Experiment number: 02

Name of the experiment : Universal gate and applications Of boolean algebra

Group number : 03

Group members names and Ids:

1. Md.Abu Hanif Siam . (21301755)
2. Vaskor Debnath. (21301211)
3. Mahmud Ferdous. (21301401)
4. Md.Tasnim Muttaki. (21101216)

BRAC
UNIVERSITY

Inspiring Excellence

Experiment number: 02

Name of the experiment : Universal gate and applications Of boolean algebra

Group number : 03

Group members names and Ids:

1. Md.Abu Hanif Siam . (21301755)
2. Vaskor Debnath. (21301211)
3. Mahmud Ferdous. (21301401)
4. Md.Tasnim Muttaki. (21101216)

Name of the Experiement: Universal gates and and applications of boolean algebra.

Objective:

i) Investigate the rules of boolean Algebra.

ii) Gain experience working with practical circuits

iii) Simplify a complex function using boolean algebra

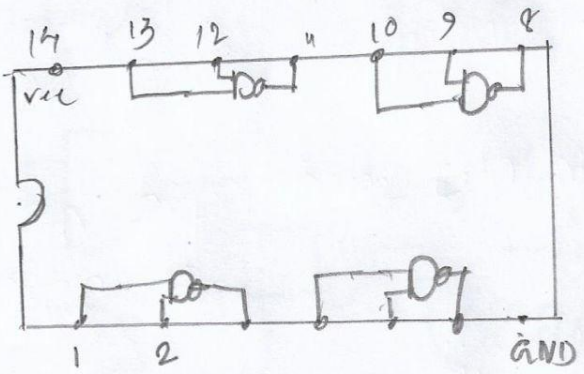
Required Components and Equipment:

i) AT-X00 Portable Analog / Digital Laboratory.

