

ITI1100C
Assignment # 3
SOLUTIONS

3.2

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

(a) $F = x'y' + xz$

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

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

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

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

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

(d) $F = y + z$

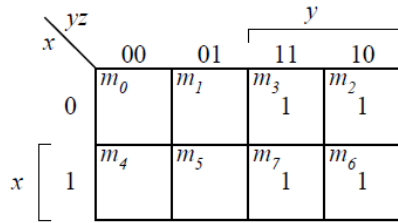
		yz		y	
		00	01	11	10
x	0	m_0 1	m_1	m_3	m_2 1
	1	m_4 1	m_5	m_7	m_6 1
		z			

(e) $F = z'$

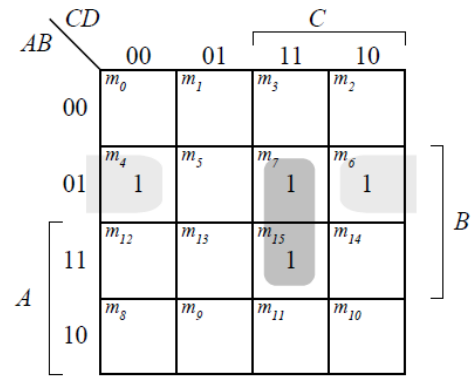
		yz		y	
		00	01	11	10
x	0	m_0	m_1	m_3 1	m_2
	1	m_4 1	m_5 1	m_7 1	m_6 1
		z			

(f) $F = x + yz$

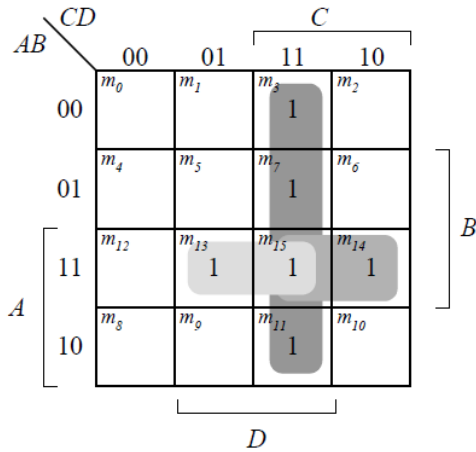
3.4



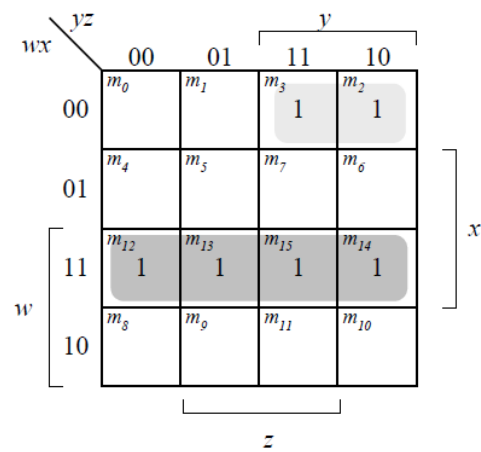
(a) $F = y$



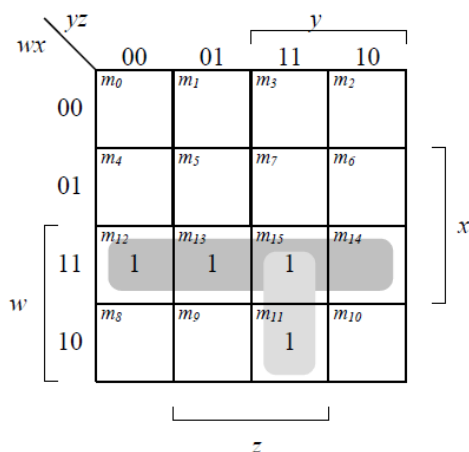
(b) $F = BCD + A'BD'$



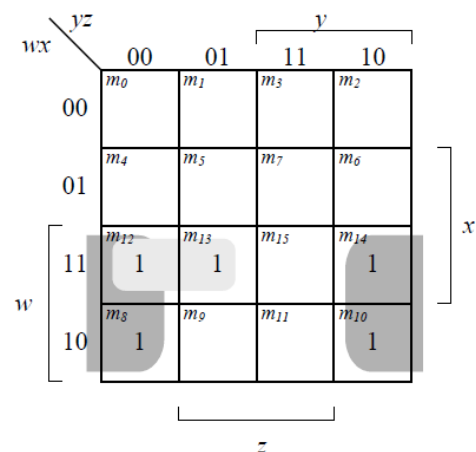
(c) $F = CD + ABD + ABC$



(d) $F = w'x'y + wx$



(e) $F = wx + wyz$

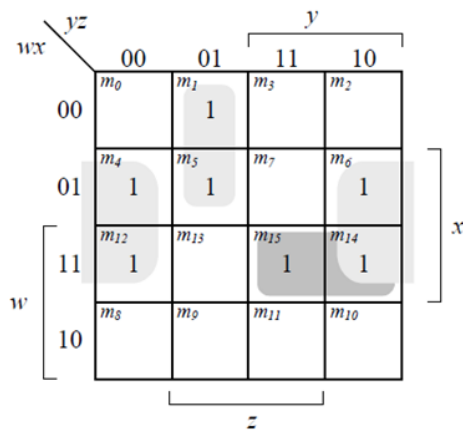


(f) $F = wz' + xy'w$

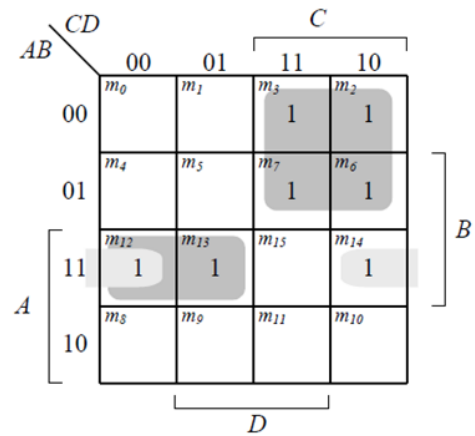
(e)

(f)

