

# ITI1100Z

Professor: Qi Hao

## Assignment # 3

Submission Deadline June 9, 2018 midnight (11h59 PM), Brightspace

From the textbook Chapter 3 pages 140-142 in the 6<sup>th</sup> edition, solve the following problems

3.3(a)(b)(c)(d), 3.4(e)(f), 3.5(c)(d), 3.7(c)(d), 3.8(c)(d), 3.10(c)(d)(f), 3.12(a), 3.13(c), 3.15(c)(d), 3.16(b)(c), 3.18, 3.20(a)

3.3

Total  
4 points

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

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

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

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

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

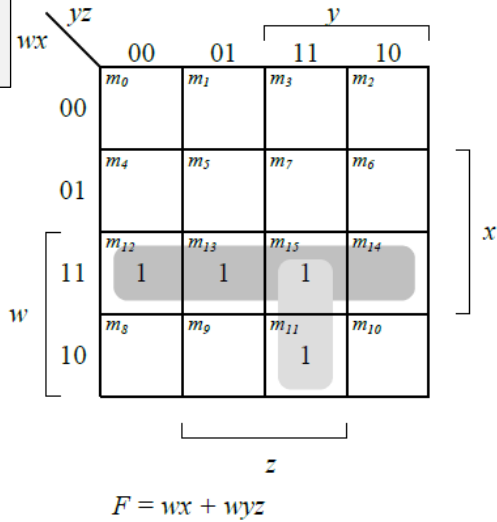
(c)  $F = x'y + yz' + y'z'$   
 $F = x'y + z'$

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

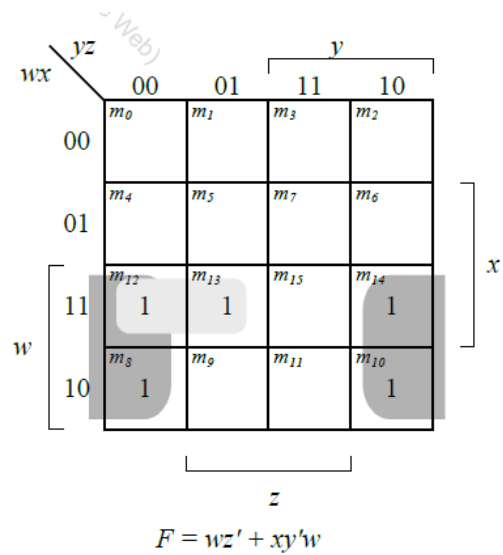
(d)  $F = x'yz + xy'z' + xy'z$   
 $F = x'yz + xy'$

3.4

Total  
2 points



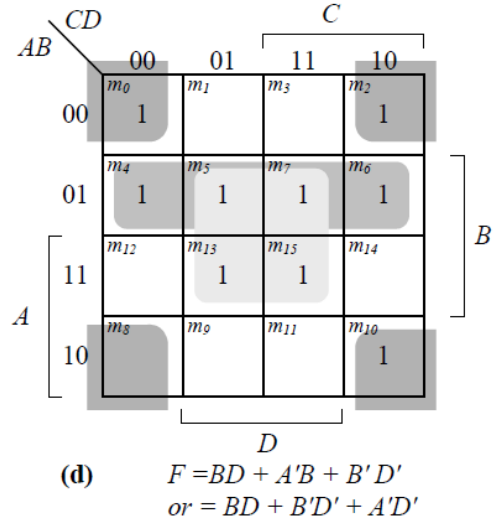
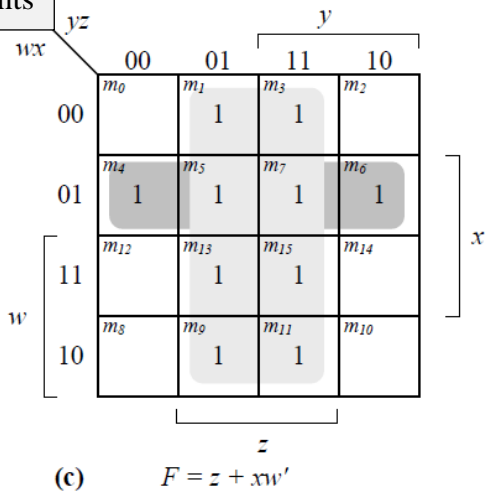
(e)



