Cpr E 281 HW06
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Representation and Arithmetic
Assigned: Week 7
Due Date: Oct. 10, 2022

P1 (8 points): Rewrite -115_{10} in the following binary formats If it is not possible simply write **Not Possible**:

a. Unsigned:
b. Sign & Magnitude:
c. 1's Compliment:
d. 2's Compliment:

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.

+ 101011 010111	+ 011101 010110	+ 110001 110111
− 101000 111010	− 101001 110101	− 110010 011100

P3 (15 points): Convert the following numbers to IEEE 754 Single-Precision Floating Point format. Write your answer in **binary**

a) -98
b) 15.25
c) 29
d) 86.0625
e) -120

P4 (15 points): Convert the following numbers from IEEE 754 Single-Precision Floating Point format to **decimal**. You may leave the result as a fraction.

a) $1100\ 0010\ 1111\ 1110\ 0000\ 0000\ 0000\ 0000_2$
b) $0100\ 0010\ 1100\ 0100\ 0100\ 0000\ 0000\ 0000_2$
c) 41800000_{16}
d) $C2C44000_{16}$
e) $C2814000_{16}$

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P5 (16 Points): Perform the following multiplications using 2's complement binary numbers. Show all your work using **binary numbers**:

a. $10011_2 * 01001_2$

b. $01010_2 * 01110_2$

c. $-7_{10} * 4$

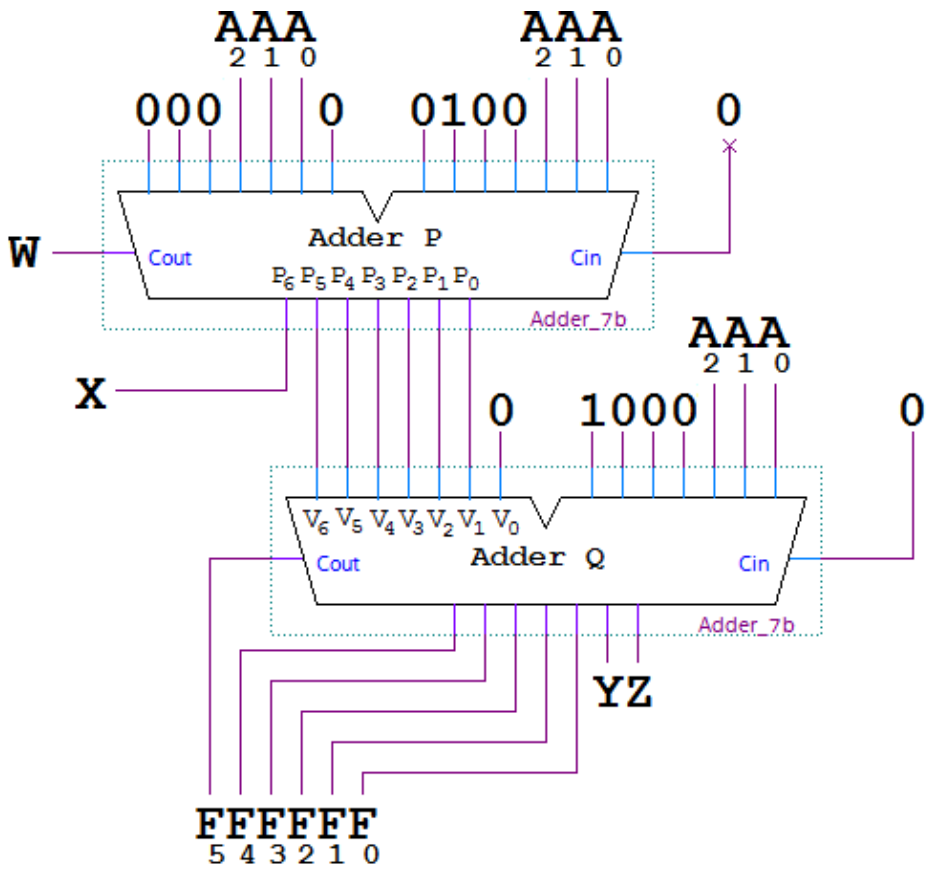
d. $16 * 32$

P6 (14 Points): Implement the function F(a,b,c,d) = $\sum m(0,1,2,5,6,10,13,14)$ as follows:

a. Use a K-map to obtain the simplified SOP expression for F

b. Implement F using only a minimal number of 2-1 Multiplexors and **no** other gates. Hint: Use Shannon's Expansion Theorem a few times.

P7 (20 Points): Consider the following circuit, which uses two 7-bit ripple carry adders "Adder P" and "Adder Q", a 3-bit unsigned input A, and a 6-bit unsigned output F:



a. What is the expression for outputs W and X in this circuit? Why?

b. Describe P, the 7-bit output of "Adder P", algebraically in terms of A.

c. Describe V, the left 7-bit input to "Adder Q", algebraically in terms of A.

d. Considering that the output bits Y and Z are ignored by F, describe F algebraically in terms of A.

e. What is the largest possible decimal value for F in this circuit? Show how you obtained your answer.