

Name: KEY

Id#

COE 202, Term 141  
Digital Logic Design

Quiz# 2

Date: Thursday, Oct. 16

Q1 Use Boolean algebra to solve the following questions. Show clearly all your steps.

a. Reduce  $F = \bar{W}X\bar{Z} + XW + \bar{W}X\bar{Y}Z + X\bar{W}YZ$  to 1 literal

$$\begin{aligned} &= \bar{W} \times [\bar{Z} + \bar{Y}Z + YZ] + XW \\ &= \bar{W} \times [\bar{Z} + Z(\bar{Y} + Y)] + XW \\ &= \bar{W} \times [\bar{Z} + Z] + XW \\ &= X[\bar{W} + W] = X \end{aligned}$$

b. Reduce  $F = (x + y)(x + \bar{y}) + xyz + \bar{x}y + xy\bar{z}$  to the sum of 2 literal

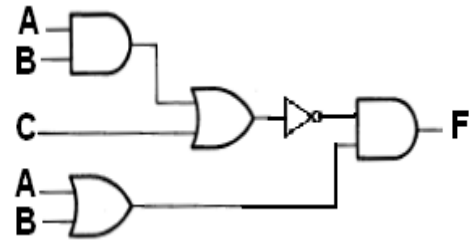
$$\begin{aligned} &= x + x\bar{y} + xy + \underbrace{y\bar{y}}_0 + xyz + \bar{x}y + xy\bar{z} \\ &= x + \bar{x}y \quad \text{by absorption} \\ &= (x + \bar{x}) \cdot (x + y) \quad \text{by distributive law} \\ &= x + y \end{aligned}$$

c. Given  $F = Y + \bar{X}Z + X\bar{Y}$ , Express  $\bar{F}$  as a single minterm

$$\begin{aligned} \bar{F} &= \overline{Y + \bar{X}Z + X} \\ &= \overline{Y + Z + X} \\ &= \bar{X}\bar{Y}\bar{Z} \end{aligned}$$

d. Express F in the logic diagram shown as a function of the input variables.  
Do not do any logic manipulations.

$$F = (\overline{AB + C}) \cdot (A + B)$$



**Q2.** Given the Boolean function  $F(X, Y, Z) = (X + Y)(X + Z)(\bar{X} + \bar{Z})$ :

- Express F as a **sum-of-minterms**,  $F = \sum m$ .
- Find the **algebraic product-of-Maxterms** expression for F.

$$a. F' = X' Y' + X' Z' + X Z = \sum m(0, 1, 2, 5, 7)$$

$$F = \sum m(3, 4, 6).$$

$$b. F = \prod M(0, 1, 2, 5, 7) = (X + Y + Z)(X + Y + \bar{Z})(X + \bar{Y} + Z)(\bar{X} + Y + \bar{Z})(\bar{X} + \bar{Y} + \bar{Z})$$

**Q3.** Given  $F(A, B, C) = \sum m(0, 3, 5, 7)$  and  $G(A, B, C) = \prod M(1, 2, 4, 7)$ , express the function  $F + \bar{G}$  as a sum-of-minterms.

$$\bar{G} = \sum m(1, 2, 4, 7)$$

$$F + \bar{G} = \sum m(0, 1, 2, 3, 4, 5, 7)$$