Digital Circuits
TECH 2504

K-Map - Minterms

Minterms for 3-Variable K-Map

ABC	Minterm
000	m_0
001	m_1
010	m_2
011	m_3
100	m_4
101	m_5
110	m_6
111	m_7

Minterms for 4-Variable K-Map

ABCD	Minterm
0000	m_0
0001	m_1
0010	m_2
0011	m_3
0100	m_4
0101	m_5
0110	m_6
0111	m_7
1000	m_8
1001	m_9
1010	m_{10}
1011	m_{11}
1100	m_{12}
1101	m_{13}
1110	m_{14}
1111	m_{15}

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K-Map – Minimization Procedure

- **Find the largest possible groups of adjacent cells (squares) containing 1s.**
    - Groups must contain 2^n cells, where *n* is an integer: 1, 2, 4, 8, 16.
    - Each 1 on the map must be included in at least one group. The 1s already in a group can be reused in another group as long as the overlapping groups include noncommon 1s.
    - Each group of cells containing 1s creates one product term composed of all variables that occur in only one form (either uncomplemented or complemented)

- **Determine the *minimum product term* for each group:**

3 variable K-map
➢ An 8-cell group yields a value of 1
➢ A 4-cell group yields a 1-variable term
➢ A 2-cell group yields a 2-variable term
➢ A 1-cell group yields a 3-variable term

4 variable K-map
➢ A 16-cell group yields a value of 1
➢ An 8-cell group yields a 1-variable term
➢ A 4-cell group yields a 2-variable term
➢ A 2-cell group yields a 3-variable term
➢ A 1-cell group yields a 4-variable term

*Notes: 1) The *terms* produced from groups are *minimum product terms*

2) When all the minimum product terms are derived form the K-map, they are summed to form the minimum SOP expression.