x = 0b 1101 1100`
    i.   (2 pts) What is the value of **x** in decimal? Give an exact number, a sum of powers of 2.

    ii. (4 pts) For each of the following expressions, indicate whether it will result in a positive, negative or a zero result. (Circle one)

- `x << 2`   Positive   Negative   Zero

- `x + 0x81`   Positive   Negative   Zero

- `x >> 4`   Positive   Negative   Zero

- `!(x ^ 0xF)`   Positive   Negative   Zero

d) (4 pts) Assume we have a floating point representation that follows the same conventions as IEEE 754, except that is uses 13 bits. 1 bit is for the sign, 6 bits are used for the exponent and 7 bits are used for the mantissa.

    `i.`   What is the bias for this representation

    `ii.`   What is the decimal value encoded by the bit pattern: 0   100110   0110100
           For potential partial credit, you may show
           your work, but work is not required.

Is this number (circle one):
positive   or
negative

2. Pointers & Memory (8 points total)

For this problem, assume we are executing on a 64-bit x86-64 machine (little endian) and that the initial contents of memory are shown below. Write the **type** and **hexadecimal value** for each expression in the table below, assuming these five statements have been executed. Write UNKNOWN if the value cannot be determined. **Make sure to specify all bits for the result of each expression** (i.e., use the correct number of bits as determined by the expression's resulting type).

Address	+0	+1	+2	+3	+4	+5	+6	+7
0x30	51	32	43	7A	3B	FA	E4	76
0x38	48	22	00	88	9A	B2	CD	27
0x40	50	00	00	00	00	00	00	00
0x48	40	03	08	15	A9	8B	F2	3F
0x50	AA	BB	CC	DD	EE	64	01	02

```
int i = 16;
char* cp = 0x42;
long* qp = 0x30;
short* sp = 0x3E;
int* ip = 0x4C;
```

Expression (in C)	Type	Value (in hex)
i	int	0x 0000 0010
*sp		
*(cp + 11)		
&qp		
((int) qp)		
((char*) sp) + 3		
(short*) (ip + 2)		
sp[-4] - 2		
((int)qp[2]) + 2		