

Name: KEY

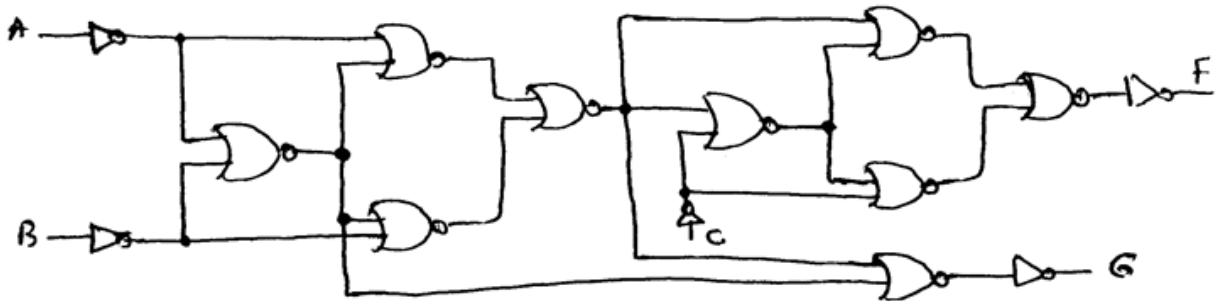
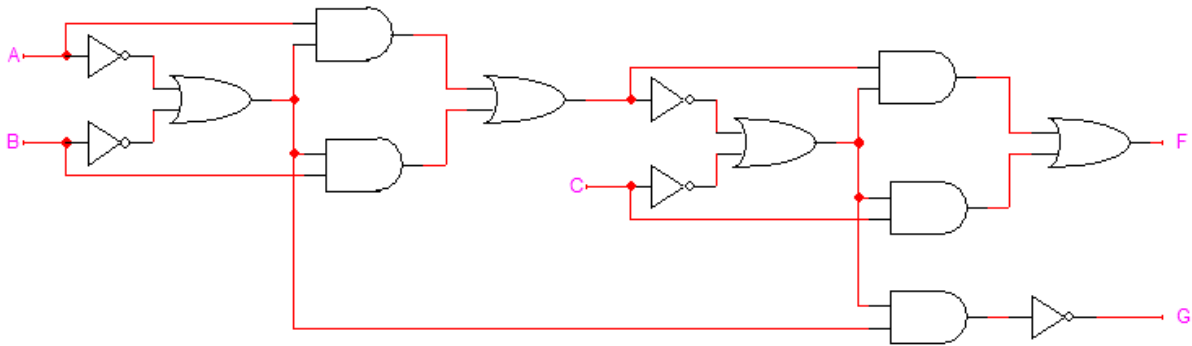
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COE 202, Term 142
Digital Logic Design

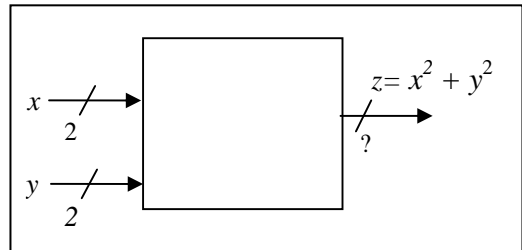
Quiz# 4

Date: Thursday, April 2, 2015

Q1 Convert the AND/OR/NOT logic diagram shown below to a NOR logic diagram.



Q2 A logic circuit has two inputs x & y each is a 2-bit unsigned number. It has an output number z such that $z = x^2 + y^2$.



- What is the minimum number of bits required for the output number z ?
- Construct the truth table of the circuit.
- Derive the Boolean expressions of the two least significant output bits (z_0, z_1) using basic logic gates.

a. $\text{Max}(z) = (3)^2 + (3)^2 = 18 \rightarrow$ Requires 5-Bits \rightarrow Outputs : $Z_4 Z_3 Z_2 Z_1 Z_0$

| | | | | | |
|-----------|-----------|----|----|----|----|
| | $y_1 y_0$ | 00 | 01 | 11 | 10 |
| $x_1 x_0$ | 00 | 0 | 1 | 1 | 0 |
| | 01 | 1 | 0 | 0 | 1 |
| | 11 | 1 | 0 | 0 | 1 |
| | 10 | 0 | 1 | 1 | 0 |

| | | | | | |
|-----------|-----------|----|----|----|----|
| | $y_1 y_0$ | 00 | 01 | 11 | 10 |
| $x_1 x_0$ | 00 | 0 | 0 | 0 | 0 |
| | 01 | 0 | 1 | 1 | 0 |
| | 11 | 0 | 1 | 1 | 0 |
| | 10 | 0 | 0 | 0 | 0 |

$$Z_0 = \bar{x}_0 y_0 + \bar{y}_0 x_0$$

$$= y_0 \oplus x_0$$

$$Z_1 = y_0 x_0$$

| x_1 | x_0 | y_1 | y_0 | Z_4 | Z_3 | Z_2 | Z_1 | Z_0 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |