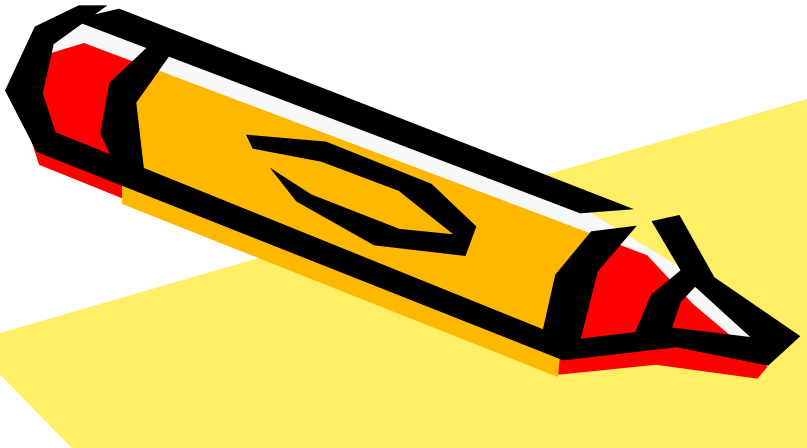
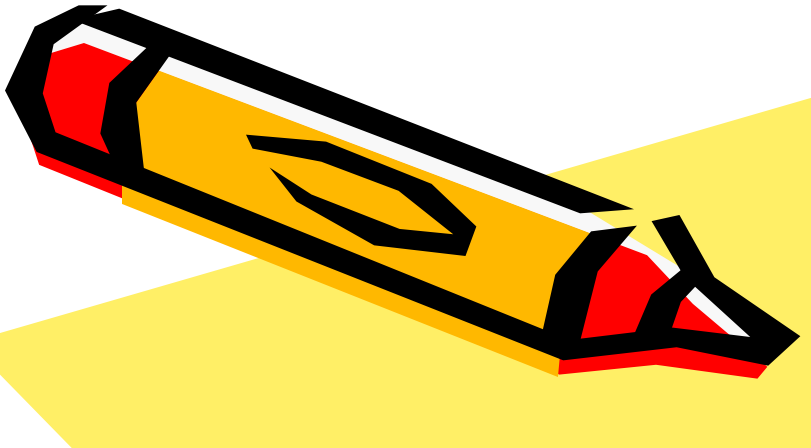


