National Chung Cheng University
Department of Electrical Engineering
Logic Design, Fall 2016

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# Quiz #2

1. Simplify the following Boolean expressions to a minimum number of literals:

   (a) $(X+Y)'(X'+Y')'$ (10%)

   Solutions:

   $(X+Y)'(X'+Y')' = (X'Y')(XY) = (X'X)(Y'Y) = 0$

   (b) $XY'Z' + XY'Z + XY$ (10%)

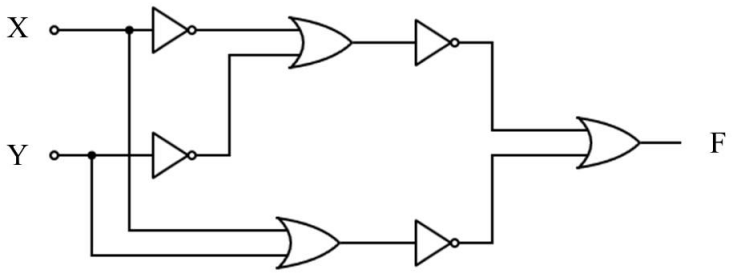
   Solutions:

   $XY'Z' + XY'Z + XY = (XY')(Z'+Z) + XY = XY' + XY = X(X+Y') = X$

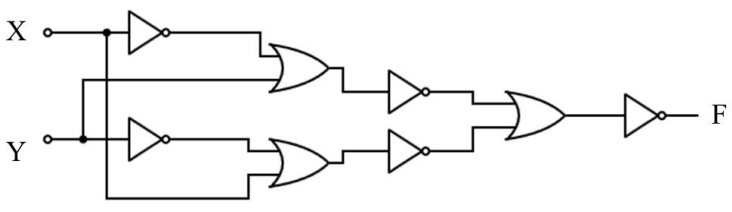
2. Implement the Boolean function $F = XY + X'Y'$ with **OR** and **inverter** gates. (20%)

   Solutions:

   $F = XY + X'Y' = (X'+Y')' + (X+Y)'$




   $F = XY + X'Y' = (X'+Y)(X+Y')$



3. For the function: $F = XY' + XZ' + YZ$:

   (a) Obtain the truth table of ***F***. (10%)

   Solutions:

| X | Y | Z | F |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

   (b) Represent the function in the **sum of minterms** form. (10%)

   Solutions: $F = m_3 + m_4 + m_5 + m_6 + m_7 = X'YZ + XY'Z' + XY'Z + XYZ' + XYZ$

   (c) Represent the function in the **product of maxterms** form. (10%)

   Solutions: $F = M_0M_1M_2 = (X + Y + Z)(X + Y + Z')(X + Y' + Z)$

4. Obtain the truth table of $F = X \oplus Y$. (10%)

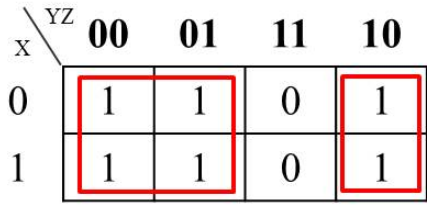
   Solutions:

| X | Y | F |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

5. Determine whether the Boolean equation is **true** or **false**:

(a) $X'Z' + XZ' + Y'Z = Y' + YZ'$ (10%)

Solutions:



| X \ YZ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 |

OR

$F_0 = X'Z' + XZ' + Y'Z$
$F_1 = Y' + YZ'$

| X | Y | Z | $F_0$ | $F_1$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 |

ANS = **true**

(b) $XZ' + Y'Z' + Y'Z = XYZ' + X'Y' + XY'$ (10%)

Solutions:

| X \ YZ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 |

OR

$F_0 = XZ' + Y'Z' + Y'Z$
$F_1 = XYZ' + X'Y' + XY'$

| X | Y | Z | $F_0$ | $F_1$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 |

ANS = **true**