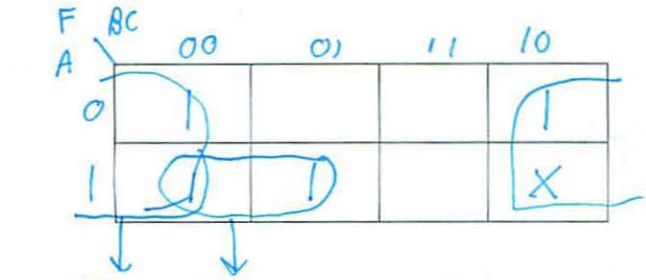
Name Answers

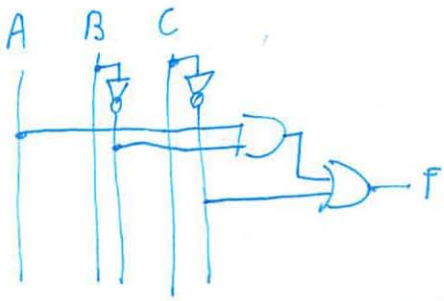
CE-1901 – Dr. Durant – Quiz 5
Fall 2015, Week 5 Quiz

1. (2 points) Let $F(ABC) = \Sigma_m(0,2,4,5) + d(6)$ (that is, m_6 is a don't care). Derive the simplest SOP expression for G using a K-map.



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

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

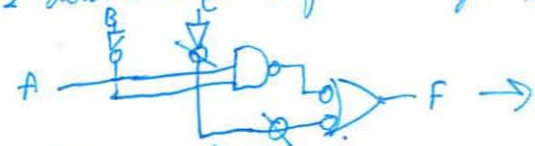


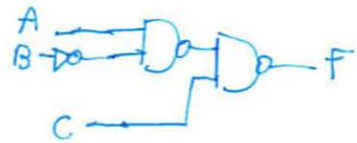
(-1/4) unneeded $\bar{A}$ gate

2

3. ~~(1 point)~~ Re-draw it using just NAND and NOT gates in the most simplified SOP form.

2 double NOTS before OR gives





(-1) wrong gate types

(-1/2) AB not reversed

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

NOT - AND - OR

$2 \times 2 + 6 + 6$

$=$

16

NAND - NOT

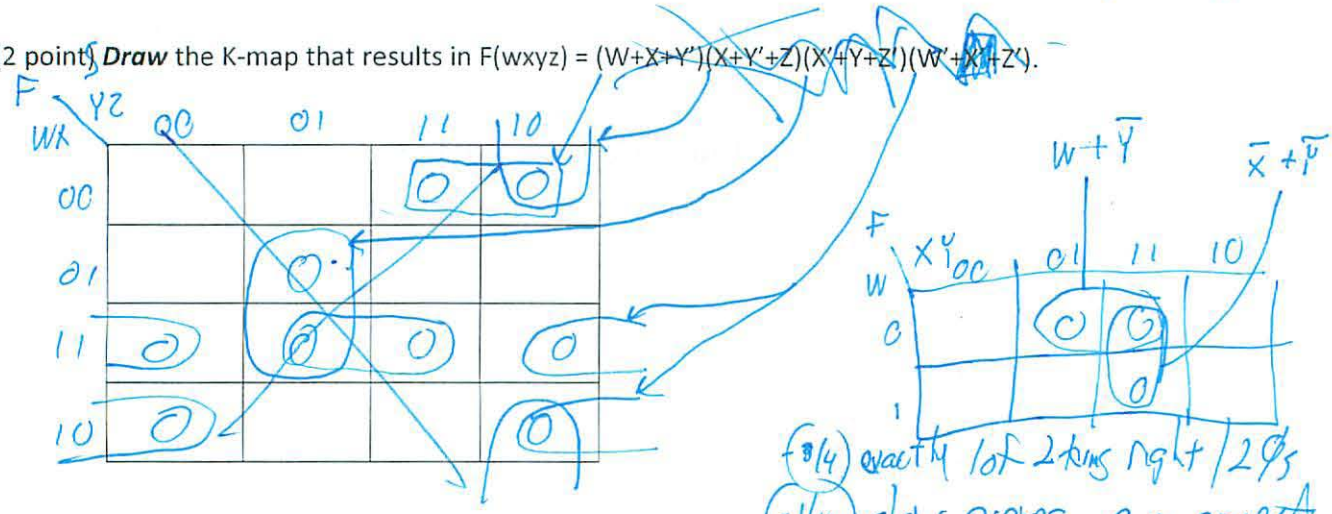
$2 \times 4 + 2$

$=$

10

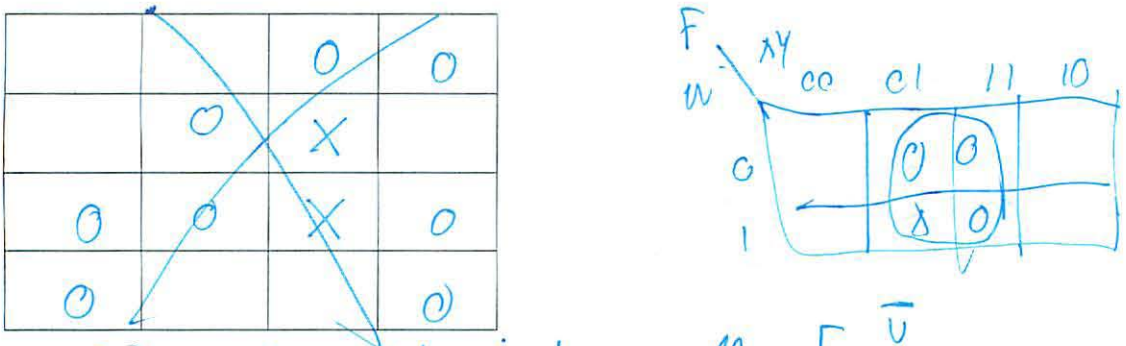
$F(WXYZ) = F = (W+\bar{Y})(\bar{X}+\bar{Y})$

5. (2 point) ***Draw*** the K-map that results in F(wxyz) = (W+X+Y')(X+Y'+Z)(X'+Y+Z')(W'+X'+Z').



(-1/4) exactly 1 of 2 true rows right / 2 Os
(-1/4) skew groups, O.w. correct

6. (2 point) ***Draw*** another map for F and fill in the same 0s as you found above. ***Modify*** your map so that m_5 is a don't care. ***Derive*** the simplified POS expression taking advantage of this change.



(-1/2) correct map, but incorrect groups, small mon $F = \bar{Y}$

7. (1 point) ***Draw*** the circuit for the reduced equation that takes advantage of the don't care.

8. (0 points, just for entertainment) ***How many*** different 3-variable K-maps are possible if no don't cares are used? (That is, how many different ways is it possible to fill the cells of a 3-variable K-map using only 0s and 1s?) How does the answer ***change*** if don't cares are also used?

3 variables → $2^3 = 8$ rows in truth table.
each of 8 rows can have 1 of 2 values, so $2^8 = 256$ possible K-maps

with don't cares
each of 8 rows can have 1 of 3 (0, 1, X) values, so $3^8 = 9^4 = 81^2$
$= 6561$ K-maps