

# Digital Logic

## 2024 Fall Assignment 2 Answer

1. (20 points 10+10)

- (a)  $((A'B')(A'C')(A'D')(B'C')(B'D'))'$
- (b)  $((A' + B')' + (A' + C' + D)' + (B' + C' + D))'$

2. (24 points 12+12)

- (a)
- $$F_1 = A + B'C + (B \oplus D)$$
- $$F_2 = A'B + D'$$

(b) Truth Table:

A	B	C	D	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	F <sub>1</sub>	F <sub>2</sub>
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
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. (18 points 8+5+5)

(a) Truth Table

A	B	C	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>
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) K-map simplification

<i>A/BC</i>	00	01	11	10
0	0	0	0	1
1	0	1	1	1

$F_1 = AC + BC'$

<i>A/BC</i>	00	01	11	10
0	1	1	1	0
1	1	0	1	0

<i>A/BC</i>	00	01	11	10
0	1	1	1	0
1	1	0	1	0

$F_2 = B'C' + BC + A'C$  or  $F_2 = B'C' + BC + A'B'$

<i>A/BC</i>	00	01	11	10
0	0	1	0	0
1	1	0	0	1

$F_3 = AC' + A'B'C$

(c) Draw the logic diagram

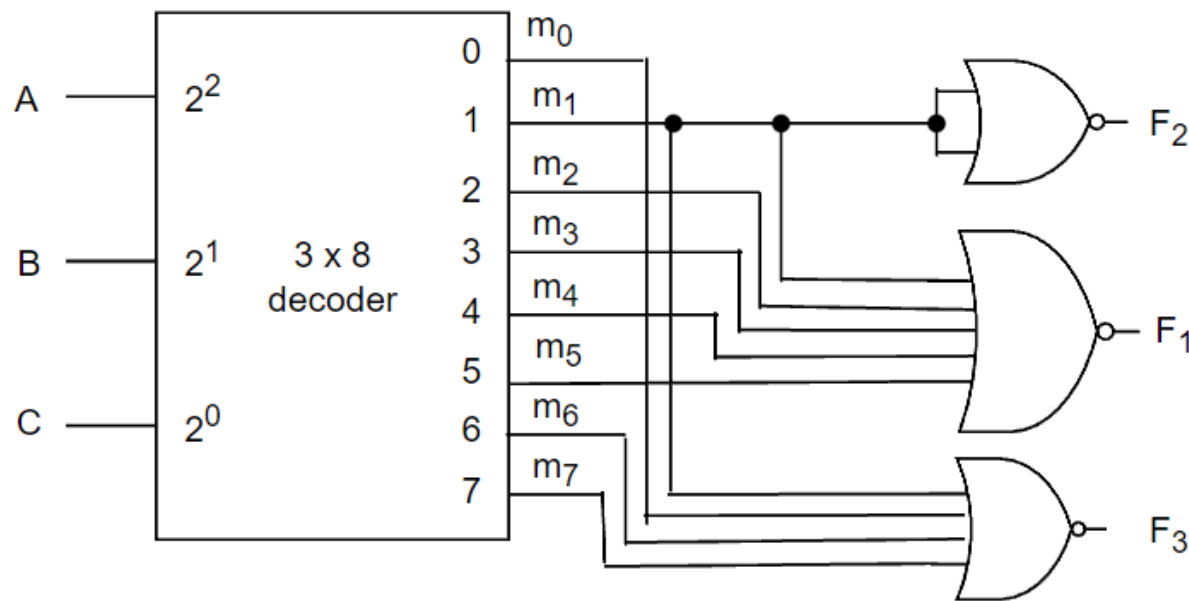
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4. (18 points 6+6+6)

$F_1 = (\sum(1,2,3,4,5))'$

$F_2 = (\sum(1))'$

$F_3 = (\sum(0,1,6,7))'$



5. (20 points 8+6+6)

(a) Truth Table

A	B	C	D	F(A, B, C, D)
0	0	0	0	0
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
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

note: The above truth table is derived from:

A	B	C	F(A, B, C, D)
0	0	0	D
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	D
1	0	1	1
1	1	0	D'
1	1	1	1

(b) Simplification

K-map:

AB/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

Result:

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

(c) An Example:

From (a) we can get:

A	B	F(A, B, C, D)
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A	B	F(A, B, C, D)		
0	0	C	D	F(A, B, C, D)
		0	0	0
		0	1	1
		1	0	0
		1	1	0
0	1	C	D	F(A, B, C, D)
		0	0	0
		0	1	0
		1	0	1
		1	1	1
1	0	C	D	F(A, B, C, D)
		0	0	0
		0	1	1
		1	0	1
		1	1	1

A	B	F(A, B, C, D)		
1	1	C	D	F(A, B, C, D)
		0	0	1
		0	1	0
		1	0	1
		1	1	1

Thus we can implement as:

