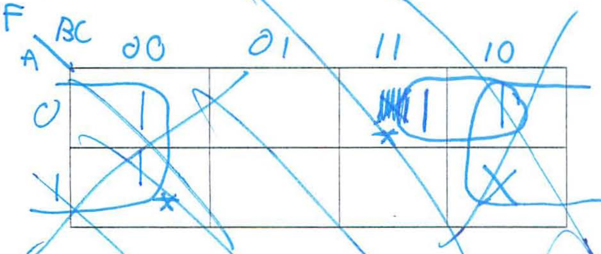
Name ~~Answers~~ Answers

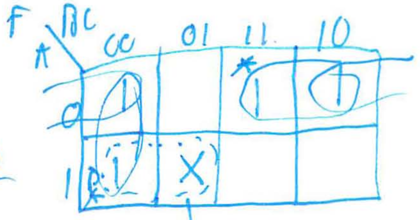
CE-1901-11 – Dr. Durant – Quiz 5
Fall 2016, Week 5 Quiz

1. (~~2~~ 1.5 points) Let F(ABC) = Σ_m(0,2,3,4) + d(~~3~~, ~~4~~ 5) (d indicates don't care conditions). Derive the simplest SOP expression for F using a K-map. **Reminders**: adjacent terms in a K-map may differ in the value of only 1 bit. Start with m_0 in the upper left corner, putting m_1 to the right and m_4 below it. Form largest groups possible. It is okay to cover terms more than once as your form larger implicants.



~~$F = \overline{C} + \overline{A}B$~~

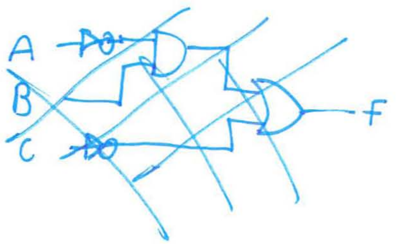
error

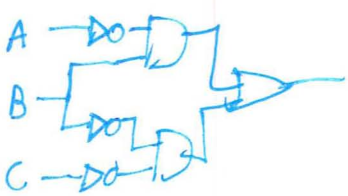


$F = \overline{B}\,\overline{C} + \overline{A}B$

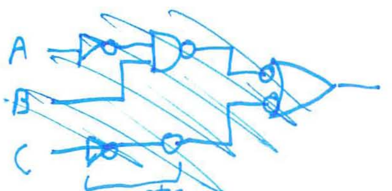
can mark, but clearly not needed, so can omit

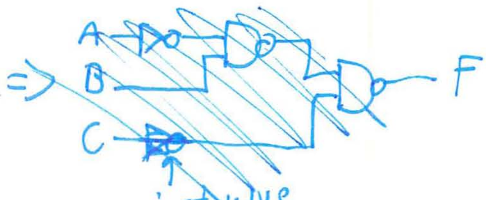
2. (1 point) Draw your reduced circuit for F directly using NOT-AND-OR gates.

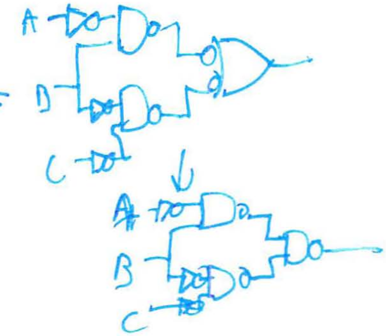




3. (~~2~~ 1 points) Re-draw it using just NAND and NOT gates based on the most simplified SOP form. **Reminders:** The first step is to put 2 NOT gates on every input to the OR gate. After that, apply DeMorgan's Theorems (bubble pushing).







4. (1 point) Calculate the number of transistors needed for each ~~reduced~~ implementation above.

~~#2: 2 NOT 4T~~
~~1 AND2 6T~~
~~1 OR2 6T~~
~~16~~

~~#3: 1 NOT 2~~
~~2 NAND2 8T~~
~~10~~

#2: 3NOT: 6
2AND2: 12
1OR2: 6
24

#3: 3NOT: 6
3NAND2: 12
18

(2 pts)

5. Let H(ABCD) = $\Sigma_m(2, 3, 4, 6, 7, 10, 11, 12, 14, 15)$. Derive the simplest SOP expression for H using a K-map.

H

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

$B\bar{D}$

C

$H = C + B\bar{D}$

6. (2 points) ***Draw*** the K-map that results in the POS equation G(WXY) = (W'+Y)(X'+Y).

