

# ITI1100Z

Professor: Qi Hao

## Assignment # 4

**Submission Deadline June 23, 2018 midnight (11h59 PM), Brightspace**

From the textbook Chapter four pages 236-241 in the 6<sup>th</sup> edition, solve the following problems:

**4.1, 4.5, 4.9, 4.21, 4.24, 4.26, 4.27, 4.28(b), 4.32(b), 4.33, 4.35(a).**

4.1

Total  
6 points

(a)

$$T_1 = B'C, T_2 = A'B, T_3 = A + T_1 = A + B'C,$$

$$T_4 = D \oplus T_2 = D \oplus (A'B) = A'BD' + D(A + B) = A'BD' + AD + B'D$$

$$F_1 = T_3 + T_4 = A + B'C + A'BD' + AD + B'D$$

$$\text{With } A + AD = A \text{ and } A + A'BD' = A + BD':$$

$$F_1 = A + B'C + BD' + B'D$$

$$\text{Alternative cover: } F_1 = A + CD' + BD' + B'D$$

$$F_2 = T_2 + D' = A'B + D'$$

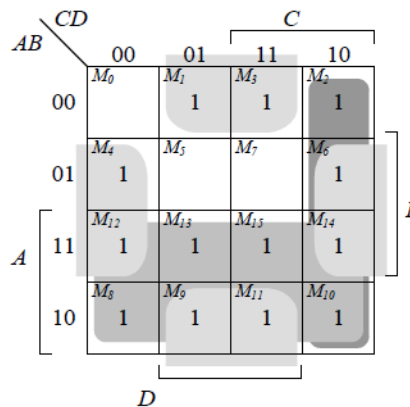
2 points

(b)

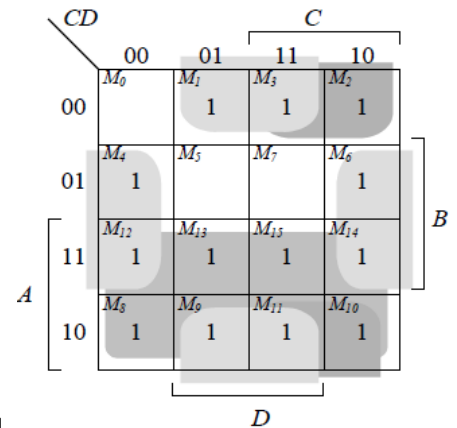
ABCD	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	F <sub>1</sub>	F <sub>2</sub>
0000	0	0	0	0	0	1
0001	0	0	0	1	1	0
0010	1	0	1	0	1	1
0011	1	0	1	1	1	0
0100	0	1	0	1	1	1
0101	0	1	0	0	0	1
0110	0	1	0	1	1	1
0111	0	1	0	0	0	1
1000	0	0	1	0	1	1
1001	0	0	1	1	1	0
1010	1	0	1	0	1	1
1011	1	0	1	1	1	0
1100	0	0	1	0	1	1
1101	0	0	1	1	1	0
1110	0	0	1	0	1	1
1111	0	0	1	1	1	0

2 points

(c)