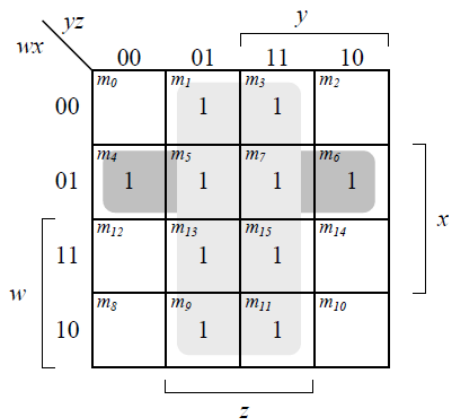
3.5



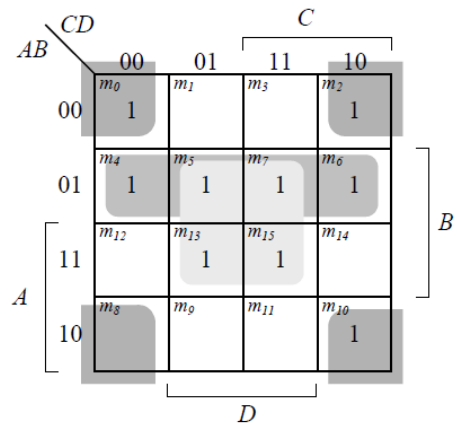
(a) $F = xz' + w'y'z + wx'y$



(b) $F = A'C + ABC' + ABD'$



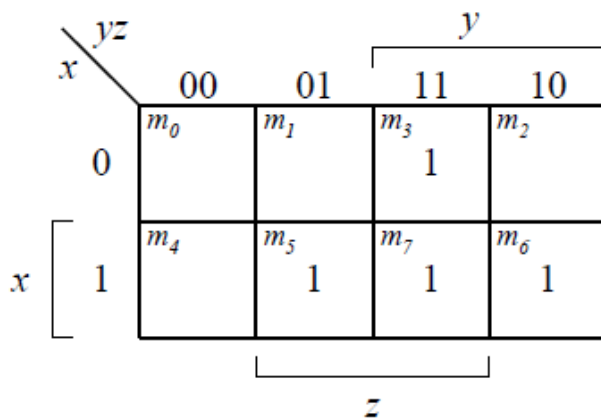
(c) $F = z + xw'$



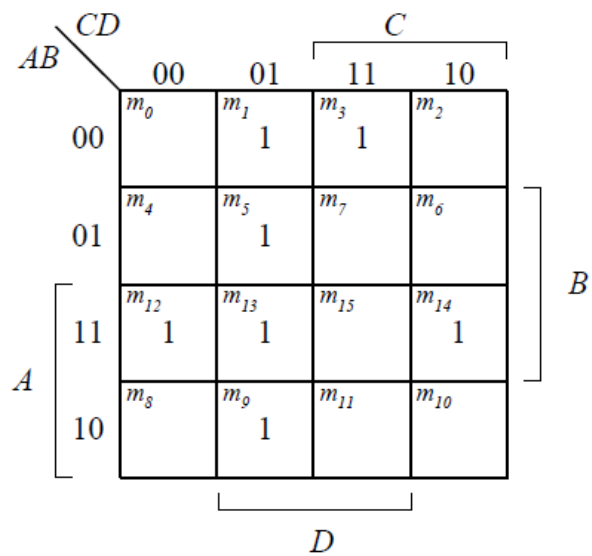
(d) $F = BD + A'B + B'D'$
or $= BD + B'D' + A'D'$

3.8

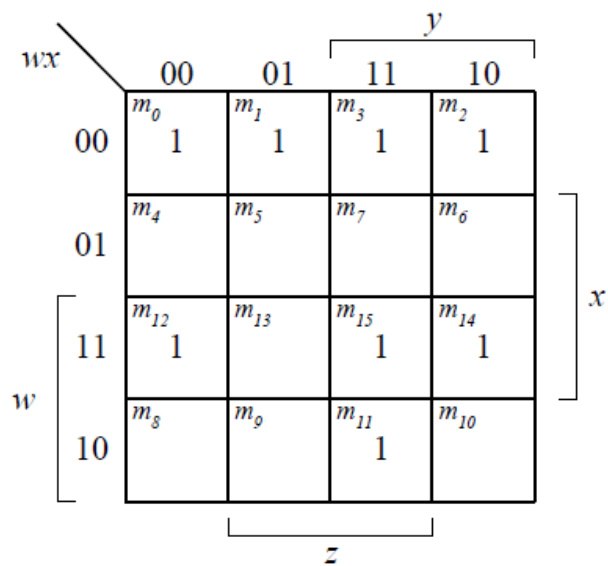
(a) $F(x, y, z) = \Sigma(3, 5, 6, 7)$



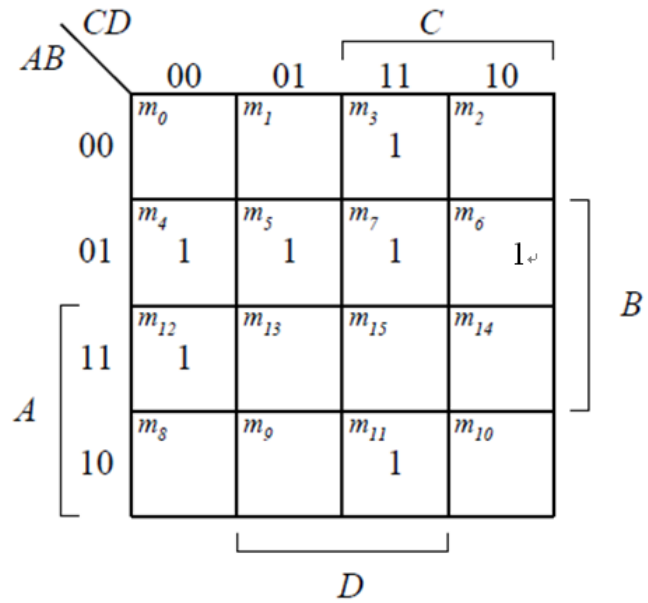
(b) $F = \Sigma(1, 3, 5, 9, 12, 13, 14)$