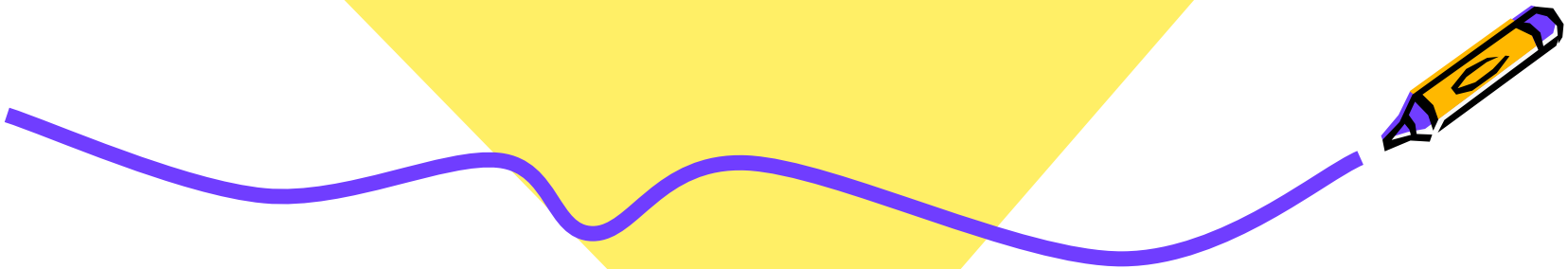
Logical Design

CS 221

Prof.Dr. Mohamed Osama Khozium



Karnaugh Maps

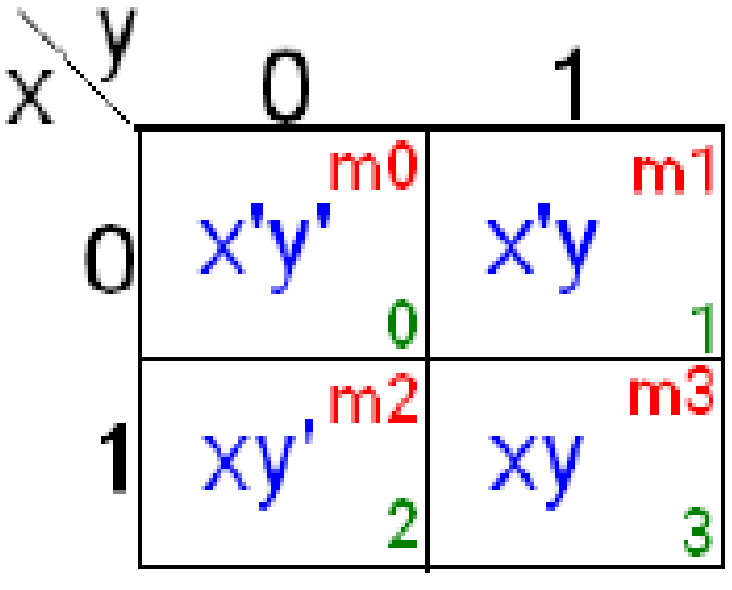


Karnaugh Maps

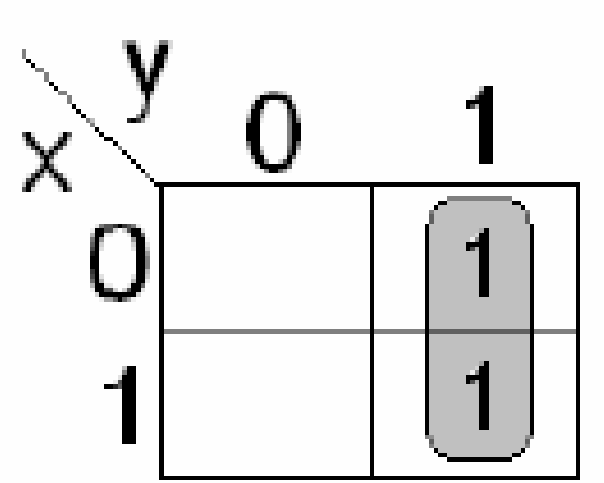
- Boolean expressions may be simplified by using algebraic operations
- But there is not set method to predict the steps to take
- That means not amenable to automated techniques
- Karnaugh Maps to the rescue
- Generates simplified expressions that are in SOP or POS form
- Produce two-level implementation with a minimum number of gates and a minimum number of inputs to the gates
- Sometimes two or more expressions that satisfy the simplification criteria