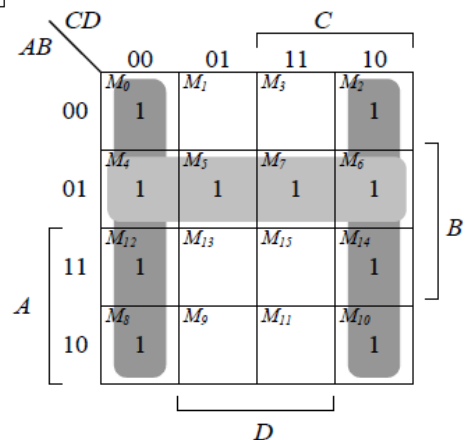


$$F_1 = A + CD' + B'D + BD'$$



$$F_1 = A + B'C + B'D + BD'$$

1 points



$$F_2 = A'B + D'$$

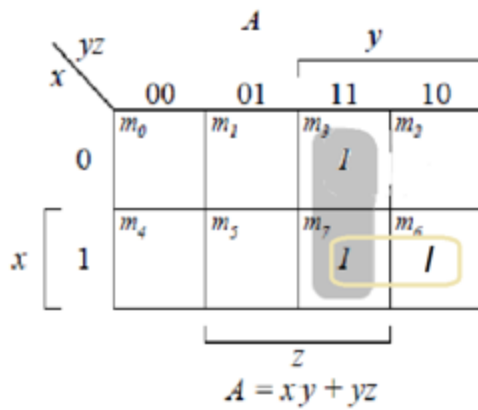
1 points

4.5

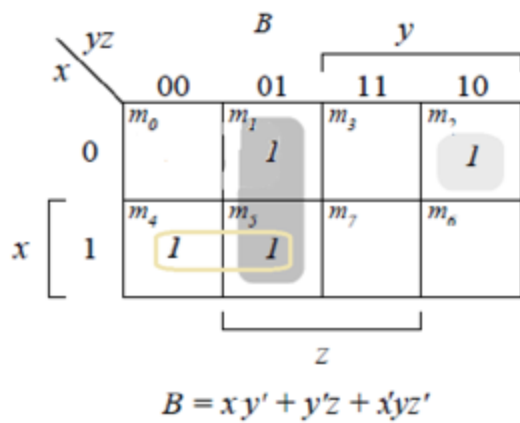
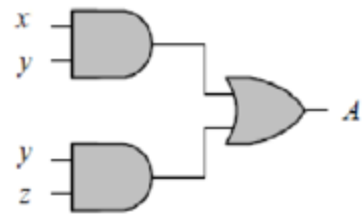
Total  
5 points

1 points

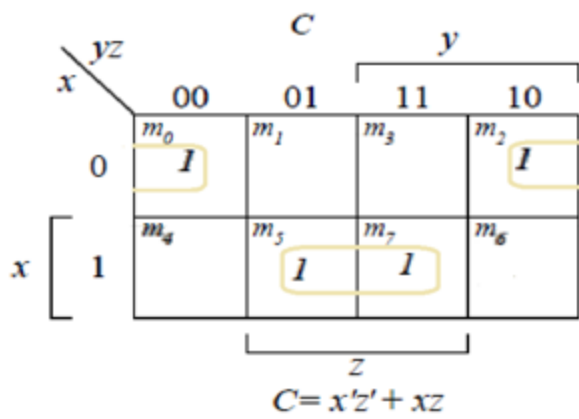
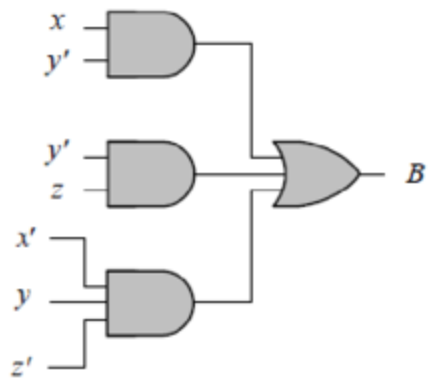
xyz	ABC
000	001
001	010
010	011
011	100
100	010
101	011
110	100
111	101



1.5 points



1.5 points

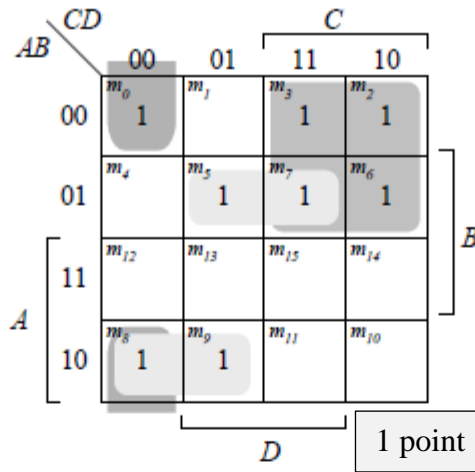


4.9

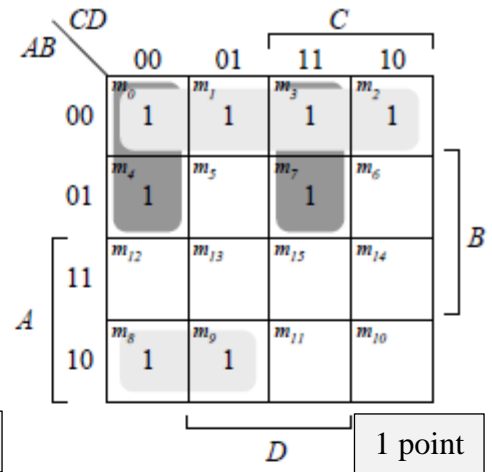
Total  
8 points

ABCD	a	b	c	d	e	f	g
0000	1	1	1	1	1	1	0
0001	0	1	1	0	0	0	0
0010	1	1	0	1	1	0	1
0011	1	1	1	1	0	0	1
0100	0	1	1	0	0	1	1
0101	1	0	1	1	0	1	1
0110	1	0	1	1	1	1	1
0111	1	1	1	0	0	0	0
1000	1	1	1	1	1	1	1
1001	1	1	1	1	0	1	1

