



Digital Design : 2021-22

Lecture 6 : Boolean Algebra Part 2

By Dr. Sanjay Vidhyadharan

Minterms

Majority Detector F

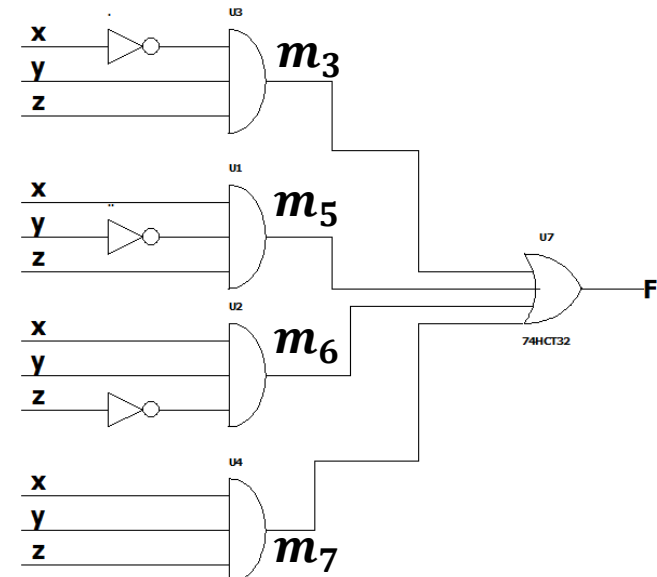
		Minterms	
F	$x y z$	Term	Designation
0	0 0 0	$x'y'z'$	m_0
0	0 0 1	$x'y'z$	m_1
0	0 1 0	$x'yz'$	m_2
1	0 1 1	$x'yz$	m_3
0	1 0 0	$xy'z'$	m_4
1	1 0 1	$xy'z$	m_5
1	1 1 0	xyz'	m_6
1	1 1 1	xyz	m_7

Sum of Products

$$F = x'yz + xy'z + xyz' + xyz$$

$$F = m_3 + m_5 + m_6 + m_7$$

$$F = \sum (3, 5, 6, 7)$$



Minterms

Even Parity Encoder F_2

4 Bit Data : $x y z F_2$

		Minterms	
F_2	$x y z$	Term	Designation
0	0 0 0	$x'y'z'$	m_0
1	0 0 1	$x'y'z$	m_1
1	0 1 0	$x'yz'$	m_2
0	0 1 1	$x'yz$	m_3
1	1 0 0	$xy'z'$	m_4
0	1 0 1	$xy'z$	m_5
0	1 1 0	xyz'	m_6
1	1 1 1	xyz	m_7

Sum of Products

$$F_2 = x'y'z + x'yz' + xy'z' + xyz$$

$$F_2 = m_1 + m_2 + m_4 + m_7$$

$$F_2 = \sum (1, 2, 4, 7)$$

Maxterms

Majority Detector F

$$F = x'yz + xy'z + xyz' + xyz$$

$$F = m_3 + m_5 + m_6 + m_7 = \sum(3, 5, 6, 7)$$

$$F = (m_0 + m_1 + m_2 + m_4)' = m'_0 \cdot m'_1 \cdot m'_2 \cdot m'_4$$

$$F = M_0 \cdot M_1 \cdot M_2 \cdot M_4 = \prod(0, 1, 2, 4)$$

		Minterms		Maxterms	
F	$x y z$	Term	Designation	Term	Designation
0	0 0 0	$x'y'z'$	m_0	$x+y+z$	M_0
0	0 0 1	$x'y'z$	m_1	$x+y+z'$	M_1
0	0 1 0	$x'yz'$	m_2	$x+y'+z$	M_2
1	0 1 1	$x'yz$	m_3	$x+y'+z'$	M_3
0	1 0 0	$xy'z'$	m_4	$x'+y+z$	M_4
1	1 0 1	$xy'z$	m_5	$x'+y+z'$	M_5
1	1 1 0	xyz'	m_6	$x'+y'+z$	M_6
1	1 1 1	xyz	m_7	$x'+y'+z'$	M_7

