TUTORIAL 3: Logic Gates Overview

1. For a 2-input NOR gate functioning as a negative-AND gate, output X is HIGH if both inputs A and B are HIGH.

   FALSE

   TRUE / FALSE

2. A two-input XNOR gate will produce a HIGH output when both inputs are equal.

   TRUE A=0, B=0 X=0+1=1 A=1, B=1 X=1+0=1

   TRUE / FALSE

3. A NOR gate with inverters at the inputs has the same logic function as an AND gate. $\overline{\bar{A}+\bar{B}} = AB$

   TRUE

   TRUE / FALSE

4. A 2-input NAND gate and a 2-input NOR gate produces the same output when both inputs are HIGH. X=0 X=0

   TRUE

   TRUE / FALSE

5. The _____ gate produces a HIGH output when all inputs are LOW.

   a. NOR

   b. NAND

   c. XOR

   d. AND

6. A 2-input logic gate **X** produces a HIGH output when input A is LOW and input B is HIGH. Which of the following is **NOT** logic gate **X**? OR

   a. OR 0 1 1

   b. NOR 0 1 0

   c. NAND 0 1 1

   d. XOR 0 1 1

7. Complete the following questions:

   i) Draw the logic symbol of an XOR gate.

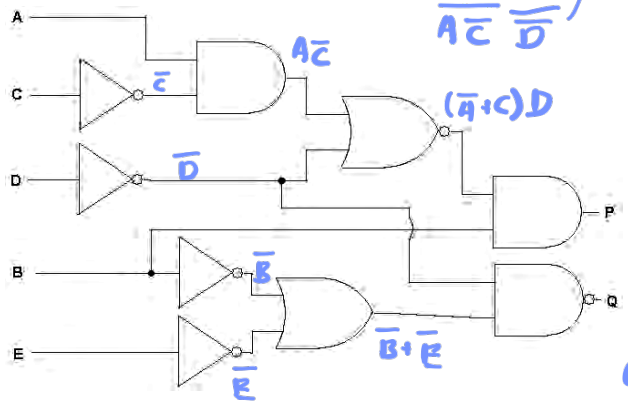
   ii) Give appropriate labels to the inputs and output.

   iii) Write its truth table.

iii)

A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

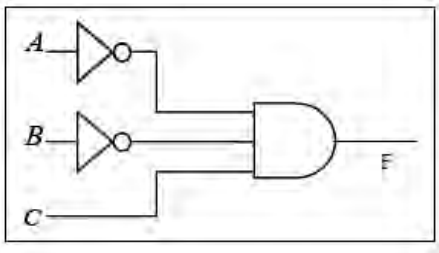
8. Write the Boolean expressions of output P and Q.

