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1. Simplify the following Boolean expressions to a minimum number of literals:
   (a) $xy + xy'$
   (b) $(x + y)(x + y')$
   (c) $xyz + x'y + xyz'$
   (d) $(A + B)'(A' + B')'$
   (e) $ABC + A'B + ABC'$
   (f) $x'yz + xz$
   (g) $(x + y)'(x' + y')$
   (h) $xy + x(wz + wz')$

   Sol:

   (a) x
   (b) x
   (c) y
   (d) 0
   (e) B
   (f) $(x + y)z$
   (g) $x'y'$
   (h) $x(y + w)$

2. List the truth table of the function:
   $F = xy + xy' + y'z$
   Sol: $F(x, y, z) = \sum(1, 4, 5, 6, 7)$

3. Implement the Boolean function
   $F = xy + x'y' + y'z$
   using only OR and inverter gates.
   Sol: $(x' + y')' + (x + y)' + (y + z')'$

4. Simplify the following Boolean functions T_1 and T_2 to a minimum number of literals: (Table 1)
   Sol: $T_1 = A'(B' + C')$ $T_2 = A + BC = T_1'$

5. Obtain the truth table of the following function, and express the function in sum-of-minterms and product-of-maxterms form:

$$(b + cd)(c + bd)$$

   Sol: $\sum(3, 5, 6, 7) = \prod(0, 1, 2, 4)$

Table 1: Problem 4

A	B	C	T_1	T_2
0	0	0	1	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	0	1
1	0	1	0	1
1	1	0	0	1
1	1	1	0	1

Table 2: Problem 5 answer

b	c	d	f
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

6. Express the following function as a sum of minterms and as a product of maxterms:

$$F(A, B, C, D) = B'D + A'D + BD$$

Sol: $\sum(1, 3, 5, 7, 9, 11, 13, 15) = \prod(0, 2, 4, 6, 8, 10, 12, 14)$

7. Convert each of the following to the other canonical form:

   (a) $F(x, y, z) = \sum(1, 3, 5)$

   (b) $F(A, B, C, D) = \prod(3, 5, 8, 11)$

   Sol:

   (a) $\prod(0, 2, 4, 6, 7)$

   (b) $\sum(0, 1, 2, 4, 6, 7, 9, 10, 12, 13, 14, 15)$

8. Convert each of the following expressions into sum of products and product of sums:

   (a) $(u + xw)(x + u'v)$

   (b) $x' + x(x + y')(y + z')$

   Sol:

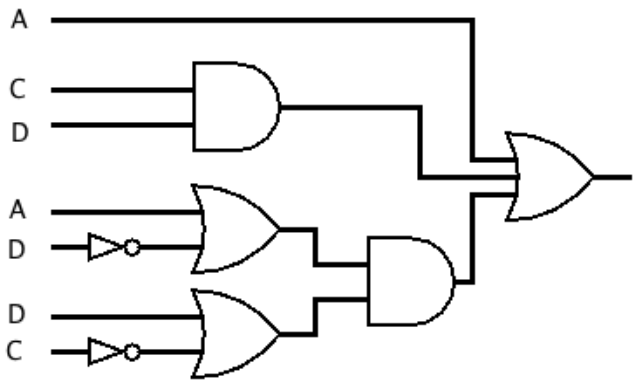
(a) $ux + xw + u'vxw$

(b) $x' + y + z'$

9. Draw the logic diagram corresponding to the following Boolean expressions without simplifying them:

$$A + CD + (A + D')(C' + D)$$

Sol:



10. Write Boolean expressions for the outputs of the circuits described by the logic diagrams in Fig. 1.

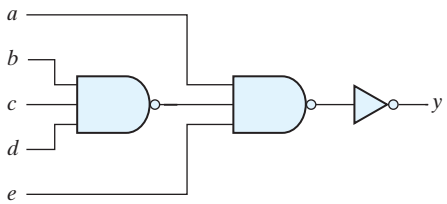


Figure 1: diagram

Sol: $y = ae(b' + c' + d')$