Chapter 2 Exercise Questions

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1. Write a Boolean equation in sum-of-products canonical form for the following truth table (5 pts.):

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

A’B’C
A’BC’
A’BC
AB’C’
AB’C
ABC’

Y= A’B’C + A’BC’ + A’BC + AB’C’ + AB’C +ABC’

2. Minimize the following SOP Boolean equation using Boolean Algebra:

Y = A’B’C + ABC’ + ABC

Make sure and show what theorems are being used (5 pts.).

Apply T8 to ABC’ + ABC -> Y = A’B’C + AB(C + C’)

Apply T5’ to C + C’ -> Y = A’B’C + AB(1)

Apply T1 to A (1) -> **Y = A’B’C + AB**

3. Populate the K-map using the following truth table (.5 pt. for each correct square or 4 pts. total):

A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

A \ BC	00	01	11	10
0	1			1
1	1	1	1	

3. Populate the K-map using the following truth table (.5 pt. for each correct square or 8 pts. total).

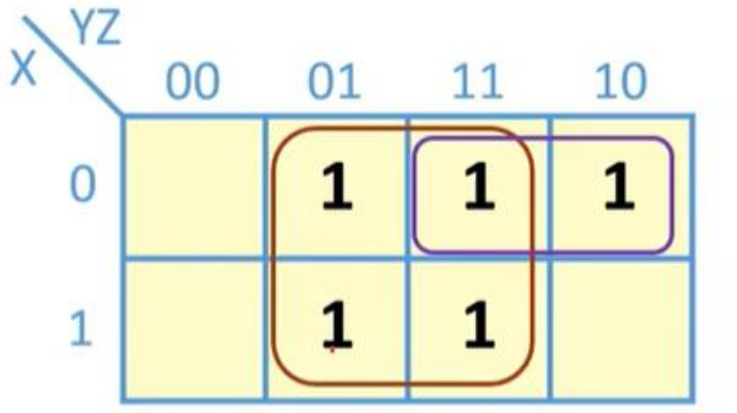
A	B	C	D	Y
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

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

4. Group the 1's in the following K-map. Use a different font color for each group (5 pts.).

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

5. Determine the product terms for the following K-map groups with an output of Q. Make sure and explain the reasoning for each term (5 pts.):



Red Product Term: **X and X change so they can be eliminated. Z is 1 the product term is Z.**

Purple Product Term: **Z changes so it can be eliminated. Y is 1 the product term is Y.**

Final Equation: **Q = Z + Y**

6. Determine the product terms for the following K-map groups with an output of Q. Make sure and explain the reasoning for each term. Each group is defined using a different font color (5 pts.):

A \ BC	00	01	11	10
0		1		
1			1	1

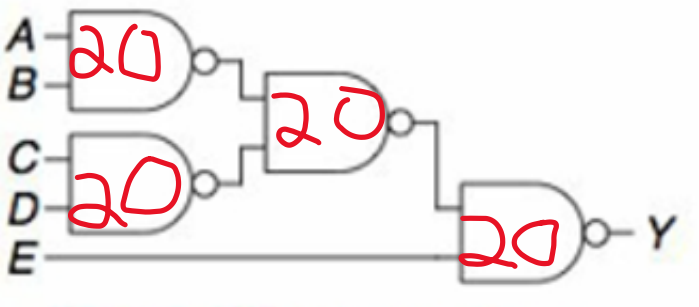
Blue Product Term: C is 1, A is 0, B is 0, so the product term is A'B'C

Red Product Term: C changes so it can be eliminated. A IS 1 AND B IS 1, so the product term is AB.

Final Equation: **A'B'C + AB**

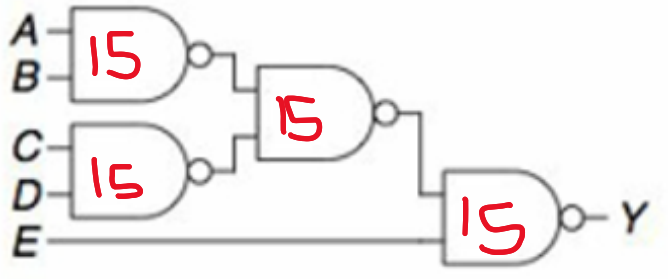
7. Determine the propagation delay and contamination of the following circuit using the gate delays in the following table. Make sure to show your work (3 pts):

Gate	t_{pd} (ps)	t_{cd} (ps)
NOT	15	10
2-input NAND	20	15
3-input NAND	30	25
2-input NOR	30	25
3-input NOR	45	35
2-input AND	30	25
3-input AND	40	30
2-input OR	40	30
3-input OR	55	45
2-input XOR	60	40



Propagation delay:

4 (2-input NAND * 20) = 80



Contamination :

4 (2-input NAND * 15) = 60