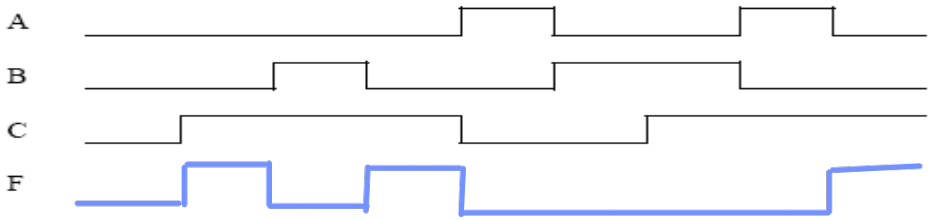


P = ? $(\bar{A}+C)BD$

Q = ? $BE+D$

9. Complete the timing diagram based on the given input for the following logic diagram.





10. Draw symbol for the following gates:

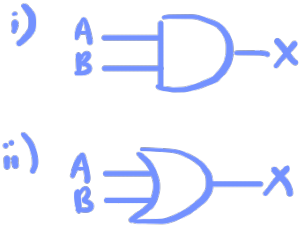
i) 2-input AND gate

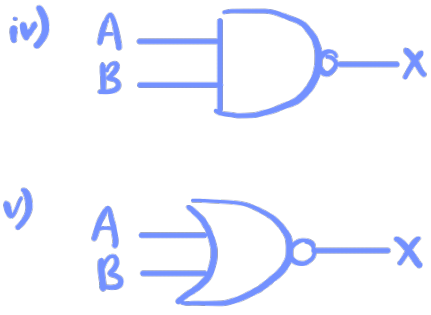
ii) 2-input OR gate

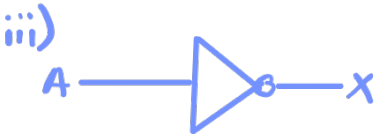
iii) Inverter

iv) 2-input NAND gate

v) 2-input NOR gate







11. Given an AND gate with 3 inputs, what should the input values be to get an output of 1 (HIGH)? All high input (1)

12. Given an OR gate with 3 inputs, what should the input values be to get an output of 1 (HIGH)? At least 1 high input (1)

13. Fill in the table below, follow the example given.

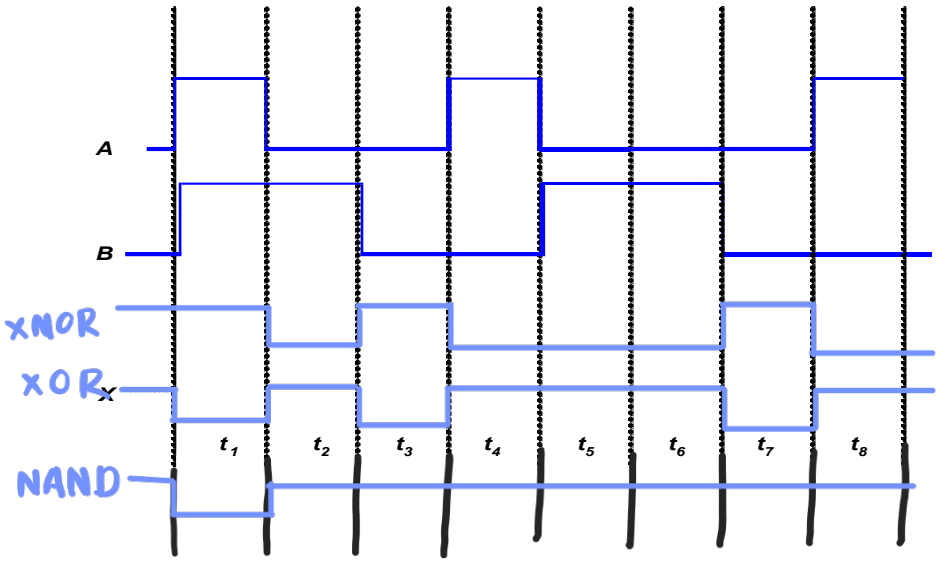
Gate	Input			Output
	A	B	C	
AND	1	0	1	$X = ABC = 0$
OR	0	1	0	$X = A + B + C = 1$
AND	1	1	1	$X = ABC = 1$
OR	0	0	0	X = A + B + C = 0 + 0 + 0 = 0
NOR	1	1	1	$X = \overline{A} + \overline{B} + \overline{C} = 0$
AND	1	0	0	$X = ABC = 0$

14. Given the input waveform(s) below, show the appropriate output waveform, ***X***, with a timing diagram.

    i) XNOR

    ii) XOR

    iii) NAND



15. Identify the following devices according to logic function:

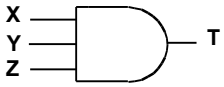
i) 74LS04 Hex inverter

ii) 74ALS10 Triple 3-input NAND gate

iii) 74HC00 Quad 2-input NAND gate

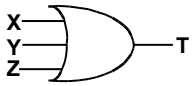
16. Given the logic gates below, write the logic expression for it.

i)



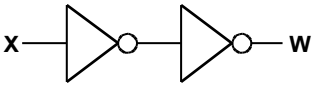
$T = XYZ$

ii)



$T = X + Y + Z$

iii)



$W = \overline{\overline{X}}$

$= X$