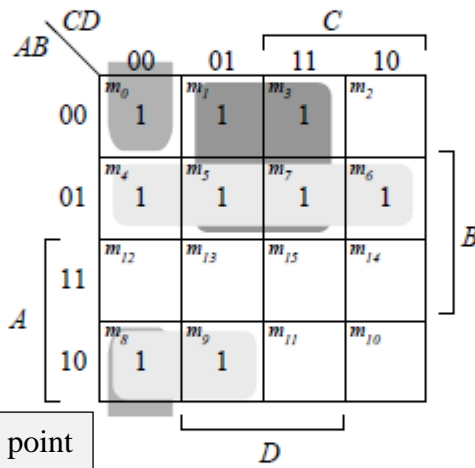
1 points



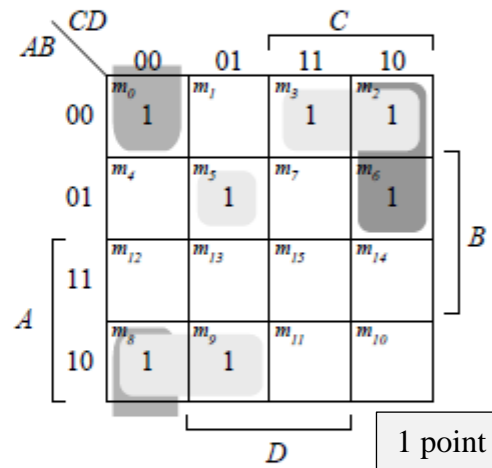
1 point



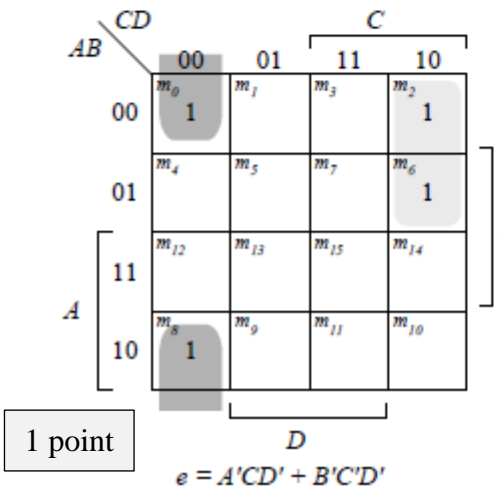
1 point



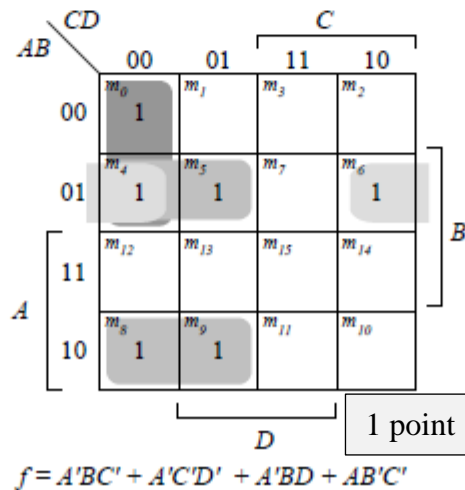
1 point



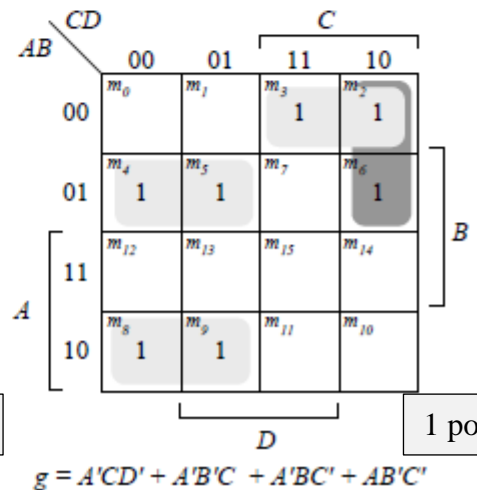
1 point



1 point



1 point

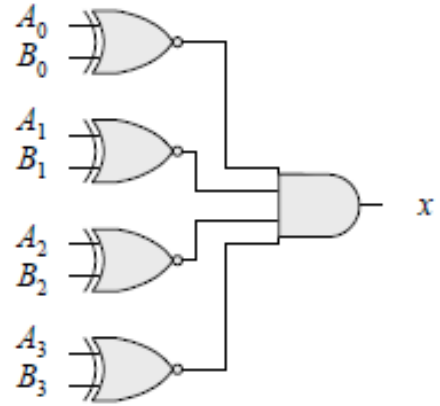


1 point

**Error Corrections:**  $b = A'B' + A'C'D' + A'CD + B'C'$   $c = A'B + A'D + B'C'$   
 $f = A'BC' + A'C'D' + A'BD' + AB'C'$

4.21

2 points



$$x = (A_0 \oplus B_0)'(A_1 \oplus B_1)'(A_2 \oplus B_2)'(A_3 \oplus B_3)'$$

4.24

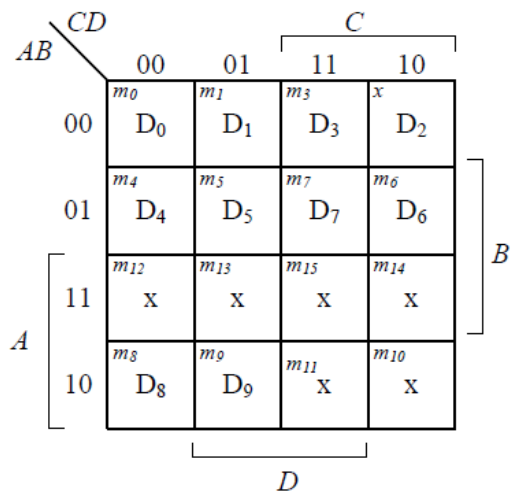
Total  
2 points

Inputs:  $A, B, C, D$

$$\begin{aligned} D_0 &= A'B'C'D' \\ D_1 &= A'B'CD \\ D_2 &= B'CD' \\ D_3 &= B'CD \\ D_4 &= BC'D' \end{aligned}$$

