

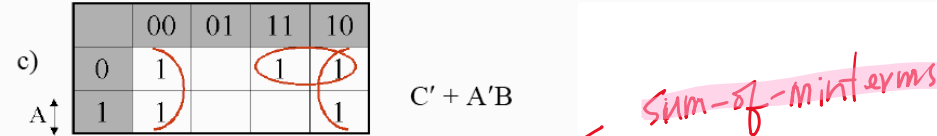
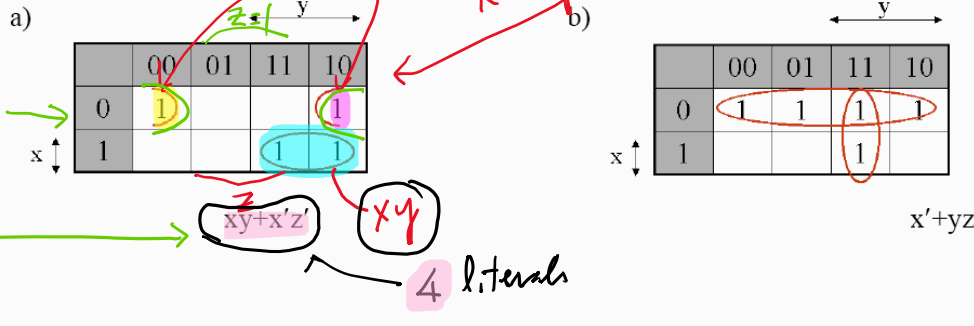
1) Simplify the following Boolean functions in **sum-of-products**, using K-maps:

a) $xy + x'y'z' + x'yz'$ ← 8 literals ← minimize # of literals

b) $x'y' + yz + x'yz'$

c) $A'B + BC' + B'C'$

Sol:



2) Simplify the following Boolean functions in **sum-of-products**, using K-maps:

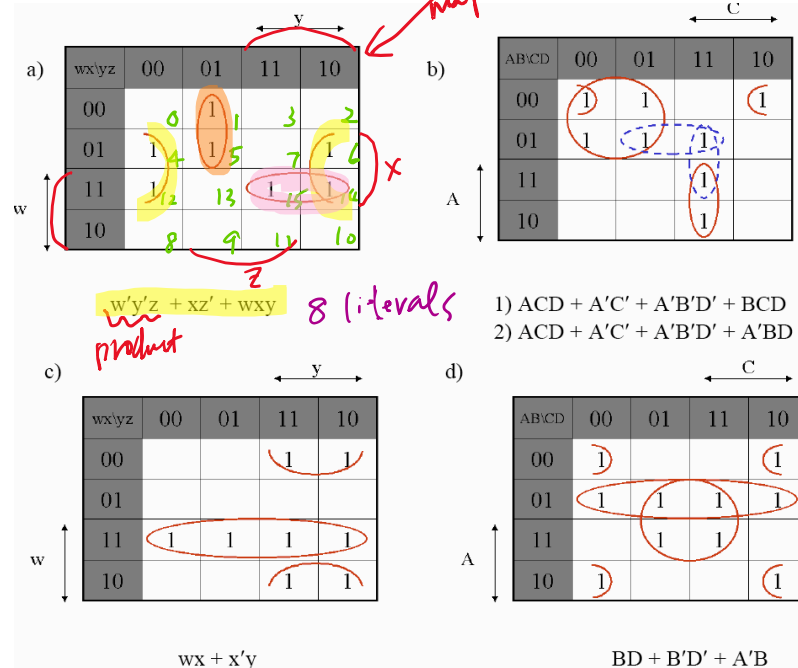
a) $F(w, x, y, z) = \Sigma(1, 4, 5, 6, 12, 14, 15)$

b) $F(A, B, C, D) = \Sigma(0, 1, 2, 4, 5, 7, 11, 15)$

c) $F(w, x, y, z) = \Sigma(2, 3, 10, 11, 12, 13, 14, 15)$

d) $F(A, B, C, D) = \Sigma(0, 2, 4, 5, 6, 7, 8, 10, 13, 15)$

Sol:



3) Simplify the following Boolean functions in **products-of-sums**.

a) $F(w, x, y, z) = \sum (0, 2, 5, 6, 7, 8, 10)$
 b) $F(A, B, C, D) = \prod (1, 3, 5, 7, 13, 15)$

Sol:

a) F'

w\yz	00	01	11	10
00	0	1	1	0
01	1	0	0	0
11	1	1	1	1
10	1	1	1	0

$F' = wx + x'z + xy'z'$
 $F = (w' + x')(x + z')(x' + y + z)$

b) F'

AB\CD	00	01	11	10
00		1	1	
01		1	1	
11		1	1	
10				

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

4) Simplify the following expressions in (1) **sum-of-products** and (2) **products-of-sums**:

a) $x'z' + y'z' + yz' + xy$
 b) $AC' + B'D + A'CD + ABCD$
 c) $(A' + B' + D')(A + B' + C')(A + B + D')(B + C' + D')$

Sol:

a) F

x\yz	00	01	11	10
0	1	0	0	1
1	1	0	1	1

$F = xy + z' = (x + z')(y + z')$

b) F

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

$F = AC' + CD + B'D = (A + D)(C' + D)(A + B' + C)$

c) F'

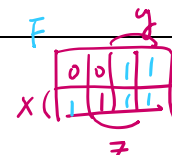
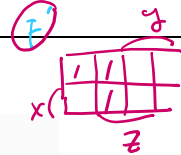
x\yz	00	01	11	10
0	1	1	1	1
1	1	1	1	1

$F' = (x'z + y'z)$
 $F = (x + z')(y + z')$

$F' = A \cdot B \cdot D + A'BC + A'B'D + B'C'D$

$F' = [AD + CD + A'BC]'$
 $F = (A + b) \cdot (C' + D) \cdot (A + B' + C)$

$$F = [(x+y)(y+z')] = x'y + y'z$$



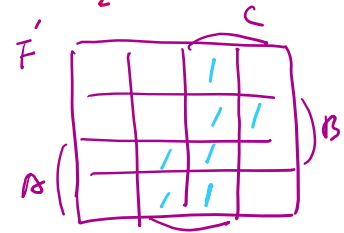
c)

		C			
	AB\CD	00	01	11	10
A	00	1	1	0	1
	01	1	1	0	0
	11	1	0	0	1
	10	1	0	0	1

S-o-P

$$F = B'D' + AD' + A'C' = (A'+D')(C'+D')(A+B'+C')$$

p-o-S



5) Simplify the following Boolean function F, together with the don't-care conditions d, and then express the simplified function in **sum of products**:

- a. $F(x,y,z) = \Sigma(0,1,2,4,5)$, $d(x,y,z) = \Sigma(3,6,7)$
- b. $F(A,B,C,D) = \Sigma(1,3,5,7,9,15)$, $d(A,B,C,D) = \Sigma(4,6,10,13)$

Sol:

3a

	yz	00	01	11	10
x	0	1	1	X	1
	1	1	1	X	X

$F=1 = \Sigma(0,1,2,3,4,5,6,7)$

3b

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

$F = A'D + BD + C'D = \Sigma(1,3,5,7,9,13,15)$

x	y	z	F
0	0	0	1
1	0	0	1
2	0	1	0
3	0	1	X
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

$$F = A'D + BD + C'D$$

ABCD	F	F
0000	1	1
0001	1	1
0010	1	1
0011	1	1
0100	1	1
0101	1	1
0110	1	1
0111	1	1
1000	1	1
1001	1	1
1010	1	1
1011	1	1
1100	1	1
1101	1	1
1110	1	1
1111	1	1

$$(F')' (B'D' + AD' + A'C')$$

$$F = (B+D) \cdot (A+D) \cdot (A'+B+C')$$