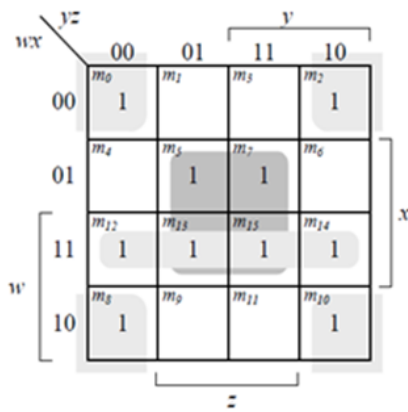
(c) $F = \Sigma(0, 1, 2, 3, 11, 12, 14, 15)$



(d) $F = \Sigma(3, 4, 5, 6, 7, 11, 12)$



3.10



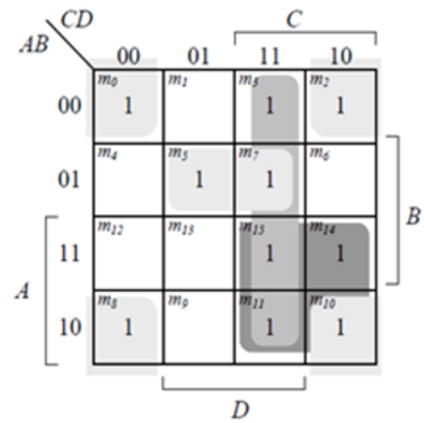
$F = \Sigma(0, 2, 5, 7, 8, 10, 12, 13, 14, 15)$

Essential: $xz, x'z'$

$F = xz + x'z' + wx$ or

$F = xz + x'z' + wz'$

(a)



$F = \Sigma(0, 2, 3, 5, 7, 8, 10, 11, 14, 15)$

Essential: $AC, B'D', A'BD'$

$F = AC + B'D' + A'BD + CD$ or

$F = AC + B'D' + A'BD + B'C'$

(b)

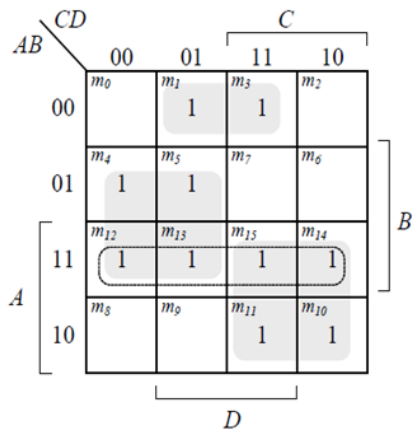
Note: From the course notes:

Essential: $AC, B'D', A'BD, AC$ (current grouping)

Essential: $wx, x'z', xz$ (current grouping) or $AC, B'D', A'BD, B'C$ (different Grouping)

or $wz', x'z', xz$ (different grouping)

Only essentials are listed in the function (depending the selected grouping)

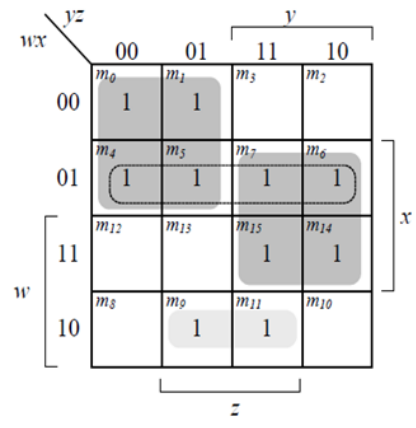


$F = \Sigma(1, 3, 4, 5, 10, 11, 12, 13, 14, 15)$

Essential: AC, BC'

$F = AC + BC' + A'B'D'$

(c)



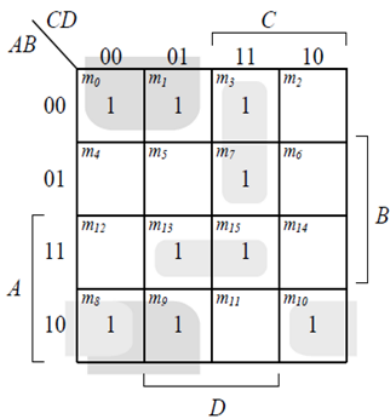
$F = \Sigma(0, 1, 4, 5, 6, 7, 9, 11, 14, 15)$

