

P1. (20 points) Use a K-map to find the minimal sum-of-products (SOP) expression for the following four problems. Show the terms that are grouped in each K-map.

a) (5 points)

		BC			
		00	01	11	10
A	0	0	0	0	1
	1	1	0	0	1

b) (5 points)

		CD			
		00	01	11	10
AB	00	1	0	0	1
	01	0	1	1	0
	11	0	0	0	0
	10	1	0	0	1

c) (5 points) $F(A, B, C) = \sum m(1, 2, 3, 5, 7)$

d) (5 points) $F(A, B, C, D) = \sum m(1, 3, 4, 5, 6, 7, 9, 11, 13, 15)$

P2. (15 points) Use a K-map to find the minimal product-of-sums (POS) expression for the following three problems. Show the terms that are grouped in each K-map.

a) (5 points)

		BC			
		00	01	11	10
A	0	0	0	0	1
	1	1	0	0	1

b) (5 points)

		CD			
		00	01	11	10
AB	00	1	0	0	1
	01	0	1	1	0
	11	0	1	1	0
	10	1	0	0	1

c) (5 points) $F(A, B, C, D) = \prod M(5, 7, 11, 13, 15)$

P3. (15 points) Given the logic expression:

$$F(X, Y, Z) = \overline{(X + \bar{X}\bar{Y})}(X + Y + \bar{Z}) + \overline{(X + \bar{Y} + X\bar{Y})}(\bar{X}\bar{Y}Z)$$

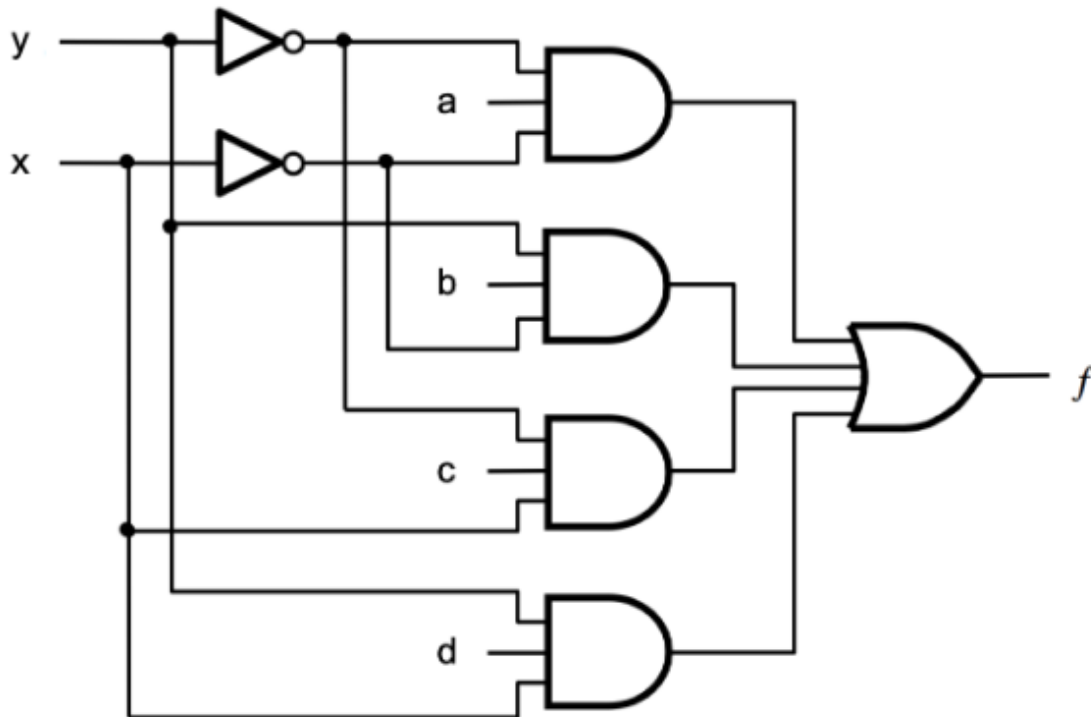
- Use the theorems of Boolean algebra to simplify the formula given above into a minimum-cost expression
- Draw the circuit diagram for the simplified expression using only NOR gates.

P4. (15 points) Given the logic expression:

$$F(A, B, C, D) = \bar{A}(\bar{A} + C)\overline{(A\bar{B} + \bar{A}\bar{B} + \bar{C})}(B + \bar{B}C)$$

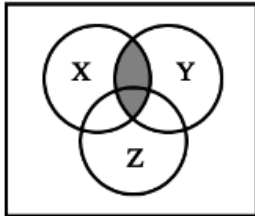
- Use the theorems of Boolean algebra to simplify the formula given above into a minimum-cost SOP expression
- Draw the circuit diagram using only NAND gates

P5. (10 points) Given the circuit shown below:



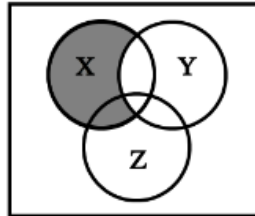
- Write the behavioral Verilog Module that corresponds to the circuit.
- Write the structural Verilog Module that corresponds to the circuit.

P6. (15 points) Given the Venn Diagrams shown below:



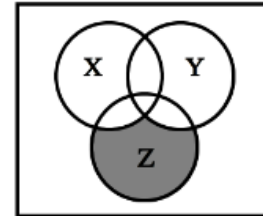
(A)

A =



(B)

B =



(C)

C =

- Write the expressions represented by each Venn diagram.
- Let $F(X,Y,Z) = A + B + C$. Use the expressions that you derived in part (a) to draw the K-map for the Boolean function F. Then use the K-map to derive the minimum cost SOP expression for F.
- Draw the circuit for your expression from part (b).

P7. (10 points) Number Conversions:

- Convert 219_{10} to binary
- Convert 1101_4 to decimal
- Convert 851304_9 to ternary (base 3)
- Convert $BEAD_{16}$ to binary
- Convert 110101011111000101_2 to hexadecimal (base 16)