CS2100 - Tutorial 9 - Logic Gates & Simplification

1(a). To generate truth table for POS:

For each sum term:

find out which combinations of variables give '1's

Rest are '0's

(b). SOP ↔ POS

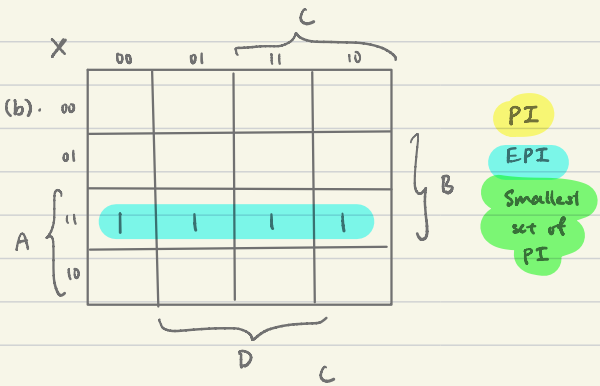
1. Σ (product terms)

?

2(a).

A	B	C	D	XYZ
0	0	0	0	000
0	0	0	1	000
0	0	1	0	000
0	0	1	1	001
0	1	0	0	001
0	1	0	1	001
0	1	1	0	010
0	1	1	1	010
1	0	0	0	010
1	0	0	1	011
1	0	1	0	011
1	0	1	1	011
1	1	0	0	100
1	1	0	1	100
1	1	1	0	100
1	1	1	1	101

(b).



X: $A \cdot B$

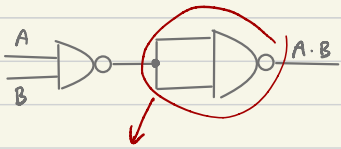
Y: $A \cdot B' + A' \cdot B \cdot C$

Z: $A \cdot C \cdot D + A \cdot B' \cdot D + A \cdot B' \cdot C + B' \cdot C \cdot D + A' \cdot B \cdot C'$

2 (c). X: $A \cdot B$

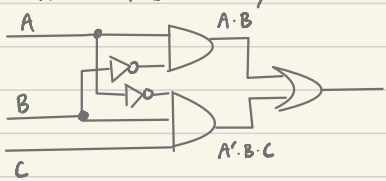
(i).

(ii).

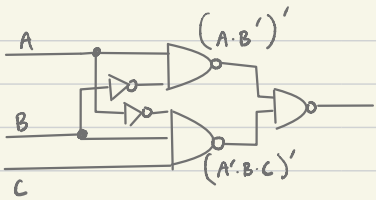


Y: $A \cdot B' + A' \cdot B \cdot C$

(i).

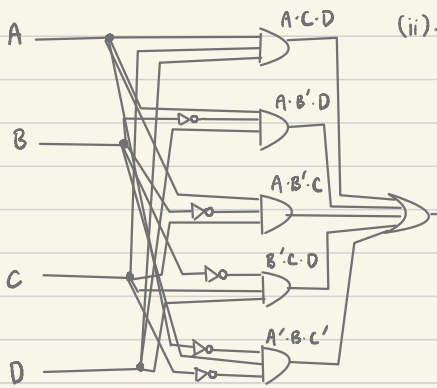


(ii).

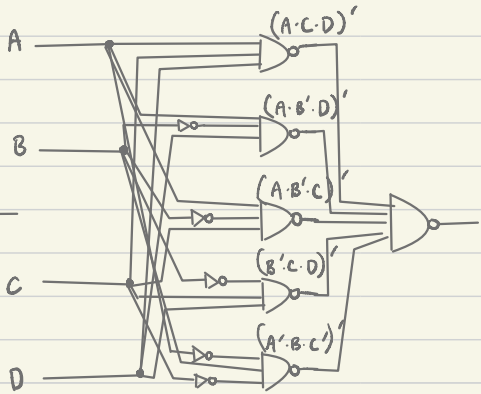


Z: $A \cdot C \cdot D + A \cdot B' \cdot D + A \cdot B' \cdot C + B' \cdot C \cdot D + A' \cdot B \cdot C'$

(i).