Essential: w'y', xy

$F = w'y' + xy + wx'z$

(d)

Use the same approach as for 3.10

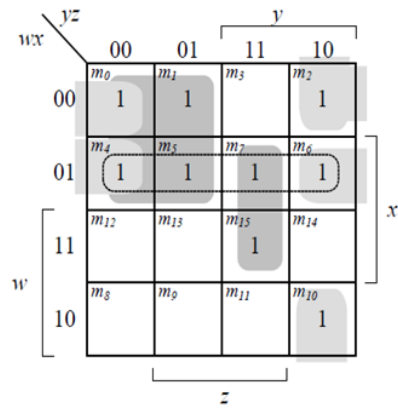


$F(A, B, C, D) = S(0, 1, 3, 7, 8, 9, 10, 13, 15)$

Essential: B'C', AB'D'

$F = B'C' + AB'D' + A'CD + ABD$

(e)



$F = S(0, 1, 2, 4, 5, 6, 7, 10, 15)$

Essential: w'y', xyz, x'yz'

$F = w'y' + xyz + x'yz' + w'z'$ or

$F = w'y' + xyz + x'yz' + w'x$

(f)

Use the same approach as for 3.10

3.15

		<i>yz</i>		<i>y</i>	
		00	01	11	10
<i>x</i>	0	m_0 1	m_1 1	m_3 x	m_2 x
	1	m_4 1	m_5 1	m_7 x	m_6 1
		<i>z</i>			

$$F = 1$$

$$F = \Sigma(0,1, 2, 3, 4, 5, 6, 7)$$

		<i>CD</i>		<i>C</i>	
		00	01	11	10
<i>A</i>	00	m_0 1	m_1	m_3	m_2 x
	01	m_4 x	m_5	m_7	m_6 1
	11	m_{12}	m_{13} 1	m_{15}	m_{14} 1
	10	m_8 1	m_9	m_{11}	m_{10} x
		<i>D</i>			

$$F = A'D' + B'D' + BCD' + ABC'D$$

$$F = \Sigma(0, 2, 4, 6, 8, 10, 13, 14)$$

		<i>CD</i>		<i>C</i>	
		00	01	11	10
<i>A</i>	00	m_0	m_1	m_3 x	m_2
	01	m_4	m_5 1	m_7 1	m_6 1
	11	m_{12} 1	m_{13}	m_{15} 1	m_{14} 1
	10	m_8	m_9 x	m_{11} x	m_{10}
		<i>D</i>			

$$F = BC + CD + ABD' + A'BD$$

$$F = \Sigma(3, 5, 6, 7, 11, 12, 14, 15)$$

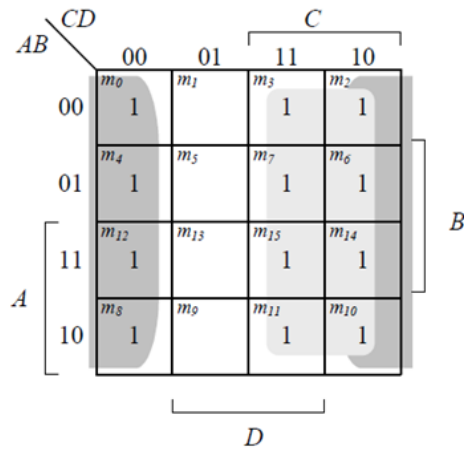
		<i>CD</i>		<i>C</i>	
		00	01	11	10
<i>A</i>	00	m_0 x	m_1	m_3	m_2 1
	01	m_4 1	m_5	m_7 1	m_6 x
	11	m_{12} 1	m_{13}	m_{15}	m_{14}
	10	m_8 x	m_9	m_{11}	m_{10} 1
		<i>D</i>			

$$F = B'D' + C'D' + A'BC$$

$$F = \Sigma(0, 2, 4, 6, 7, 8, 10, 12)$$

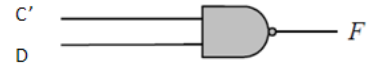
3.16

(a)