Two-Variable Map

X	Y	Minterms	
0	0	x'y'	m0
0	1	x'y	m1
1	0	xy'	m2
1	1	xy	m3

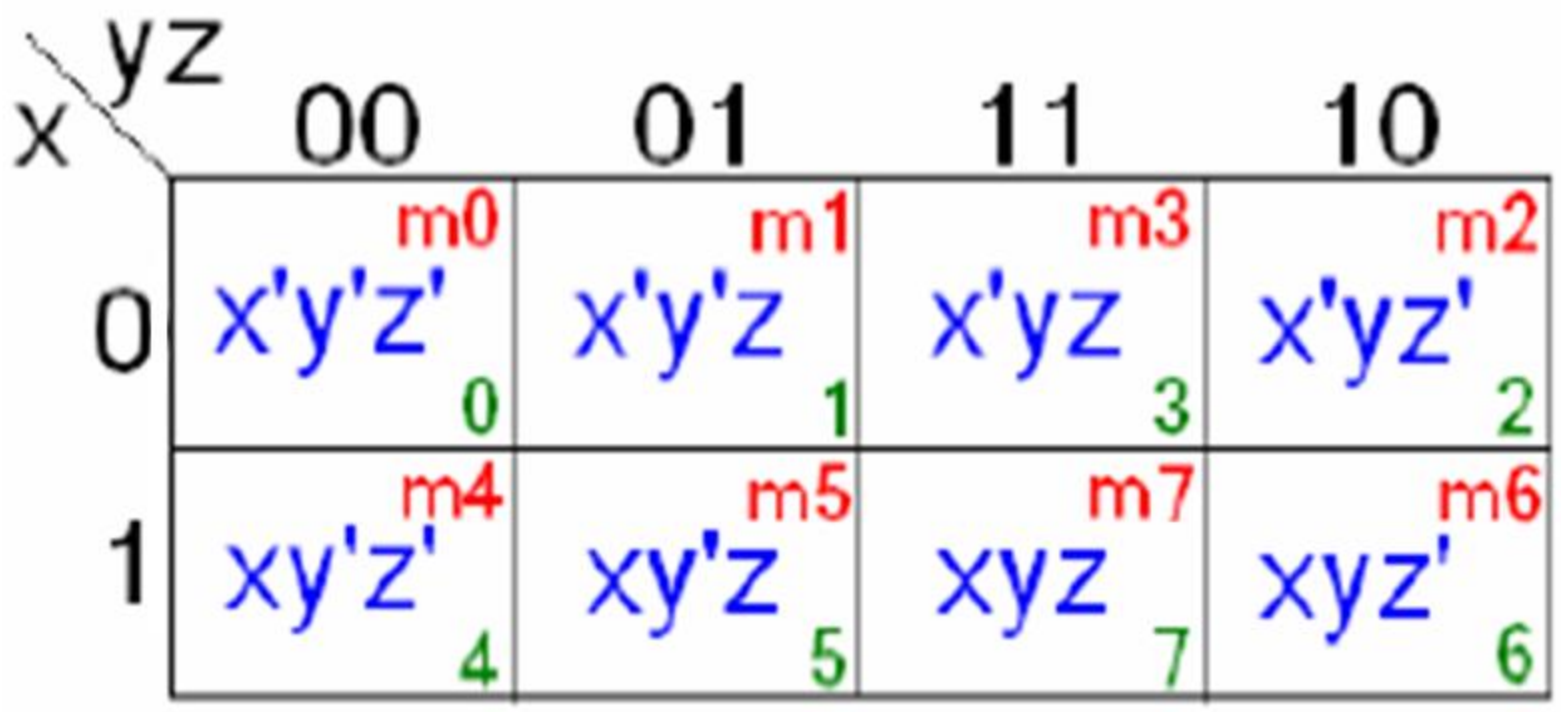


$$F(x,y) = xy + x'y$$



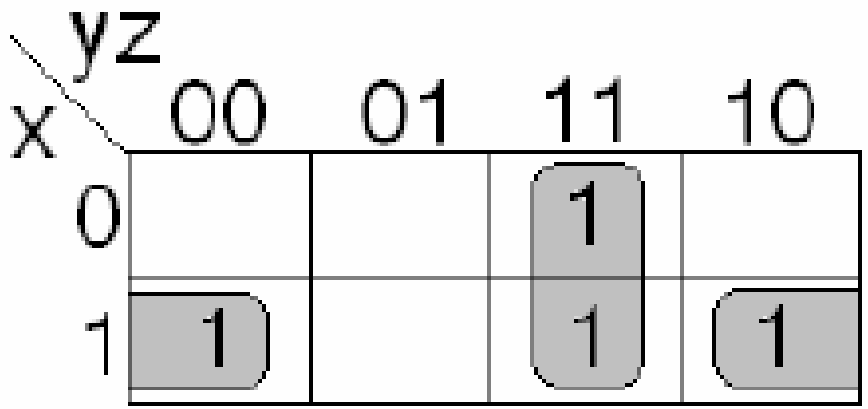
$$F(x,y) = y$$

Three Variables Map



Simplify the following Boolean function

$$F(x,y,z) = \Sigma(3,4,6,7)$$

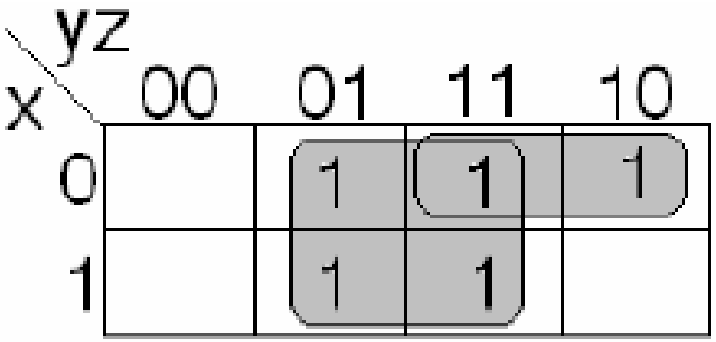


$$F(x,y,z) = xz' + yz$$

$$F(x,y,z) = A'C + A'B + AB'C + BC$$

Express it in sum of minterms

Find the minimal sum of products expression



$$F(x,y,z) = \Sigma(1,2,3,5,7)$$

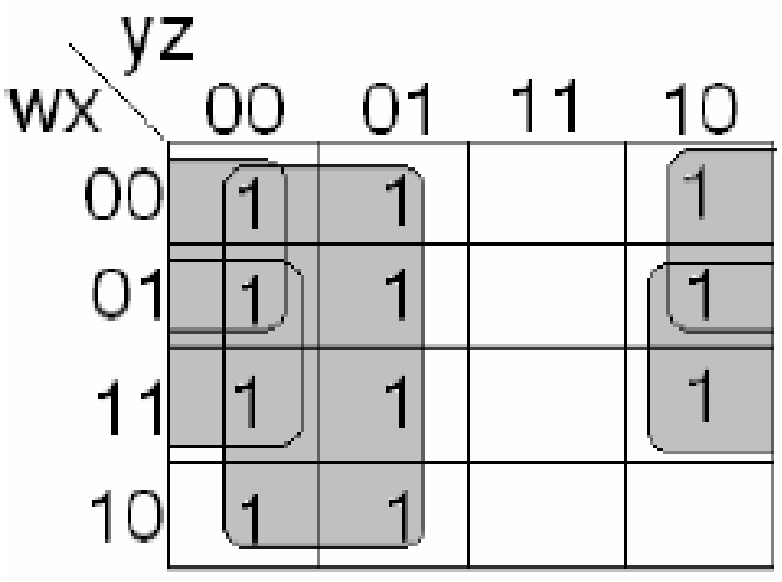
$$F(x,y,z) = C + A'B$$

Four Variables Map

wx \ yz	00	01	11	10
00	m0 w'x'y'z' 0	m1 w'x'y'z 1	m3 w'x'yz 3	m2 w'x'yz' 2