(ii).



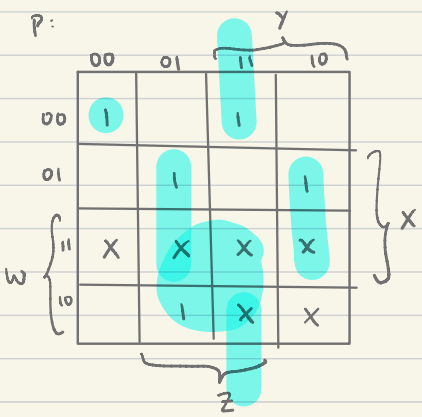
3 (a).

X	Y	Z	W	P
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0

X	Y	Z	W	P
1	0	0	0	0
1	0	0	1	1
1	0	1	0	X
1	0	1	1	X
1	1	0	0	X
1	1	0	1	X
1	1	1	0	X
1	1	1	1	X

X : don't care

(b).



P: $w \cdot z + x \cdot y \cdot z' + x \cdot y' \cdot z + x' \cdot y \cdot z + w' \cdot x' \cdot y' \cdot z'$

Extra practice

1(a). $F(x, y, z) = (x + y \cdot z') \cdot (y' + y) + x' \cdot (y \cdot z' + y)$

$= (x + y \cdot z') \cdot 1 + x' \cdot y$

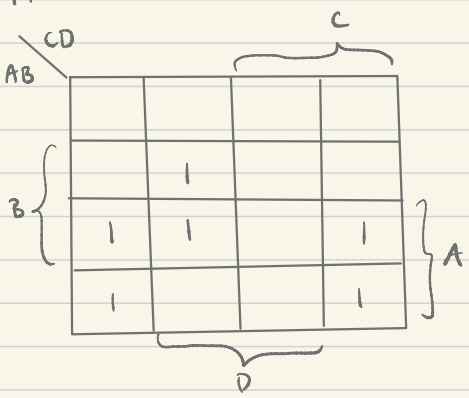
(inverse / complement) (absorption)

$= x + y + y \cdot z'$ (absorption)

$= x + y$ (absorption)

4.