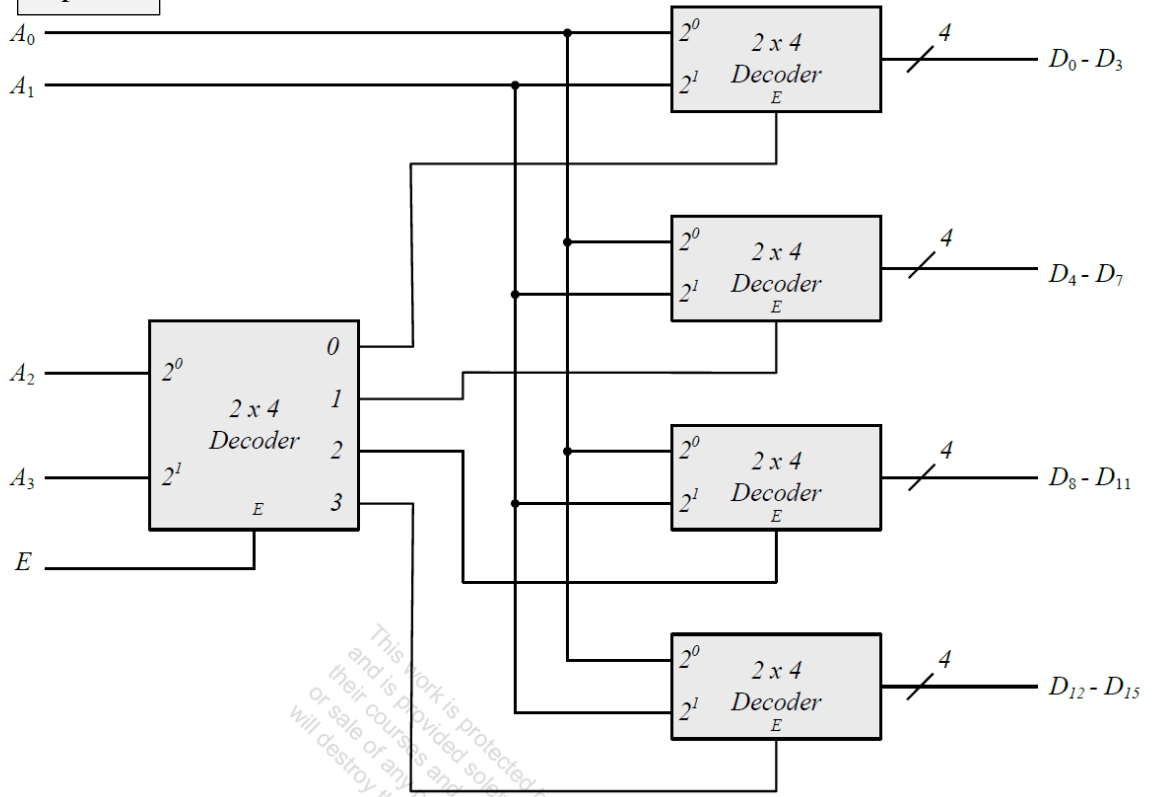
Outputs:  $D_0, D_1, \dots, D_9$

$$\begin{aligned} D_5 &= BC'D \\ D_6 &= BCD' \\ D_7 &= BCD \\ D_8 &= AD' \\ D_9 &= AD \end{aligned}$$



4.26

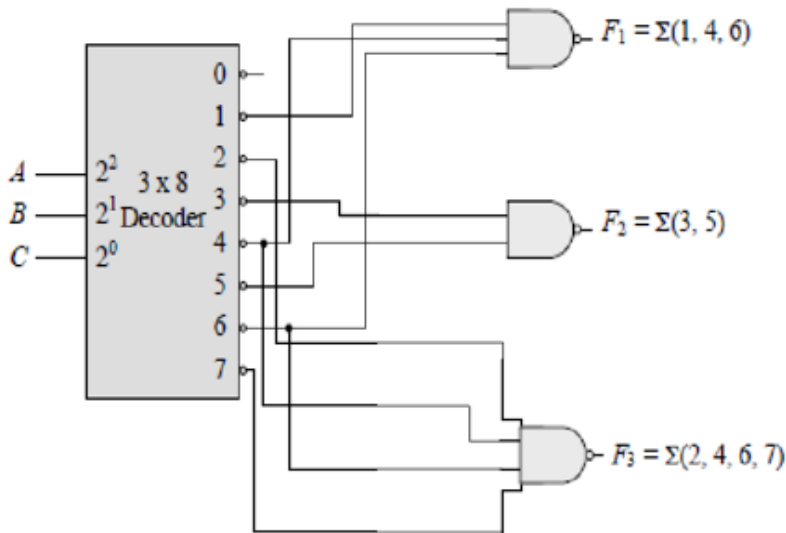
Total  
3 points



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4.27

Total  
3 points



1 point

1 point

1 point

4.28(b)

Total  
3 points

$$F_1 = (y' + x)z = y'z + xz = (x + x')y'z + x(y + y')z$$

