CprE 2810 HW02
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Boolean algebra, AND/OR/NOT gates
Assigned Date: Second Week
Finish by: Sep. 8, 2025

P1. **(10 points)** Given the functions $f_1 = \overline{x}y\overline{z} + xy + xz$ and $f_2 = x(y+z) + \overline{x}(\overline{y} + \overline{z})$

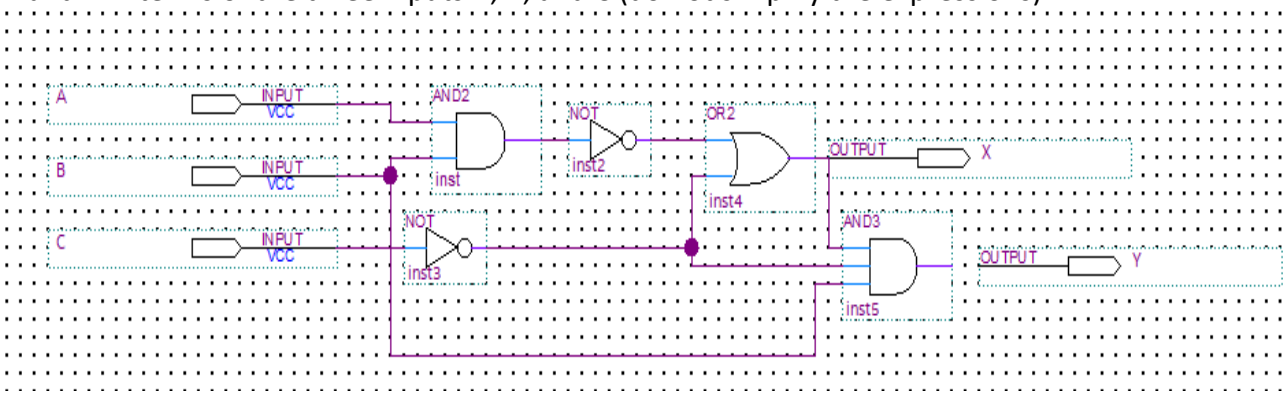
A. Draw the truth table for each function.
B. Draw the Venn diagram for each function.

P2. **(10 points)** Prove the following using Boolean Algebra:

A. $(A+B)(A+C)(A+D) + \overline{A}BC + BCD = A + BC$

B. $\overline{(AB + CD)} + \overline{ACD} + \overline{BCD} = \overline{A} + \overline{B} + \overline{C} + \overline{D}$

P3. **(10 points)** Given the circuit below, find the Boolean expressions for the two outputs X and Y in terms of the three inputs A, B, and C (do not simplify the expressions):



P4. **(20 points)** Given the following truth table, show the following:

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

A. Canonical Sum-of-Products expression
B. Shorthand Notation for SOP
C. Canonical Products-of-Sum expression
D. Shorthand Notation for POS

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P5. **(15 points)** Given the following function $F = AB + \overline{B}C$

A. Draw the circuit using only AND, OR, or NOT gates
B. Convert F into Canonical POS expression
C. Draw the new circuit using the expression you created in part B

P6. **(15 points)** Given the following function $F = (\overline{A} + B)(\overline{B} + C)C$

A. Draw the circuit using only AND, OR, or NOT gates
B. Convert F into an SOP expression (need not be the Canonical SOP expression)
C. Draw the new circuit using the expression you created in part B

P7. **(20 points)** Consider the logic function $f(w, x, y, z) = \sum m(0,1,2,6,7,8,12,13,14,15)$.

A. Write the canonical Sum-Of-Products for the function above.
B. Simplify f using Boolean algebra.
C. Draw the logic circuit for the simplified version of f in Part B.
D. Let the cost of a logic circuit be the total number of gates plus the total number of inputs to all gates in the circuit. What is the cost of the simplified circuit?