Digital Logic Theory Assignment 2

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1. a)

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

$$F = A'B' + A'C' + B'C' + A'D + B'D$$
$$= A'B' + (A' + B')C' + (A' + B')D$$
$$= A'B' + (AB)'C' + (AB)'D$$
$$= \{[A'B' + (AB)'C' + (AB)'D]'\}'$$
$$= \{(A'B')'[(AB)'C']'[(AB)'D]'\}'$$

b)

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

$$F' = AB + ACD' + BCD'$$
$$F = (F')' = (AB + ACD' + BCD')' = [(A' + B')' + (A' + C' + D)' + (B' + C' + D)']'$$

2. a) $T_1 = B'C$, $T_2 = A'B$, $T_3 = A + T_1 = A + B'C$, $T_4 = T_2 \oplus D = A'BD' + (A + B')D$.

$F_1 = T_3 + T_4 = A + B'C + A'BD' + (A + B')D = A + B'C + A'BD' + B'D = A + B'(C+D) + BD'$.

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

b)

A	B	C	D	T_1	T_2	T_3	T_4	F_1	F_2
0	0	0	0	0	0	0	0	0	1
0	0	0	1	0	0	0	1	1	0
0	0	1	0	1	0	1	0	1	1

A	B	C	D	T_1	T_2	T_3	T_4	F_1	F_2
0	0	1	1	1	0	1	1	1	0
0	1	0	0	0	1	0	1	1	1
0	1	0	1	0	1	0	0	0	1
0	1	1	0	0	1	0	1	1	1
0	1	1	1	0	1	0	0	0	1
1	0	0	0	0	0	1	0	1	1
1	0	0	1	0	0	1	1	1	0
1	0	1	0	1	0	1	0	1	1
1	0	1	1	1	0	1	1	1	0
1	1	0	0	0	0	1	0	1	1
1	1	0	1	0	0	1	1	1	0
1	1	1	0	0	0	1	0	1	1
1	1	1	1	0	0	1	1	1	0

3. a)

x	y	z	A	B	C
0	0	0	0	1	0
0	0	1	0	1	1
0	1	0	1	0	0
0	1	1	0	1	0
1	0	0	0	1	1
1	0	1	1	0	0
1	1	0	1	0	1
1	1	1	1	1	0

b) A

yz \ x	0	1
00	0	0
01	0	1
11	0	1
10	1	1

$A = xz + yz'$

B

yz \ x	0	1
00	1	1
01	1	0
11	1	1
10	0	0

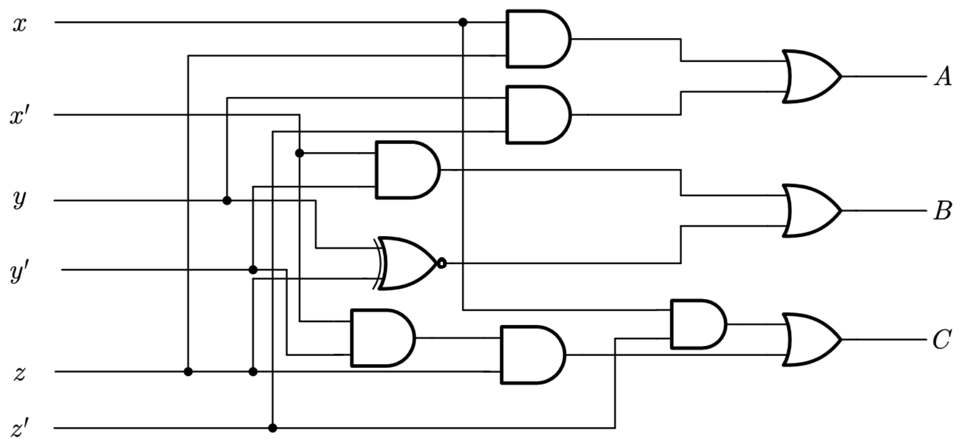
$B = x'y' + y'z' + yz$

C

yz \ x	0	1
00	0	1
01	1	0
11	0	0
10	0	1

$C = x'y'z + xz'$

c)



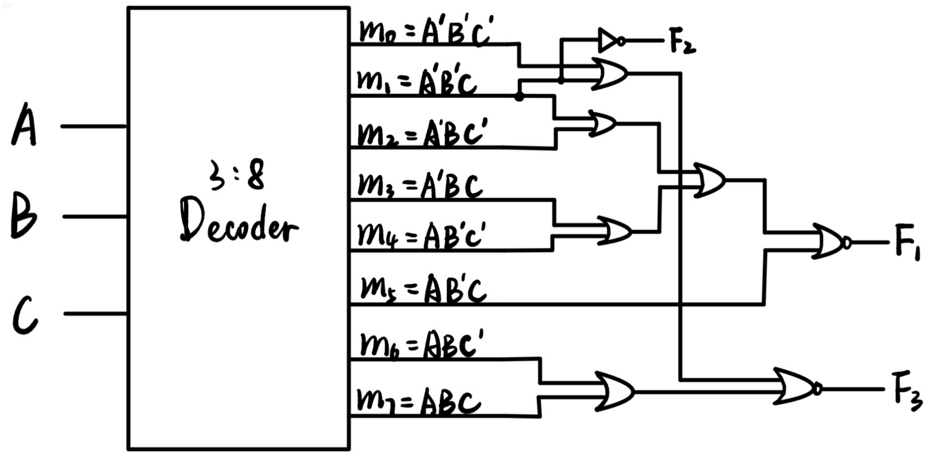
4.

A	B	C	F_1	F_2	F_3
0	0	0	1	1	0
0	0	1	0	0	0
0	1	0	0	1	1
0	1	1	0	1	1
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	1	1	0
1	1	1	1	1	0

$F_1 = AB + A'B'C' = (m_1 + m_2 + m_3 + m_4 + m_5)'$

$F_2 = A + B + C' = m_1'.$

$F_3 = A'B + AB' = (m_0 + m_1 + m_6 + m_7)'.$



5. a)

I	A	B	C	D	F
$I_0 = D$	0	0	0	0	0
$I_0 = D$	0	0	0	1	1
	0	0	1	0	0
	0	0	1	1	0
	0	1	0	0	0
	0	1	0	1	0
$I_3 = 1$	0	1	1	0	1
$I_3 = 1$	0	1	1	1	1
$I_4 = D$	1	0	0	0	0
$I_4 = D$	1	0	0	1	1
$I_5 = 1$	1	0	1	0	1
$I_5 = 1$	1	0	1	1	1
$I_6 = D'$	1	1	0	0	1
$I_6 = D'$	1	1	0	1	0
$I_7 = 1$	1	1	1	0	1
$I_7 = 1$	1	1	1	1	1

b)

$AB \backslash CD$	00	01	11	10
00	0	1	0	0
01	0	0	1	1
11	1	0	1	1
10	0	1	1	1

$F = AC + BC + ABD' + B'C'D = (A+B)C + ABD' + B'C'D.$

c) When $AB = 00$, $F = B'C'D = C'D$.

When $AB = 01$, $F = C$.

When $AB = 10$, $F = C + C'D$.

When $AB = 11$, $F = C + D'$.