01	m4 w'xy'z' 4	m5 w'xy'z 5	m7 w'xyz 7	m6 w'xyz' 6
11	m12 wxy'z' 12	m13 wxy'z 13	m15 wxyz 15	m14 wxyz' 14
10	m8 wx'y'z' 8	m9 wx'y'z 9	m11 wx'yz 11	m10 wx'yz' 10

Simplify the following Boolean function

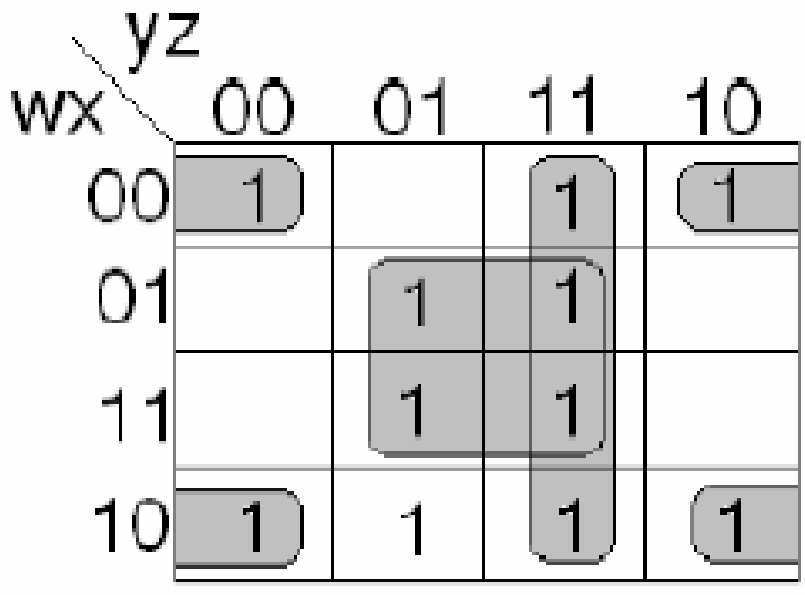
$$F(w,x,y,z) = \Sigma(0,1,2,4,5,6,8,9,12,13,14)$$



$$F(w,x,y,z) = y' + w'z' + xz'$$

Simplify the following Boolean function

$F(w,x,y,z) = \Sigma(0,2,3,5,7,8,9,10,11,13,15)$



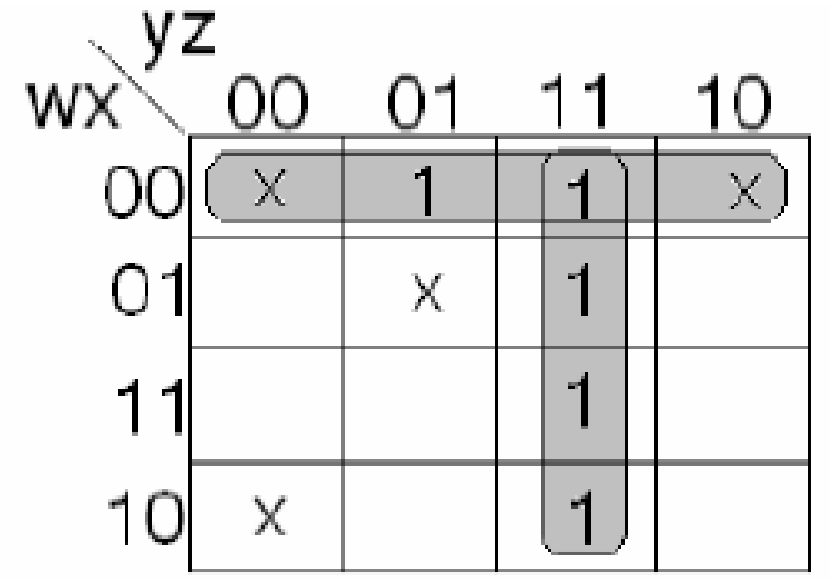
$F(w,x,y,z) = wx' + yz + xz + x'z'$

Don't Care Conditions

Simplify the following Boolean function

$$F(w,x,y,z) = \Sigma(1,3,7,11,15)$$

Which has the don't care conditions $d(w,x,y,z) = \Sigma(0,2,5,8)$



$$F(w,x,y,z) = w'x' + yz$$

Thank you