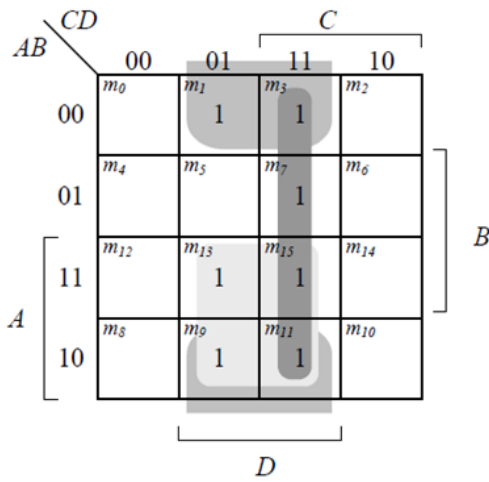


$$F = C + D'$$

$$F = (C'D)'$$

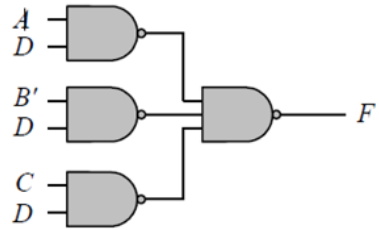


(b)

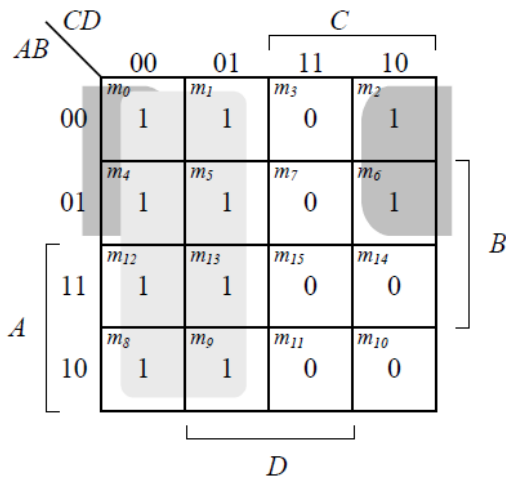


$$F = AD + B'D + CD$$

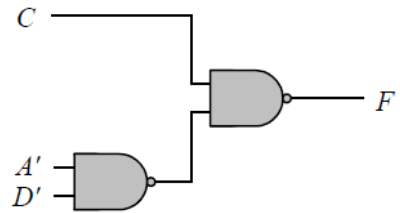
$$F = ((AD)'(B'D)'(CD))'$$



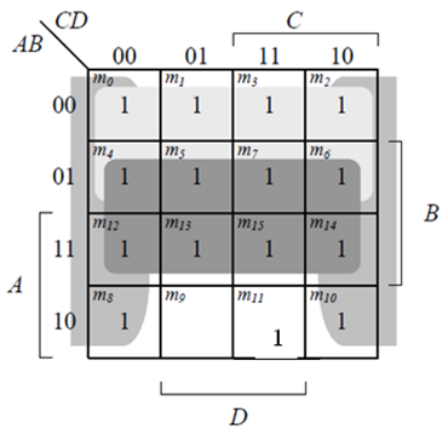
(c) $F = (A' + C' + D')(A' + C')(C' + D')$
 $F' = (A' + C' + D)' + (A' + C)' + (C' + D)'$
 $F' = ACD + AC + CD$



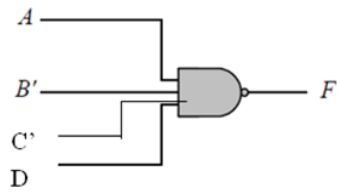
$F = C' + A'D'$
 $F = (C(A + D))'$
 $F = (C(A'D'))'$



(d)



$F = A' + B + C + D'$
 $F = (A(B')(C')D)'$



$$\begin{aligned}
 F &= (A \oplus B)'(C \oplus D) = (AB' + A'B)'(CD' + C'D) \\
 &= (AB + A'B')(CD' + C'D) = ABCD' + ABC'D + A'B'CD' + A'B'C'D \\
 F' &= (AB + A'B)' + (CD' + C'D)' \\
 F' &= ((A' + B)' + (A + B)')' + ((C' + D)' + (C + D)')'
 \end{aligned}$$