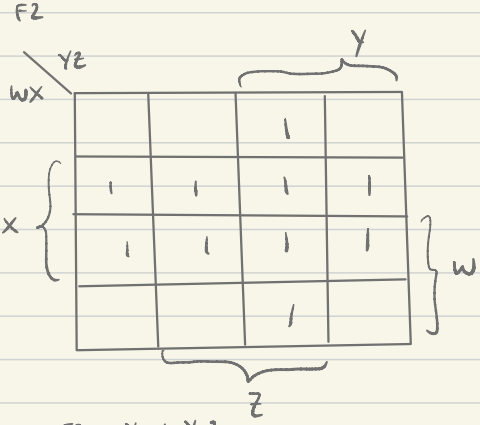
F1



$F1 = A \cdot D' + B \cdot C' \cdot D$

EPI = 2, PI = 3

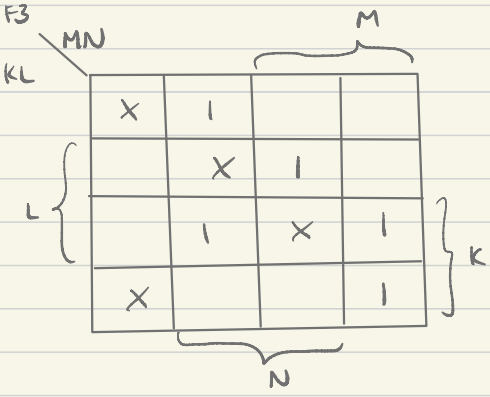
F2



$F2 = X + Y \cdot Z$

EPI = 2, PI = 2

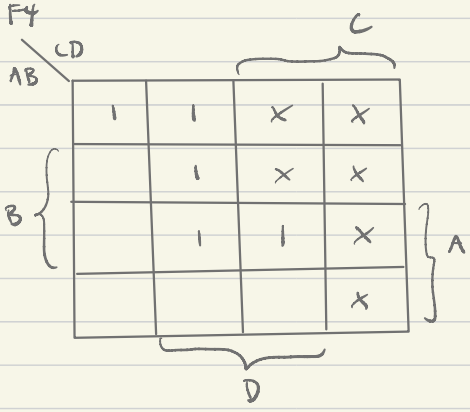
F3



$F3 = L \cdot N + K \cdot M \cdot N' + K' \cdot L' \cdot M'$

EPI = 1, PI = 6

F4

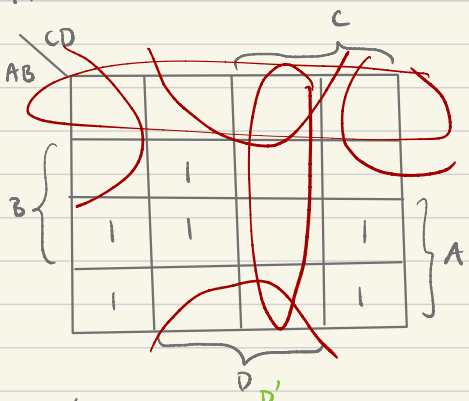


$F4 = A' \cdot B' + B \cdot D$

EPI = 2, PI = 4

5.

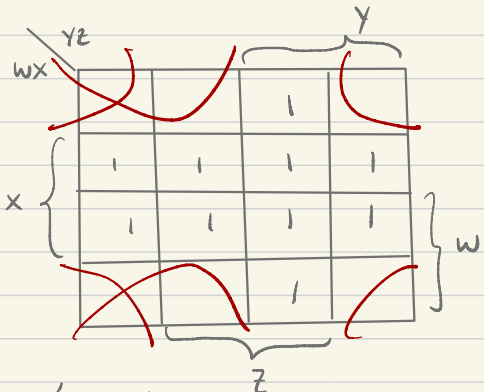
F1



$F1' = C \cdot D + A' \cdot C \cdot D' + B' \cdot D$

$F1 = (C'+D') \cdot (A+C) \cdot (B+D')$

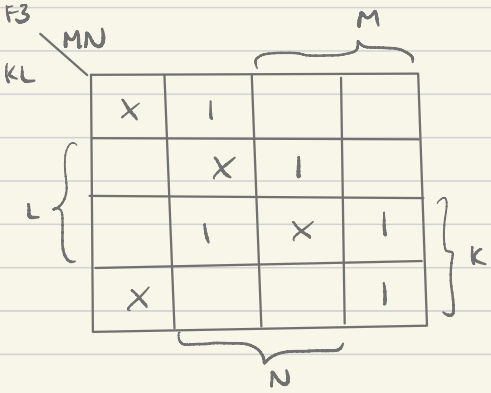
F2



$F2' = X' \cdot Y' + X' \cdot Z'$

$F2 = (X+Y) \cdot (X+Z)$

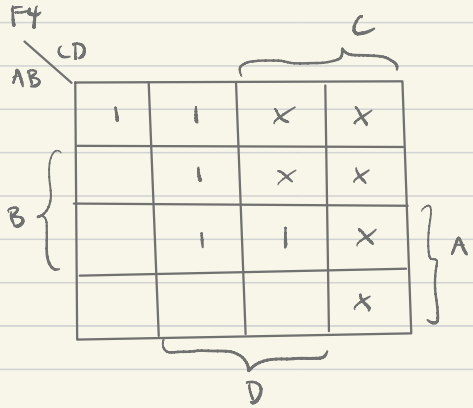
F3



$F3' = M' \cdot N' + K' \cdot N' + K' \cdot L' \cdot M + K \cdot L' \cdot N$

$F3 = (M+N) \cdot (K+N) \cdot (K+L+M') \cdot (K'+L+N')$

F4



$F4' = A \cdot B' + B \cdot D'$

$F4 = (A'+B) \cdot (B'+D)$