G

W \ XY	00	01	11	10
0				0
1	0			0

$\bar{X} + Y$

$\bar{W} + Y$

1.5

7. (~~2~~ points) ***Draw*** another map for G and use it to ***derive*** the simplest SOP expression for G.

G

W \ XY	00	01	11	10
0	1	1	1	
1		1	1	

$\bar{W}\bar{X}$

Y

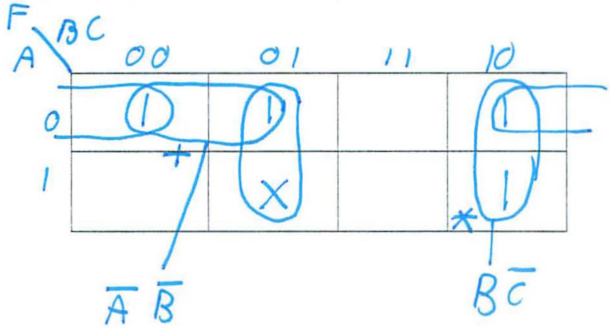
$G = \bar{W}\bar{X} + Y$

Note: this is also an application of the distributive theorem.

Name Answers

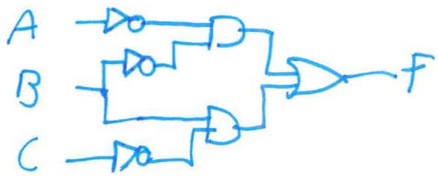
CE-1901-12 – Dr. Durant – Quiz 5
Fall 2016, Week 5 Quiz

1. (1.5 points) Let $F(ABC) = \Sigma_m(0,1,2,6) + d(5)$ (d indicates don't care conditions). Derive the simplest SOP expression for F using a K-map. **Reminders**: adjacent terms in a K-map may differ in the value of only 1 bit. Start with m_0 in the upper left corner, putting m_1 to the right and m_4 below it. Form largest groups possible. It is okay to cover terms more than once as your form larger implicants.

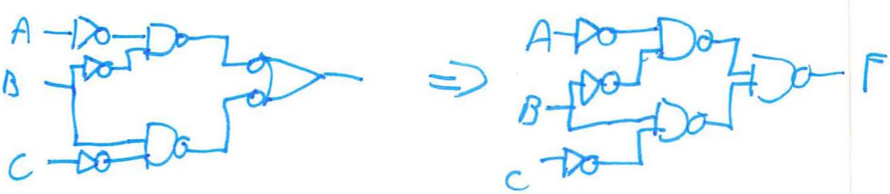


$F = \bar{A}\bar{B} + B\bar{C}$

2. (1 point) Draw your reduced circuit for F directly using NOT-AND-OR gates.



3. (1 point) Re-draw it using just NAND and NOT gates based on the most simplified SOP form. **Reminders:** The first step is to put 2 NOT gates on every input to the OR gate. After that, apply DeMorgan's Theorems (bubble pushing).



4. (1 point) Calculate the number of transistors needed for each reduced implementation above.

#2: 3 NOT 6T
2 AND2 12T
1 OR2 6T
24T

#3: 3 NOT = 6T
3 NAND2 = 12T
18T

5. (2 points) Let H(ABCD) = $\Sigma_m(1, 4, 5, 6, 7, 8, 12, 13, 14, 15)$. Derive the simplest SOP expression for H using a K-map.

$\bar{A}\bar{C}D$

H: AB \ CD	00	01	11	10
00	0	1	0	0
01	1	1	1	1
11	1	1	1	1
10	1	0	0	0

B

$A\bar{C}\bar{D}$

$\boxed{F = B + \bar{A}\bar{C}D + A\bar{C}\bar{D}}$ ← ANSWER

$= B + \bar{C}(\bar{A}D + A\bar{D})$

$= B + \bar{C}(A \oplus D)$ ← No longer SOP

6. (2 points) ***Draw*** the K-map that results in the POS equation G(WXY) = (Y')(W'+X).

G: W \ XY	00	01	11	10
0		0	0	
1	0	0	0	

$\bar{W}+X$

$\bar{Y}$

7. (1.5 points) ***Draw*** another map for G and use it to ***derive*** the simplest SOP expression for G.

G: W \ XY	00	01	11	10
0	1			1
1				1

$\bar{W}\bar{Y}$

$X\bar{Y}$

$\boxed{G = \bar{W}\bar{Y} + X\bar{Y}}$ answer

$= \bar{Y}(\bar{W}+X)$ Boolean algebra, distributive theorem, another way to move back to POS in this case