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

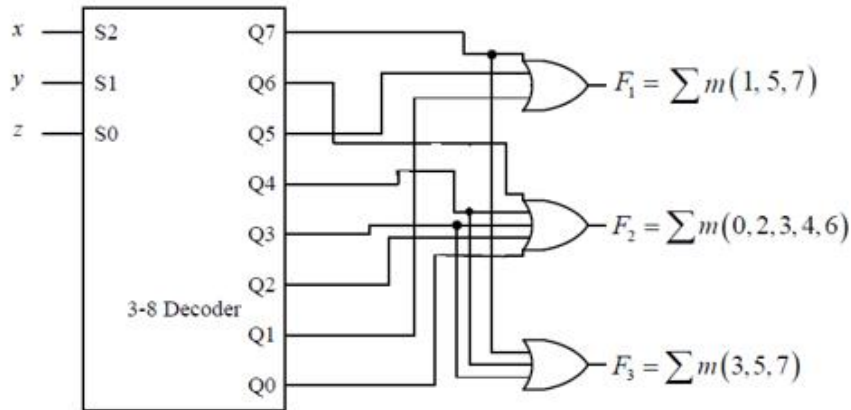
$$= x'y'z + x'y'z + xyz = \sum m(1, 5, 7)$$

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

$$= x'y'z' + x'y'z' + x'yz + xy'z' + xyz' = \sum m(0, 2, 3, 4, 6)$$

$$F_3 = (x + y)z = xz + yz = x(y + y')z + (x + x')yz = xy'z + xy'z + xyz + x'yz$$

$$= x'yz + xy'z + xyz = \sum m(3, 5, 7)$$



4.32

Total  
3 points

(b)

Mux input line (ABC)