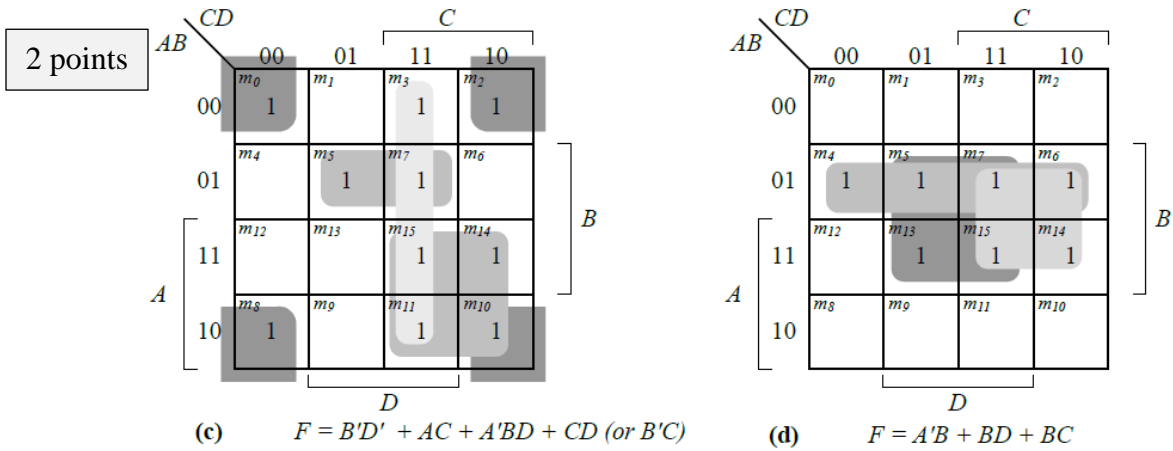
(f)

3.5

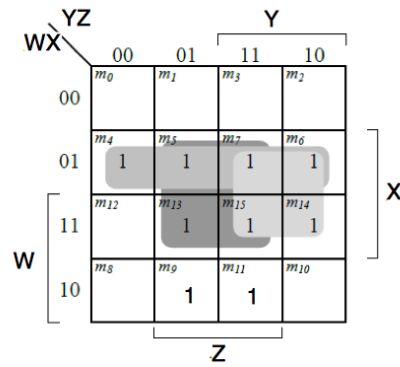
Total  
2 points



3.7



Error in (d). Correction:

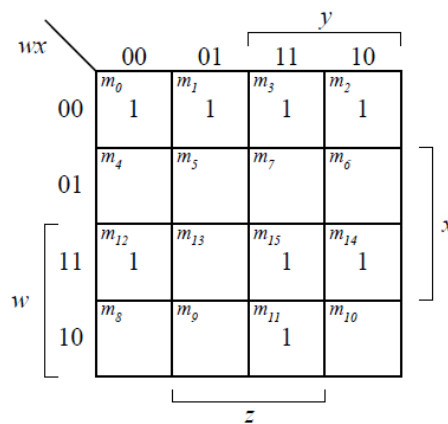


(d)  $F = w'x + wz + xy$

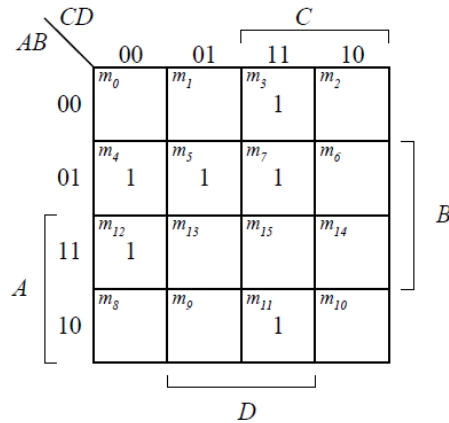
3.8

Total 2 points

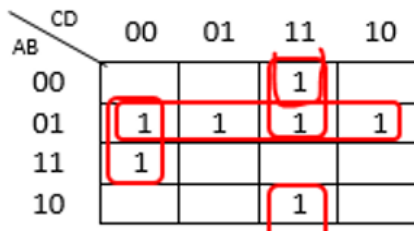
(c)  $F = \Sigma(0, 1, 2, 3, 11, 12, 14, 15)$



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

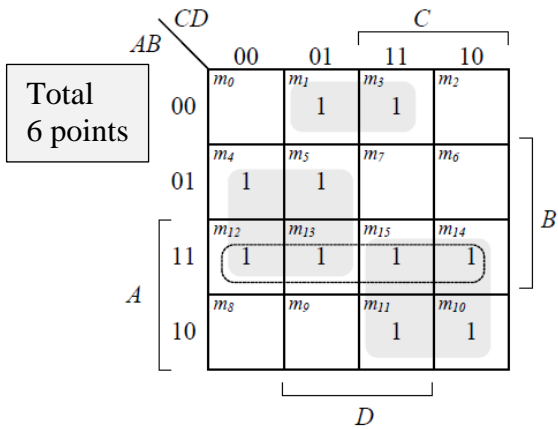


(d) **Error. Correction:**



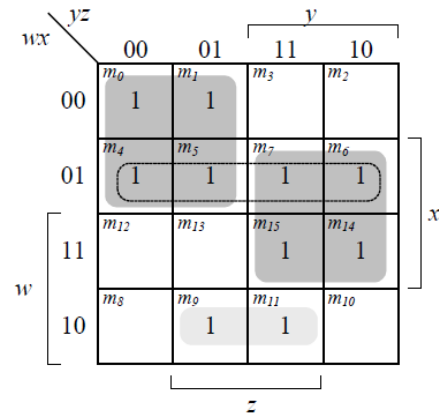
$F(A, B, C, D) = \Sigma(3, 4, 5, 6, 7, 11, 12)$

3.10



$F = \Sigma(1, 3, 4, 5, 10, 11, 12, 13, 14, 15)$   
**Essential:** AC, BC', A'B'D  
**Non-essential:** AB, A'B'D, B'CD, A'C'D  
 $F = AC + BC' + A'B'D$

(c)



$F = \Sigma(0, 1, 4, 5, 6, 7, 9, 11, 14, 15)$   
**Essential:** w'y', xy, wx'z  
**Non-essential:** wx, x'y'z, w'wz, w'x'z  
 $F = w'y' + xy + wx'z$

(d)

(c) Error. The correction is:

c)

	CD	00	01	11	10
AB	00		1	1	
	01	1	1		
	11	1	1	1	1
	10			1	1

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

Essential:  $BC', AC$

		y				
	y/z	00	01	11	10	
wx	00	$m_0$ 1	$m_1$ 1	$m_3$	$m_2$ 1	x
	01	$m_4$ 1	$m_5$ 1	$m_7$ 1	$m_6$ 1	
	11	$m_{12}$	$m_{13}$	$m_{15}$ 1	$m_{14}$	
w	10	$m_8$	$m_9$	$m_{11}$	$m_{10}$ 1	
		z				

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

Essential:  $w'y', w'z', xyz, x'yz'$   
 Non-Essential:  $w'x$   
 $F = w'y' + w'z' + xyz + x'yz'$

(f)

3.12

$$F = \Pi(1, 3, 5, 7, 13, 15)$$

$$F' = A'D + B'D \quad \leftarrow F' = A'D + BD$$

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

$$F = C'D' + AB' + CD'$$

Total  
2 points

		C				
	CD	00	01	11	10	
AB	00	$m_0$	0	0	$m_2$	B
	01	$m_4$	0	0	$m_6$	
	11	$m_{12}$	0	0	$m_{14}$	
A	10	$m_8$	$m_9$	$m_{11}$	$m_{10}$	
		D				

3.13

Total  
3 points

c) The answer in the solution manual is wrong. The correct answer is as the follows:

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

$$F' = AB'D + ABC + ABC' + BC'D$$

	CD	00	01	11	10
AB	00				
	01		0		
	11	0	0	0	0
	10		0	0	

$$F' = AB + AD + BC'D$$

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

	CD	00	01	11	10
AB	00	1	1	1	1
	01	1	0	1	1
	11	0	0	0	0
	10	1	0	0	1

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

3.15

Total  
4 points

		CD				
		00	01	C		
A	AB	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	$m_8$	$m_9$	$m_{11}$	$m_{10}$	
		D				B

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

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

(c)

		CD				
		00	01	C		
A	AB	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	$m_8$	$m_9$	$m_{11}$	$m_{10}$	
		D				B

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

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

(d)

(c) has error. Correction is:

c)

