Mapping Functions for three-variable map

- When you have already been provided a function, you can map the function into a K-map by remembering
  - the cells of a k-map represent minterms
  - a 1 in a cell indicates that the minterm is part of the function
  - two adjacent 1's represent a two literal term
  - four adjacent 1's represent a one literal term
  - eight adjacent 1's represent a true function, F = 1

Minimization Characteristics in 3-Variable Maps

- Since any two adjacent cells in a 3-variable map represent a change in only a single bit, we use this to do minimization.
  - Consider the two cells for m_0 and m_1 where the difference is the negation of the bit z.
  - $F = m_0 + m_1 = x'y'z' + x'y'z = x'y'(z' + z) = x'y'$

x \ yz	00	01	11	10
0	m_0	m_1	m_3	m_2
1	m_4	m_5	m_7	m_6

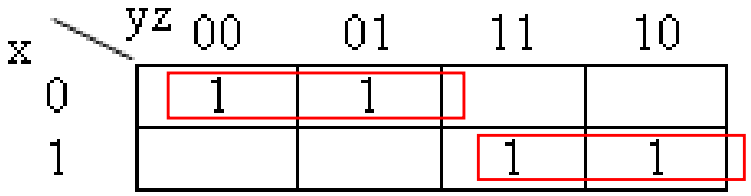
x \ yz	00	01	11	10
0	x'y'z'	x'y'z	x'yz	x'yz'
1	xy'z'	xy'z	xyz	xyz'

Minimization Example

- Each of the two adjacent pairs of entries can be simplified by eliminating the changing bit (z in both cases).

$$F(x, y, z) = \sum(0,1,6,7)$$

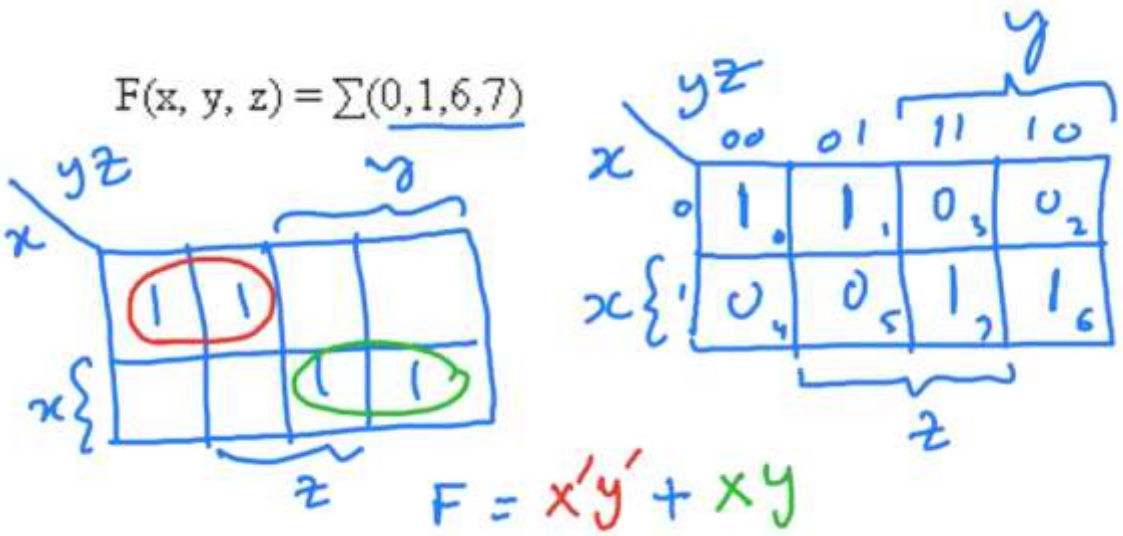
x \ yz	00	01	11	10
0	m_0	m_1	m_3	m_2
1	m_4	m_5	m_7	m_6



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

Minimization Example

- Each of the two adjacent pairs of entries can be simplified by eliminating the changing bit (z in both cases).



Note on Adjacency

- So far, we have assumed that adjacent cells in the map need to touch each other but this is not always the case.
  - m_0 and m_2 are considered adjacent
    - $m_0 + m_2 = x'y'z' + x'yz' = x'z'(y' + y) = x'z'$
  - m_4 and m_6 are considered adjacent
    - $m_4 + m_6 = xy'z' + xyz' = xz'(y' + y) = xz'$

x \ yz	00	01	11	10
0	m_0	m_1	m_3	m_2
1	m_4	m_5	m_7	m_6

x \ yz	00	01	11	10
0	x'y'z'	x'y'z	x'yz	x'yz'
1	xy'z'	xy'z	xyz	xyz'

Four-Variable Map

- A four-variable map holds 16 minterms for four variables.
  - Again, we mark the squares of the minterms that belong to a given function.
  - Note that the sequence is not arranged in a binary way.
  - The sequence used is a Gray code and allows only one bit to change from column to column and row to row.

wx \ yz	00	01	11	10
00	w'x'y'z'	w'x'y'z	w'x'yz	w'x'yz'
01	w'xy'z'	w'xy'z	w'xyz	w'xyz'
11	wxy'z'	wxy'z	wxyz	wxyz'
10	wx'y'z'	wx'y'z	wx'yz	wx'yz'

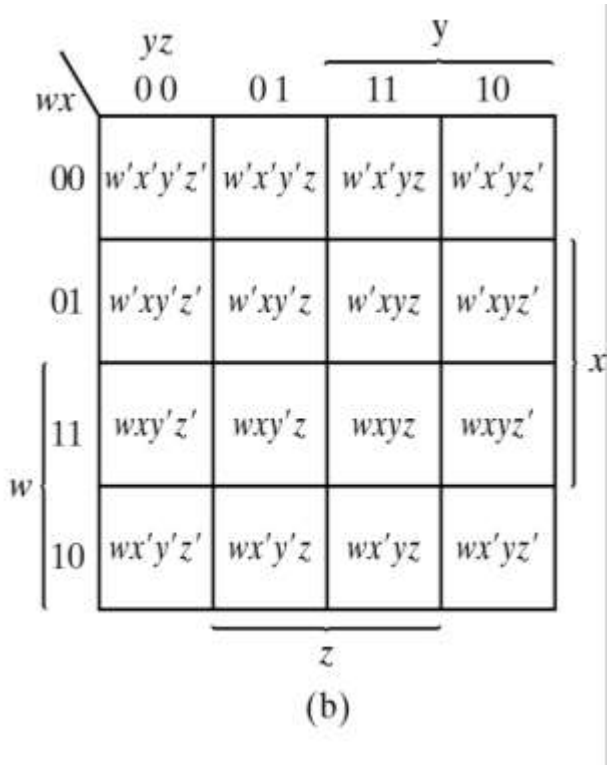
wx \ yz	00	01	11	10
00	m_0	m_1	m_3	m_2
01	m_4	m_5	m_7	m_6
11	m_{12}	m_{13}	m_{15}	m_{14}
10	m_8	m_9	m_{11}	m_{10}

4-Variable Map

Minterms Labeling

m_0	m_1	m_3	m_2
m_4	m_5	m_7	m_6
m_{12}	m_{13}	m_{15}	m_{14}
m_8	m_9	m_{11}	m_{10}

(a)



(b)

The End