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

Experiment # 2: Universal Gates, 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:

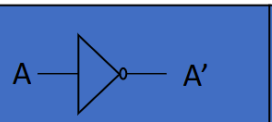
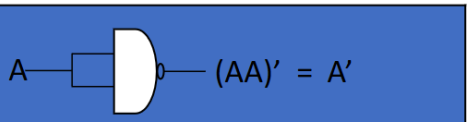
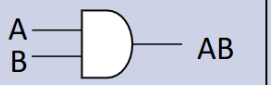
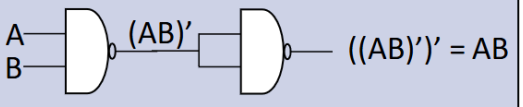
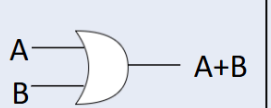
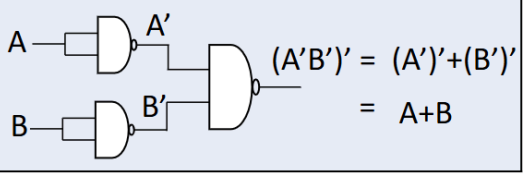
1. IC 7400 × 1
2. IC 7402 x 2

Boolean Postulates & Theorems:

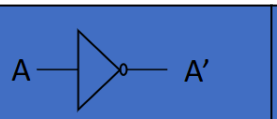
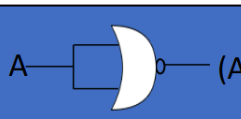
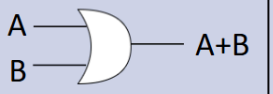
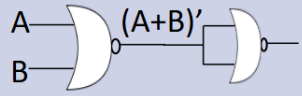
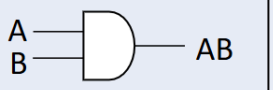
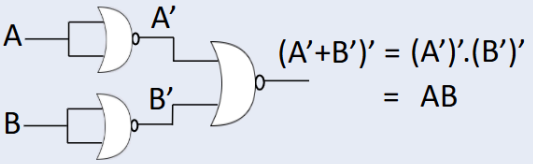
Postulate 2:	(a) x + 0 = x	(b) x . 1 = x
Postulate 3: Commutative	(a) x + y = y + x	(b) x . y = y . x
Postulate 4: Distributive	(a) x(y+z) = xy + xz	(b) x + yz = (x+y).(x+z)
Postulate 5:	(a) x + x' = 1	(b) x . x' = 0
Theorem 1:	(a) x + x = x	(b) x . x = x
Theorem 2:	(a) x + 1 = 1	(b) x . 0 = 0
Theorem 3: Involution	(x')' = x	
Theorem 4: Associative	(a) x+(y+z) = (x+y) +z	(b) x.(y.z) = (x.y).z
Theorem 5: DeMorgan	(a) (x + y)' = x' . y'	(b) (xy)' = x' + y'
Theorem 6: Absorption	(a) x + xy = x	(b) x. (x + y) = x

Diagrams:

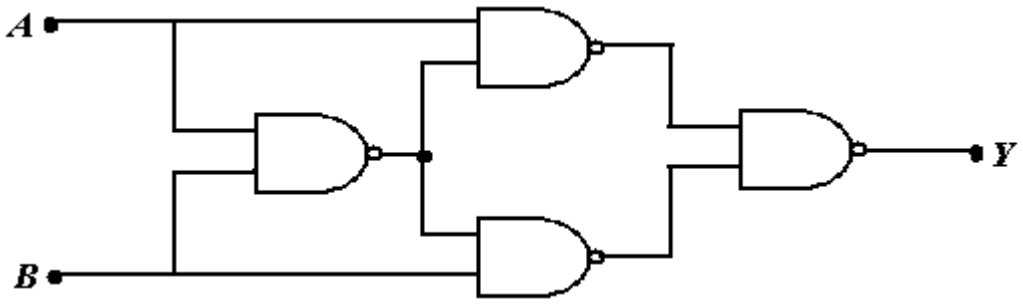
Building basic gates using Universal (NAND) Gate(s):

Not		
And		
Or		

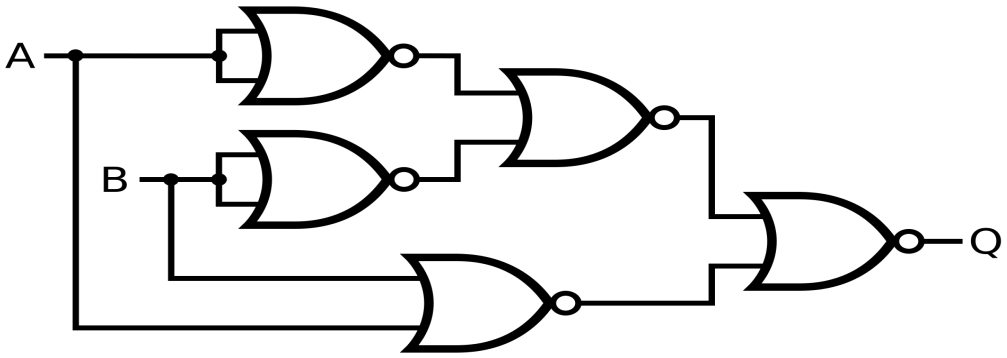
Building basic gates using Universal (NOR) Gate(s):

Not		
Or		
And		

Circuit Diagram - 1:



Circuit Diagram - 2:



Procedure:

- Construct the Circuit Diagram - 1 on the breadboard.
- Remember to connect each IC's VCC pin to the "+5V" position of the DC Power Supply of the trainer board, and the GND or 0V pin to the "GND" position of the trainer board.
- Connect the inputs to the Data switches and outputs to any position of the LED Display.
- Find out the outputs for all possible combinations of input states.
- Write down the input-output in tabular form.

Report:

Your report must have the following segments:

1. Name of the Experiment.
2. Objective.
3. Required Components.
4. Experimental Setup - Draw the Circuit Diagram 1 and 2.
5. Results - Detailed Truth Table of both circuit diagrams.
6. Discussions - Answer the following questions:
   a)What is the Boolean Equation for the output (for both circuit diagrams)?
   b) Simplify the Boolean equations using Boolean algebra (for both diagrams).
   c) The circuits' functions are identical to two single gates. Write down the name of those gates.
   d) Implement the following function using NAND gate only: (A+(AB+CD))'. Do not simplify the function. Draw the circuit diagram only.