		CD			
		00	01	11	10
AB	00			X	
	01		1	1	1
	11	1		1	1
	10		X	X	

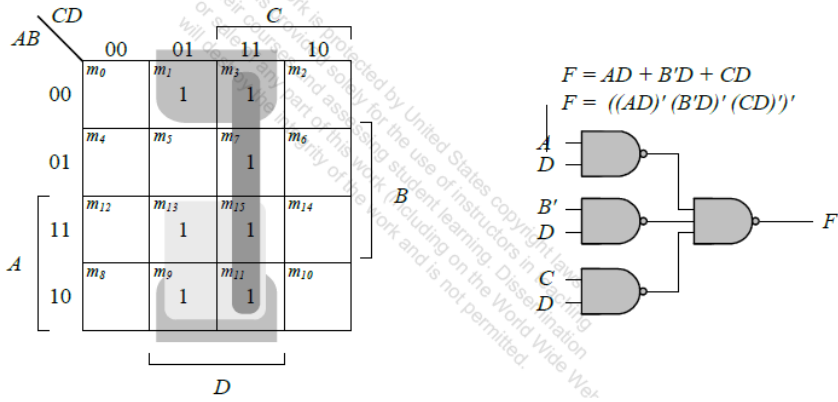
$$F = BC + A'BD + ABD' =$$

$$\Sigma(5, 6, 7, 12, 14, 15)$$

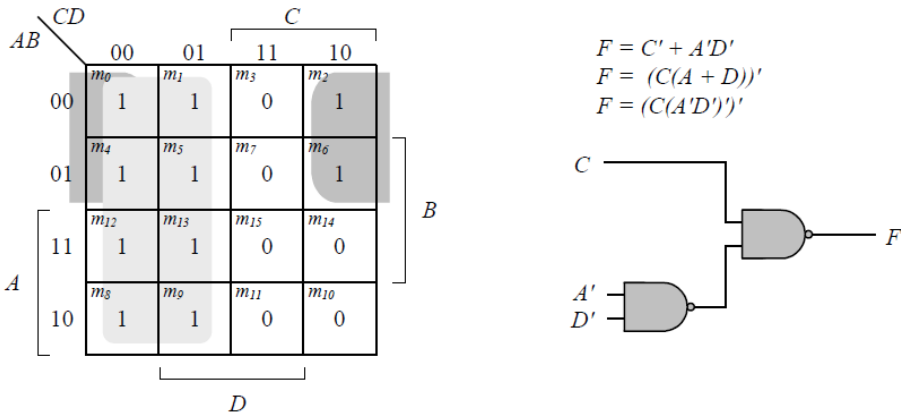
3.16

Total  
4 points

(b)



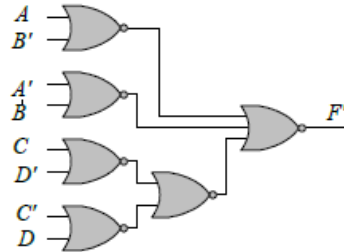
- (c)  $F = (A' + C' + D')(A' + C')(C' + D')$   
 $F' = (A' + C' + D)' + (A' + C)' + (C' + D)'$   
 $F' = ACD + AC + CD$



(3.18) (a)

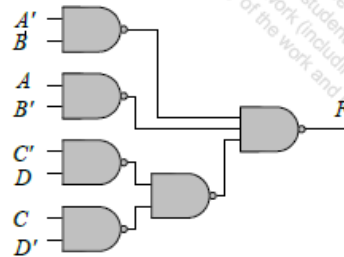
Total  
6 points

$$\begin{aligned} F(A, B, C, D) &= (A \text{ XOR } B)'(C \text{ XOR } D) \\ &= (A'B + AB')'(C'D + CD) \\ &= ((A'B + AB') + (C'D + CD))' \\ &= ((A + B)' + (A' + B)) + ((C + D)' + (C' + D))' \quad (\text{nor gates}) \end{aligned}$$



(b)

$$\begin{aligned} F(A, B, C, D) &= (A \text{ XOR } B)'(C \text{ XOR } D) \\ &= (A'B + AB')'(C'D + CD) \\ &= (A'B)'(AB)'((C'D)'(CD)')' \quad (\text{nand gates}) \end{aligned}$$



**Note: there are also other alternative solutions for 3.18.**

## 3.20

## Multi-level NOR:

Total  
3 points

$$F = ACD(B + C) + (BC' + DE')$$

$$F' = [ACD(B + C) + (BC' + DE')]'$$

$$F' = [(A' + C' + D')(B + C) + (B' + C)' + (D' + E)]'$$

$$F' = [((A' + C' + D') + (B + C)')' + (B' + C)' + (D' + E)]'$$

$$F' = [(A' + C' + D' + (B + C)')' + (B' + C)' + (D' + E)]'$$

