Cpr E 281 HW06
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Representation and Arithmetic
Assigned: Week 7
Due Date: Oct. 11, 2021

For the first part of this HW please submit a PDF as usual.

P1 (8 points): For the grid below, shade the boxes for each number in the column that can be represented with only 4-bits under the format for that particular row.

	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Unsigned																	
Sign & Magnitude																	
1's Complement																	
2's Complement																	

P2 (12 points): Perform the following operations on the numbers and indicate if overflow occurs for each operation. All numbers are 6 bits wide (stored in 2's complement). Show your work and all carry bits.

```
+ 011111      + 100001      + 100001
  010100        001111        100111

- 100000      - 100001      - 100010
  111000        111101        011110
```

P3 (10 points): Convert the following numbers to IEEE 754 Single-Precision Floating Point format. Write your answer in **binary** and in **hexadecimal**, and indicate if an answer has a repeating mantissa:

a) -43
b) 28
c) 39
d) 1.2
e) -82

P4 (10 points): Convert the following numbers from IEEE 754 Single-Precision Floating Point format to **decimal**. Note that each number is given in hexadecimal. You may leave the result as a fraction.

a) $C0A00000_{16}$
b) $42F00000_{16}$
c) 41080000_{16}
d) $C101999A_{16}$
e) $C1980000_{16}$

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For all remaining problems, please write a complete program in C, C++, Java, Python, or any other programming language. Please write one program for each problem. For this part of the HW please submit only one zip file of a folder that contains all your source files.

P5 (10 Points): Write a program that reads in a positive decimal number from the keyboard and prints its binary version on the screen.

P6 (10 Points): Write a program that reads in a positive decimal number from the keyboard and prints its hexadecimal version on the screen.

P7 (10 Points): Write a program that reads from the keyboard a string that represents an unsigned 8-bit binary number and prints its decimal version on the screen.

P8 (10 Points): Write a program that reads from the keyboard a string that represents a signed 8-bit binary number (in 2's complement representation) and prints its decimal version on the screen.

P9 (10 Points): Write a program that reads from the keyboard a string that represents a signed 8-bit binary number (in 2's complement representation), negates it, and then prints the negated version on the screen as a string (in 2's complement representation).

P10* (10 Points): Write a program that exhaustively enumerates all possible pairs of 3-bit signed numbers (both positive and negative numbers in 2's complement representation), adds them, and computes the carry bits and the overflow flag for each pair. Print all additions on the screen in human readable form and indicate when an overflow occurs.

Sample output for one pair (the first binary line shows the carry bits):

```
-4 + -4 = -8

 1000
+ 100
  100
-----
  000
overflow
```