Department of Computer Science and Engineering
BRAC University
CSE 260: Digital Logic Design

Experiment # 2

Universal Gates and Applications of Boolean algebra

Objective:

- To investigate the rules of Boolean algebra.
- To gain experience working with practical circuits
- To simplify a complex function using Boolean algebra

Required Components and Equipments

1. AT-700 Portable Analog/Digital Laboratory
2. 7400×1

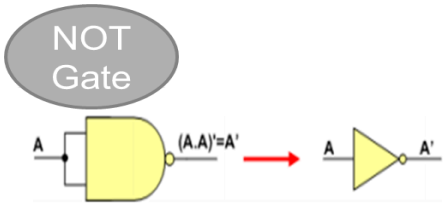
Mandatory Readings:

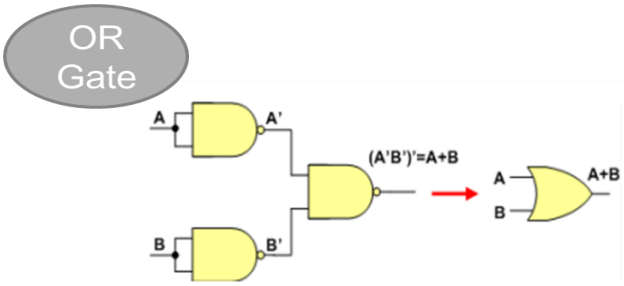
BOOLEAN THEOREMS

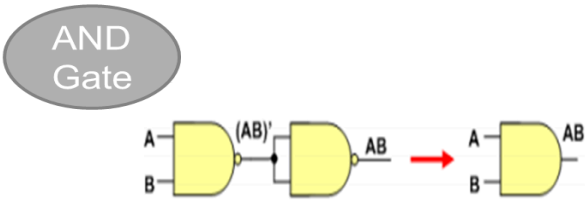
1. x.0=0
2. x.1=x
3. x.x=x
4. $x.\overline{x}$ =0
5. x+0=x
6. x+1=1
7. x+x=x
8. $x+\overline{x}$ =1
9. x+y=y+x (Commutative laws)
10. x.y=y.x (Commutative laws)
11. x+(y+z)=(x+y)+z=x+y+z (Associative laws)
12. x(yz)=(xy)z=xyx (Associative laws)
13. (w+x)(y+z)=wy+xy+wz+xz
14. x+xy=x
15. $x+\overline{x}y=x+y$
16. $\overline{x}+xy=\overline{x}+y$
17. $\overline{x+y}=\overline{x}.\overline{y}$ (DeMorgan's Theorem)
18. $\overline{x.y}=\overline{x}+\overline{y}$ (DeMorgan's Theorem)

Diagram of Circuit:

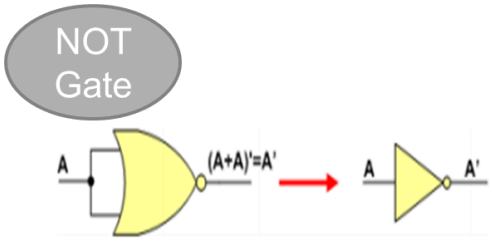
Building Basic Gates using Universal [NAND] Gates:

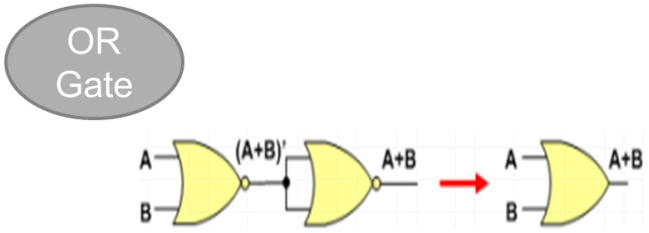






Building Basic Gates using Universal [NOR] Gates:





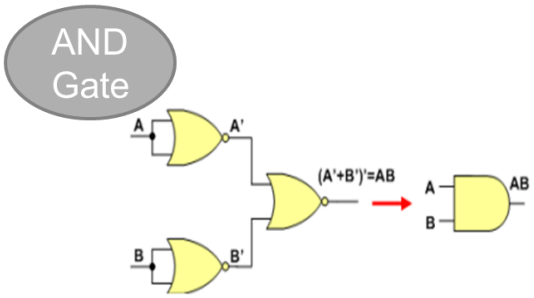


Diagram 1: Building Circuit using Universal Gates [NAND]:

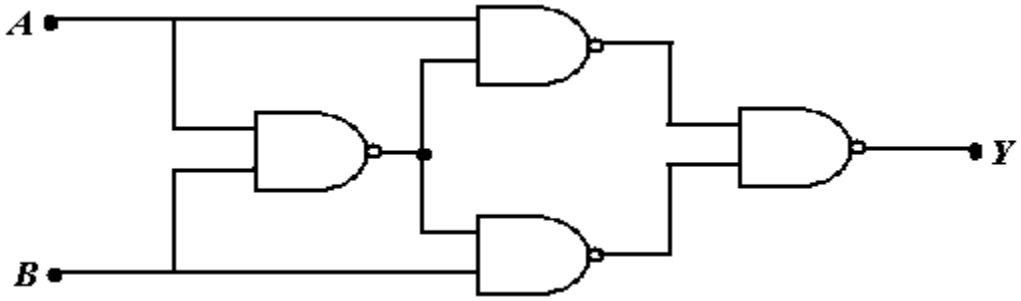
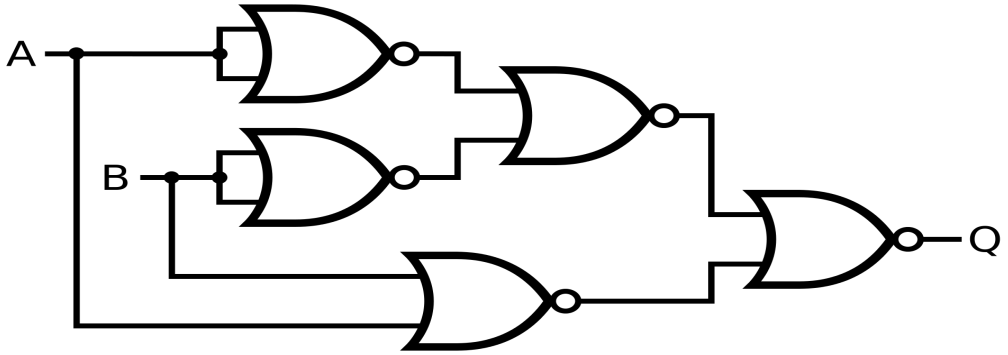


Diagram 2: Building Circuit using Universal Gates [NOR]:



Procedure:

- Construct the Circuit of Figure 1, on the breadboard of AT-700.
- Remember each IC's pin 14 connected to "+5V" position of DC Power Supply of AT-700, and pin 7 connected to "GND" position.
- Connect the inputs to Data switches and outputs to any position of LED Display.
- Find out the outputs for all possible combinations of input states.
- Write down the input-output in tabular form.

Report:

The report should cover the followings

1. Name of the Experiment
2. Objective
3. Required Components and Equipments
4. Experimental Setup (Draw diagram 1 and 2)
5. Results (Truth Table) and Discussions .The discussions part must include the answers of the following questions:
    - What is the Boolean Equation for the output (for both diagrams)?
    - Simplify the Boolean equations (for both diagrams).
    - The circuits' functions are identical to two single gates. Write down the name of those gates.
    - Implement the following function using NAND gate only: (A(AB+CD))'. Do not simplify the function. Draw the diagram only.