Maxterms

Majority Detector F

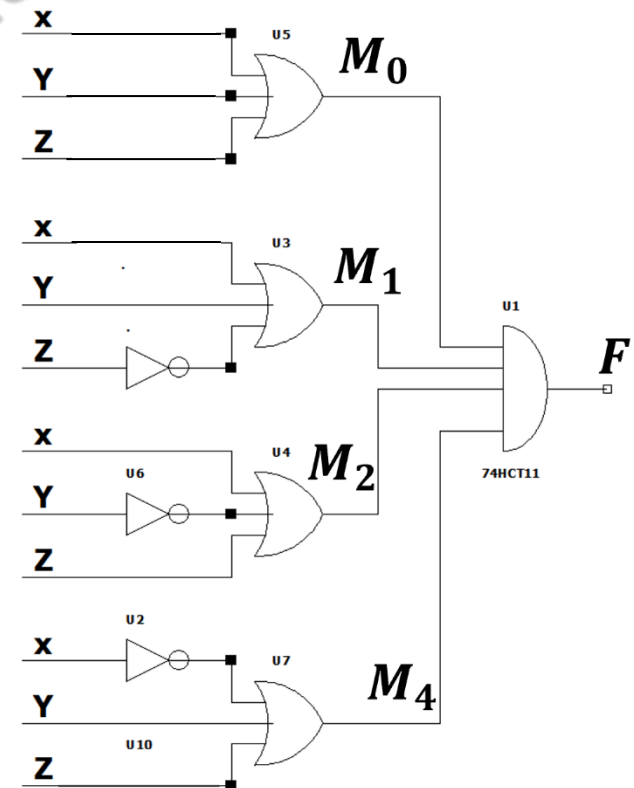
$$F = x'yz + xy'z + xyz' + xyz$$

$$F = m_3 + m_5 + m_6 + m_7 = \Sigma(3, 5, 6, 7)$$

$$F = (m_0 + m_1 + m_2 + m_4)' = m'_0 \cdot m'_1 \cdot m'_2 \cdot m'_4$$

$$F = M_0 \cdot M_1 \cdot M_2 \cdot M_4 = \Pi(0, 1, 2, 4) \text{ Product of Sums}$$

		Maxterms	
F	$x y z$	Term	Designation
0	0 0 0	$x+y+z$	M_0
0	0 0 1	$x+y+z'$	M_1
0	0 1 0	$x+y'+z$	M_2
1	0 1 1	$x+y'+z'$	M_3
0	1 0 0	$x'+y+z$	M_4
1	1 0 1	$x'+y+z'$	M_5
1	1 1 0	$x'+y'+z$	M_6
1	1 1 1	$x'+y'+z'$	M_7



