School of Electrical Engineering & Telecommunications

ELEC1111 Tutorial

Topic 10: Digital Logic Circuits

1. Convert the following unsigned binary numbers to decimal:
   1. 101
   2. 10111
   3. 1101

2. Convert the following decimal numbers to binary:
   1. 9
   2. 45
   3. 255

3. How many binary digits are required to allow a variable to range between 0 and 1000?

4. Write a Boolean expression for the following statement: "Z is TRUE if either A or B is FALSE, otherwise Z is FALSE". Write a truth table for this expression.

5. Consider the functions X(A,B,C) and Y(A,B,C) specified in the truth table

A	B	C	$X(A,B,C)$	$Y(A,B,C)$
0	0	0	1	0
0	0	1	0	0
0	1	0	0	0
0	1	1	0	1
1	0	0	1	0
1	0	1	1	1
1	1	0	0	1
1	1	1	1	1

   1. Write a logic expression corresponding to the functions $X(A,B,C)$ and $Y(A,B,C)$.
   2. Implement $X(A,B,C)$ using logic gates.
   3. Implement $Y(A,B,C)$ using logic gates.
   4. Using DeMorgan's Theorem, implement $X(A,B,C)$ using only two-input NAND gates.

6. Complete the truth tables of the following logic equations:
    1. Output = $A \cdot \overline{B}$
    2. Output = $A \cdot \overline{B} \cdot C$
    3. Output = $\overline{A} + B$
    4. Output = $A \cdot \overline{B} + C$

7. Draw the logic diagrams which represent the function of these logic equations using NAND Gates only:
    1. Output = $A \cdot \overline{B}$
    2. Output = $A \cdot \overline{B} \cdot C$
    3. Output = $\overline{A} + B$
    4. Output = $A \cdot \overline{B} + C$

8. Draw the logic diagram which represent the function of this logic equation
   $X = A \cdot \overline{B} \cdot C + A \cdot B \cdot \overline{C}$