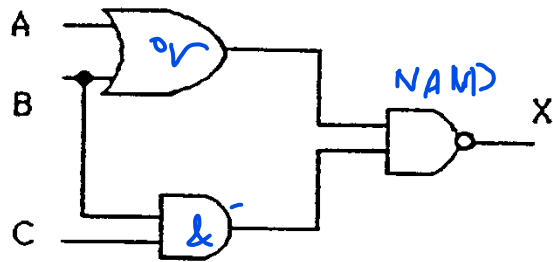
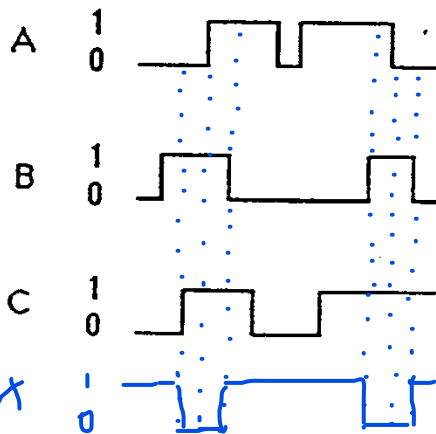


SC1005 Digital Logic Tutorial 2

Logic gates and Boolean algebra

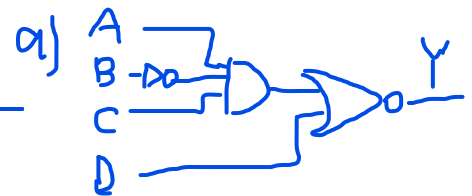
1. From the following figure,

- Express X as a Boolean function of inputs A, B and C.
- Sketch the output waveform at point X.



2. A logic circuit's output expression is $Y = [(A B' C) + D]'$.

- Draw the logic circuit diagram for Y.
- Construct the truth table for the circuit.



3. Simplify the following expressions using Boolean algebra:

- $X = A'B'C'D' + A'B'CD' + A'BCD' + ABCD' + AB'CD'$
- $X = [AB(C+D)'AB]'$
- $X = A(AB)' + A'B'C + ABC$

Hand-drawn truth table for the circuit in question 2:

A	B	C	D	Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

4. Show using Boolean algebra that the following equation is true:

$$AB + ABC'D + ABDE' + A'BC'E + A'B'C'E = AB + A'C'E$$

5. Implement the function $(A+B)(C+D)$ using only

- Two-input NAND gates
- Two-input NOR gates

Answers

1. (a) $X = [(A + B) B C]'$
2. (b) There are 7 1's in the Y column of the truth table
3. a) $X = A'B'D' + CD'$
b) $X = A' + B' + C + D$
c) $X = AB' + AC + B'C$
5. a) 8 two-input NAND gates needed.
b) 3 two-input NOR gates needed.