Cpr E 281 HW06

ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Representation and Arithmetic
Assigned: Week 7
Due Date: Oct. 14, 2019

P1 (10 points): Write -14 in the following binary number formats or state why it is not possible to write it in that format.
A: 8-bit Unsigned binary.
B: 8-bit Sign and magnitude.
C: 8-bit One's complement.
D: 8-bit Two's complement.
E: 32-bit IEEE 754 Floating Point.

P2 (8 points): For the grid below, shade the boxes for each number in the column that cannot be represented with only 3-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																	

P3 (12 points): Given the following numbers in 6-bit 2's complement, find the negative of the number; that is, given each number as X, find Y such that X+Y=0.

A: 000100
B: 111111
C: 011001
D: 110110
E: 001100
F: 000000

P4 (12 points): Perform the following operations on the given 2's complement numbers and indicate if overflow exists for each operation.

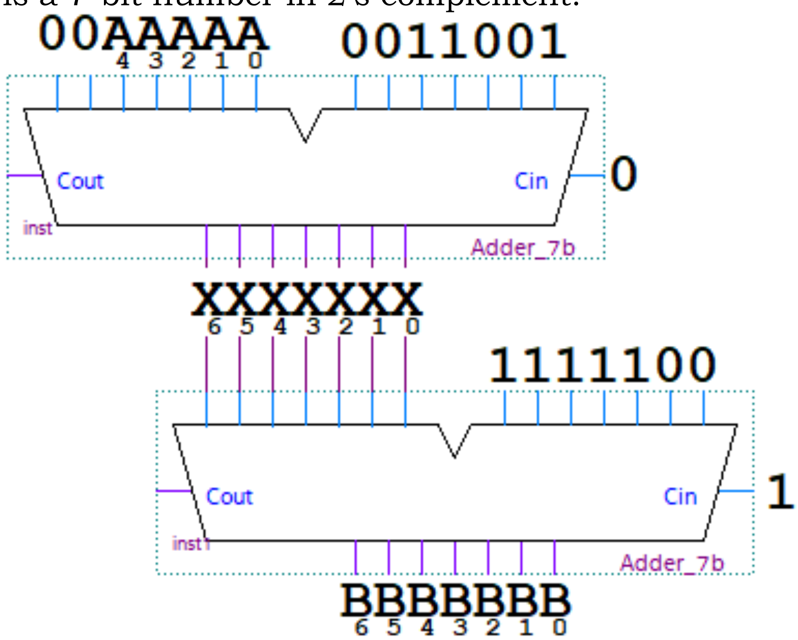
A: 10010 + 01001
B: 01111 - 11111
C: 10010 + 10001
D: 01000 - 11000
E: 11011 + 00101
F: 01011 - 01101

P5 (16 points): Let A be a three-bit unsigned number. Use a seven-bit adder (and NOT gates, as necessary) to design a circuit that calculates the following operations. Note that the output may be assumed as unsigned, unless it is possible for the operation to produce a negative answer, in which case, the output must be correct in 2's complement:

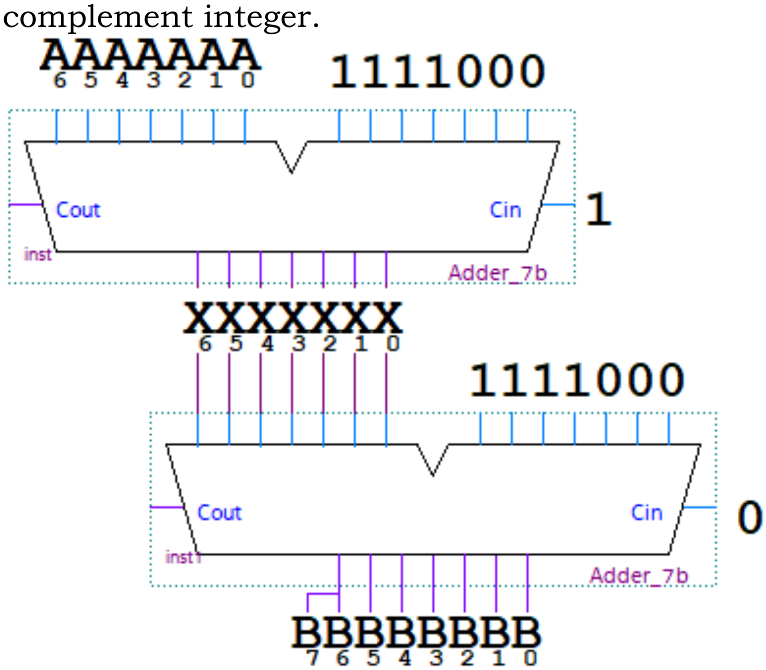
W = 3A + 1
X = 2A – 17
Y = 40A + 6
Z = 32 – 4A