Maxterms

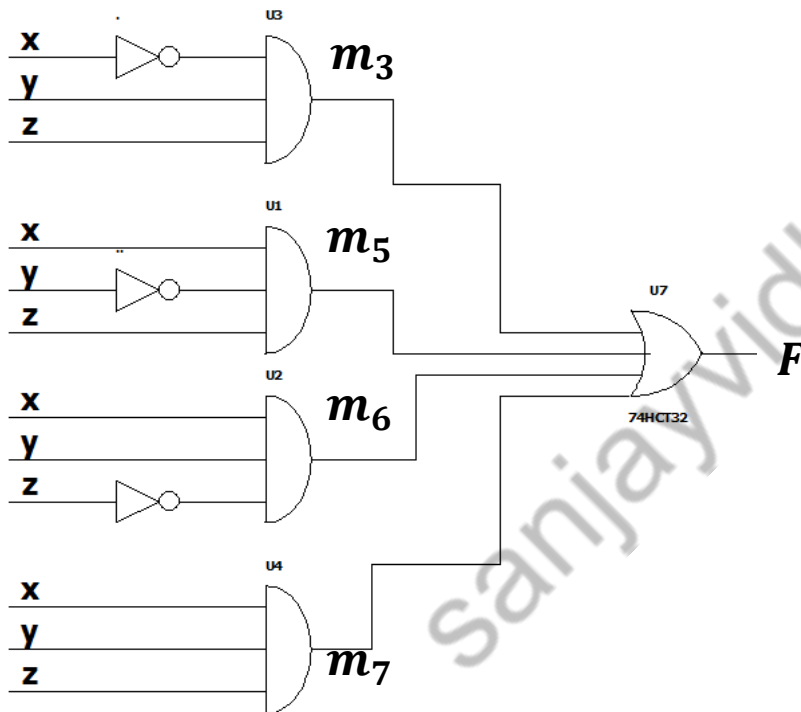
Majority Detector F

$$F = x'yz + xy'z + xyz' + xyz$$

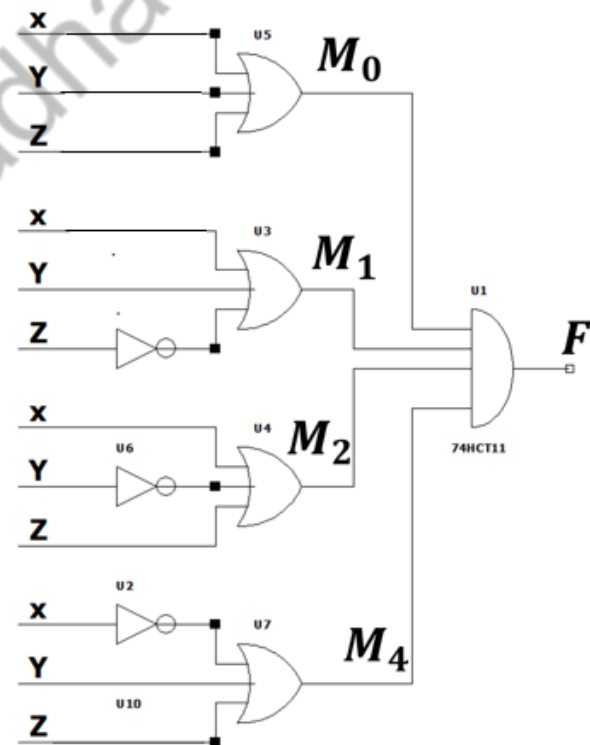
$$F = m_3 + m_5 + m_6 + m_7 = \sum(3, 5, 6, 7)$$

$$F = (m_0 + m_1 + m_2 + m_4)' = m'_0 \cdot m'_1 \cdot m'_2 \cdot m'_5$$

$$F = M_0 \cdot M_1 \cdot M_2 \cdot M_5 = \prod(0, 1, 2, 5)$$



Sum of Products



Product of Sums

Maxterms

Even Parity Encoder F_2

4 Bit Data : $x y z F_2$

		Minterms	
F_2	$x y z$	Term	Designation
0	0 0 0	$x'y'z'$	m_0
1	0 0 1	$x'y'z$	m_1
1	0 1 0	$x'yz'$	m_2
0	0 1 1	$x'yz$	m_3
1	1 0 0	$xy'z'$	m_4
0	1 0 1	$xy'z$	m_5
0	1 1 0	xyz'	m_6
1	1 1 1	xyz	m_7