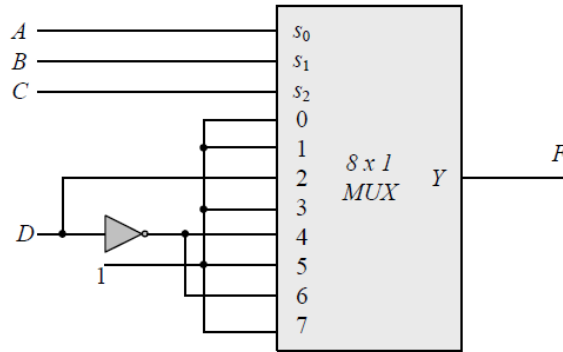
$$F = \Pi(2, 6, 11) = (A' + B' + C + D')(A' + B + C + D')(A + B' + C + D)$$

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

$$F' = (ABC'D) + (AB'CD) + (A'BC'D) = \Sigma(13, 9, 4)$$

$$F = \Sigma(0, 1, 2, 3, 5, 6, 7, 8, 10, 11, 12, 14, 15)$$

Inputs ABCD	Mux input line ABC	Mux value Y	
000 0	0	0	$1_{F=1}$
000 1	0	1	1
001 0	1	2	$1_{F=1}$
001 1	1	3	$1_{F=1}$
010 0	2	4	$0_{F=D}$
010 1	2	5	$1_{F=1}$
011 0	3	6	$1_{F=1}$
011 1	3	7	1
100 0	4	8	$1_{F=D'}$
100 1	4	9	0
101 0	5	10	$1_{F=1}$
101 1	5	11	1
110 0	6	12	$1_{F=D'}$
110 1	6	13	0
111 0	7	14	$1_{F=1}$
111 1	7	15	1



4.33

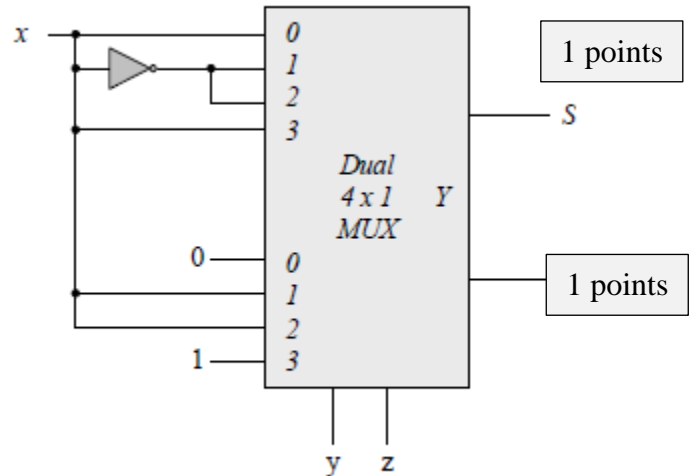
1 point

Total  
3 points

$$S(x, y, z) = \Sigma(1, 2, 4, 7)$$

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

S	I <sub>0</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	C	I <sub>0</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>
x'	0	1	2	3	x'	0	1	2	3
x	4	5	6	7	x	4	5	6	7
	x	x'	x'	x		0	x'	x'	1

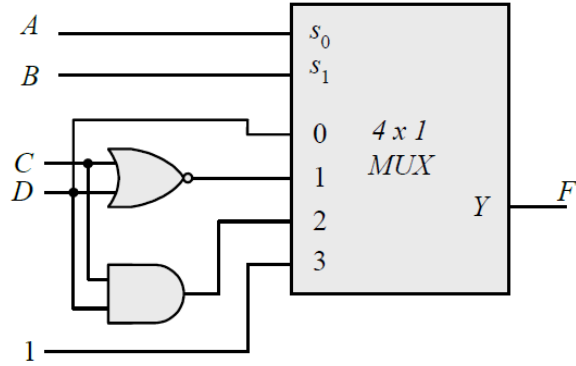


4.35

Total  
2 points

(a)

Inputs ABCD	F
0000	0
0001	1 $AB = 00$
0010	0 $F = D$
0011	1
0100	1 $AB = 01$
0101	0 $F = C'D'$
0110	0 $= (C + D)'$
0111	0
1000	0
1001	0 $AB = 10$
1010	0 $F = CD$
1011	1
1100	1 $AB = 11$
1101	1 $F = 1$
1110	1
1111	1



.Digital Design With An Introduction to the Verilog HDL, VHDL, and SystemVerilog, Sixth Edition – Solution Manual.  
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