P6 (18 points): In the circuits below, find the algebraic expression for **B(X)** (B in terms of X) and **X(A)** (the expression for X in terms of A). Overflow is ignored, but all results that would produce overflow should not be accepted as an allowed value.

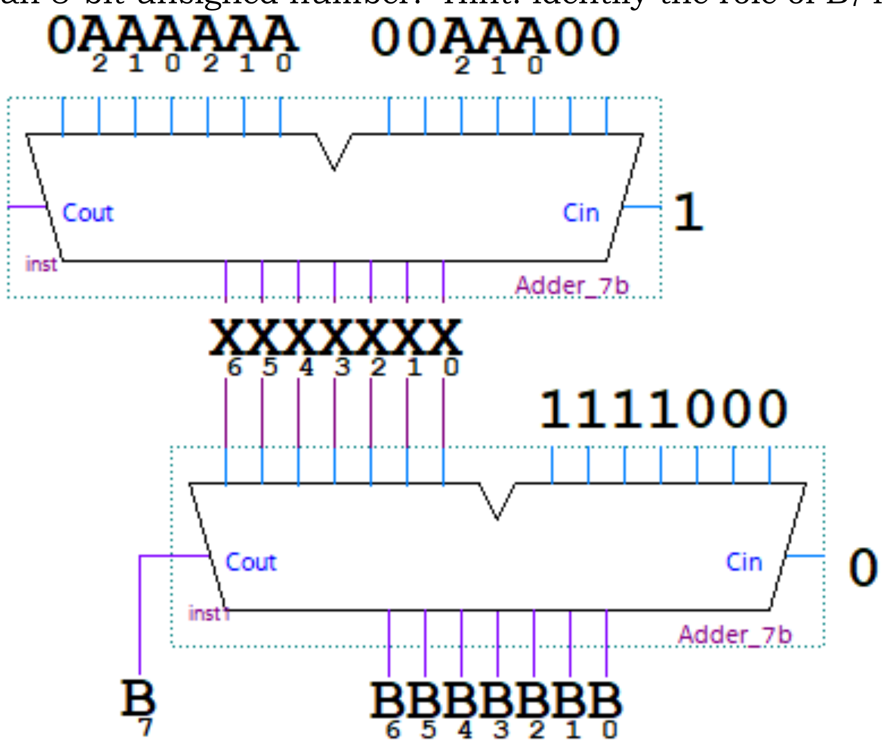
I: Here, A is a 5-bit unsigned integer, X is a 7-bit unsigned integer, and B is a 7-bit number in 2's complement.



II: A and X are both 7-bit 2's complement integers, but B is an 8-bit 2's complement integer.



III: A is a 3-bit unsigned integer, X is an unsigned 7-bit integer, and B is an 8-bit unsigned number. Hint: identify the role of B_7 in the circuit.



P7 (12 points): Convert the following numbers to IEEE 754 Single-Precision Floating Point binary format:
A: -8.125
B: 239
C: 19/512

P8 (12 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: $BF000000_{16}$
B: $42C80000_{16}$
C: $BD600000_{16}$