$$F_2 = x'y'z + x'y'z' + xy'z' + xyz$$

$$F_2 = m_1 + m_2 + m_4 + m_7$$

$$F_2 = \sum (1, 2, 4, 7)$$

$$F_2 = M_0 \cdot M_3 \cdot M_5 \cdot M_6 = \prod (0, 3, 5, 6)$$

Canonical Forms-Type1

<i>x</i>	<i>y</i>	<i>F1</i>
0	0	0
0	1	0
1	0	0
1	1	1

$$F1 = xy$$

<i>x</i>	<i>y</i>	<i>F2</i>
0	0	1
0	1	0
1	0	0
1	1	0

$$F2 = x'y'$$

<i>x</i>	<i>y</i>	<i>F3</i>
0	0	1
0	1	0
1	0	0
1	1	1

$$F3 = xy + x'y'$$

Sum of Products

$$F3 = \sum (1, 3)$$

Canonical Forms-Type2

<i>x</i>	<i>y</i>	<i>F1</i>
0	0	0
0	1	1
1	0	1
1	1	1

$$F1 = x + y$$

<i>x</i>	<i>y</i>	<i>F2</i>
0	0	1
0	1	1
1	0	1
1	1	0

$$F2 = x' + y'$$

<i>x</i>	<i>y</i>	<i>F3</i>
0	0	0
0	1	1
1	0	1
1	1	0

$$F3 = (x + y). (x' + y')$$

Product of Sums

Examples

Express in minterms: $F = y + x'yz'$

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

$$F = xyz + xyz' + x'yz + x'yz' + x'yz' \quad F = m_7 + m_6 + m_3 + m_2$$

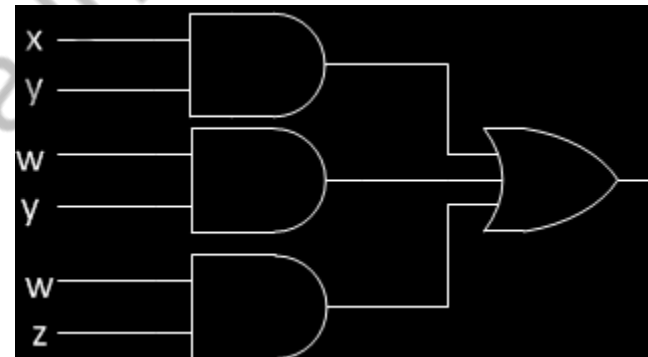
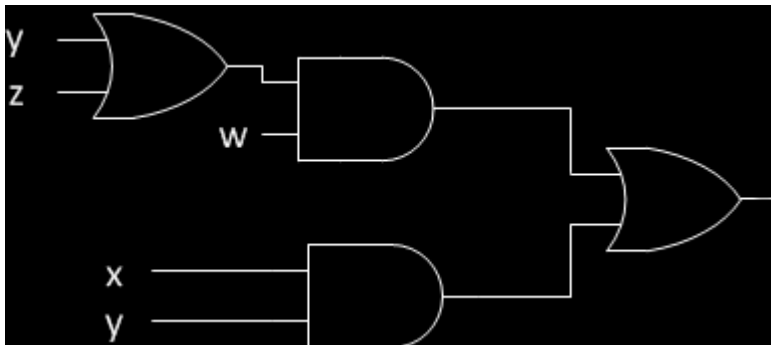
x	y	z	$x'yz'$	F
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	0	1
1	0	0	0	0
1	0	1	0	0
1	1	0	0	1
1	1	1	0	1

$$F = m_2 + m_3 + m_6 + m_7$$

$$F = M_0 \cdot M_1 \cdot M_4 \cdot M_5$$

Examples

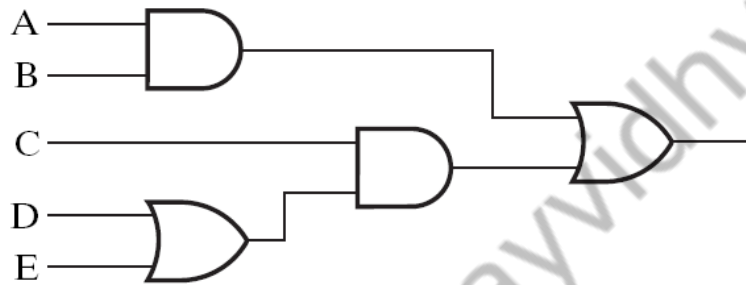
$$F = xy + w(y + z)$$



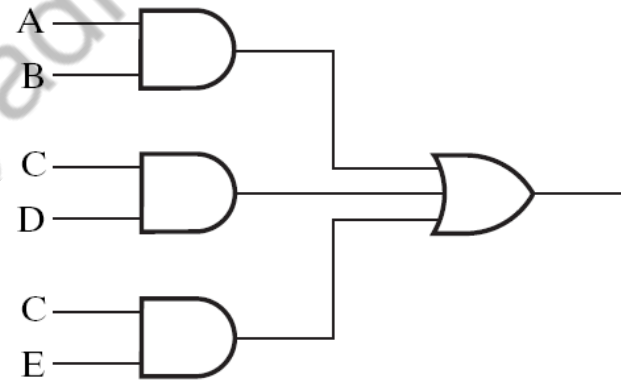
Standard Form

Examples

$$F = AB + C(D + E) = AB + CD + CE$$



(a) $AB + C(D + E)$



(b) $AB + CD + CE$

Thank you