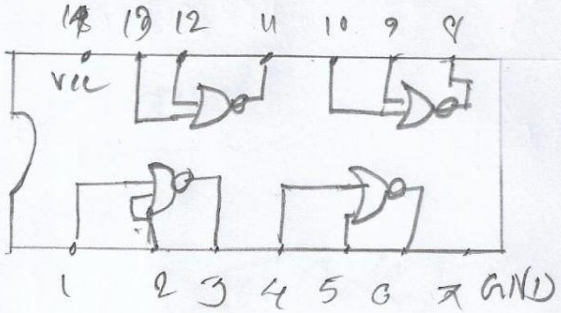
ii) 74801

Experimental setup

1) Nand Gate based logic IC

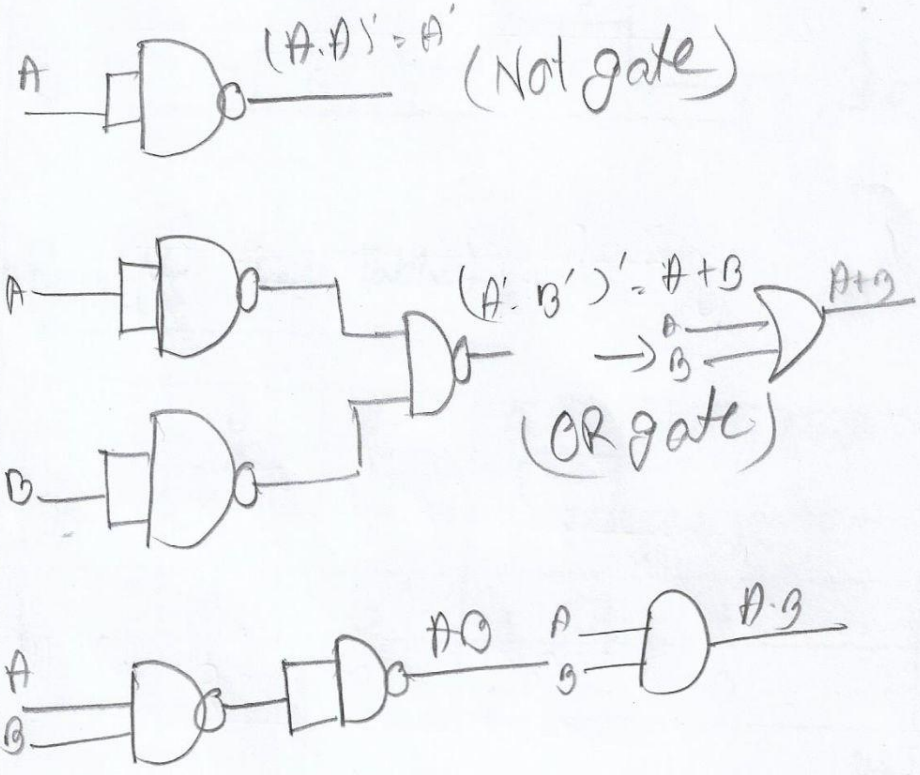


11) Nor gate based IC

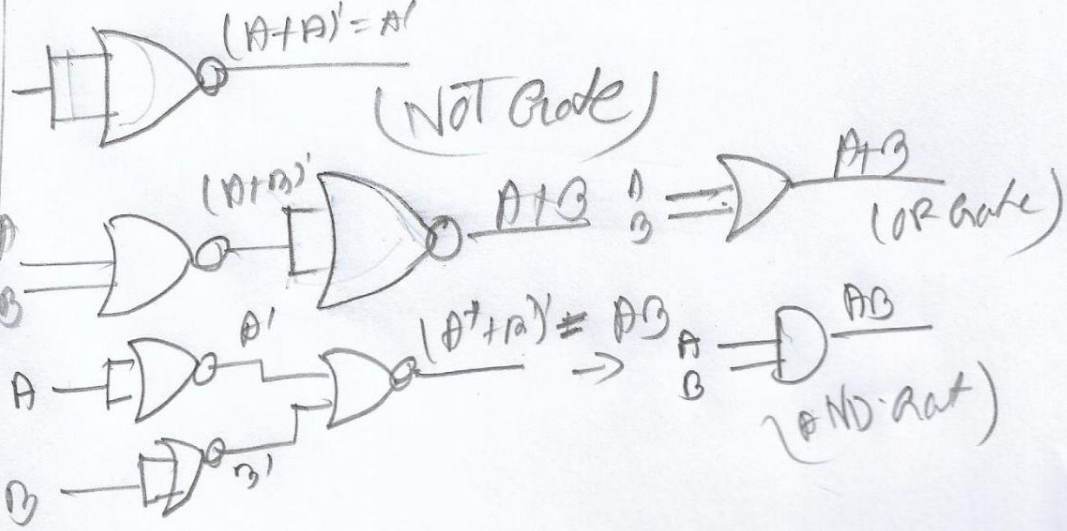


Circuit Diagram

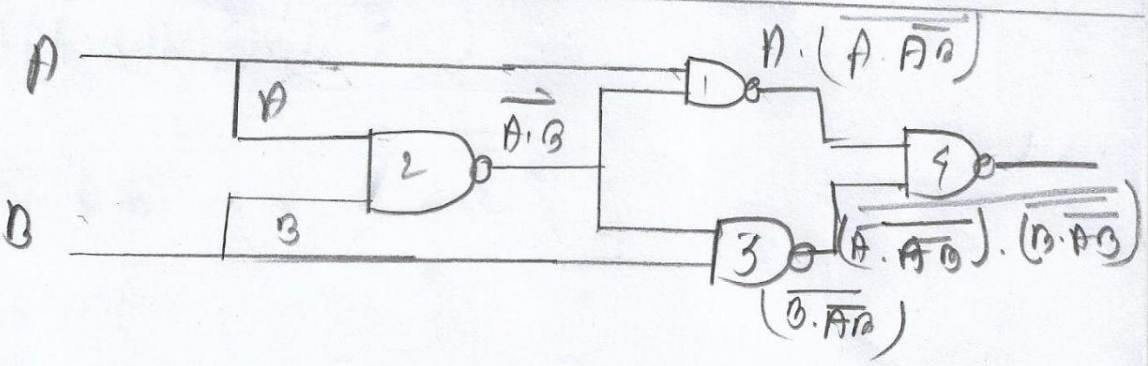
i) Nand Gate based:



ii) Nor Gate based:



Building a circuit with a universal gate (Nand):



Results (Truth Table)

A	B	$\overline{A}$	$\overline{B}$	$(\overline{A \cdot (\overline{AB})}) \cdot (\overline{B \cdot (\overline{AB})})$
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0

Simplification

$$\overline{(A.\overline{(AB)}).(B.\overline{AB})}$$

$$\Rightarrow \overline{A.\overline{AB}} + \overline{B.\overline{AB}}$$

$$\Rightarrow A.\overline{AB} + B.\overline{AB}$$

$$\Rightarrow \overline{AB}(A+B)$$

$$\Rightarrow (\overline{A}+\overline{B})(A+B)$$

$$\Rightarrow \overline{A}A + \overline{A}B + A\overline{B} + \overline{B}B$$

$$\Rightarrow \overline{A}B + A.\overline{B}$$

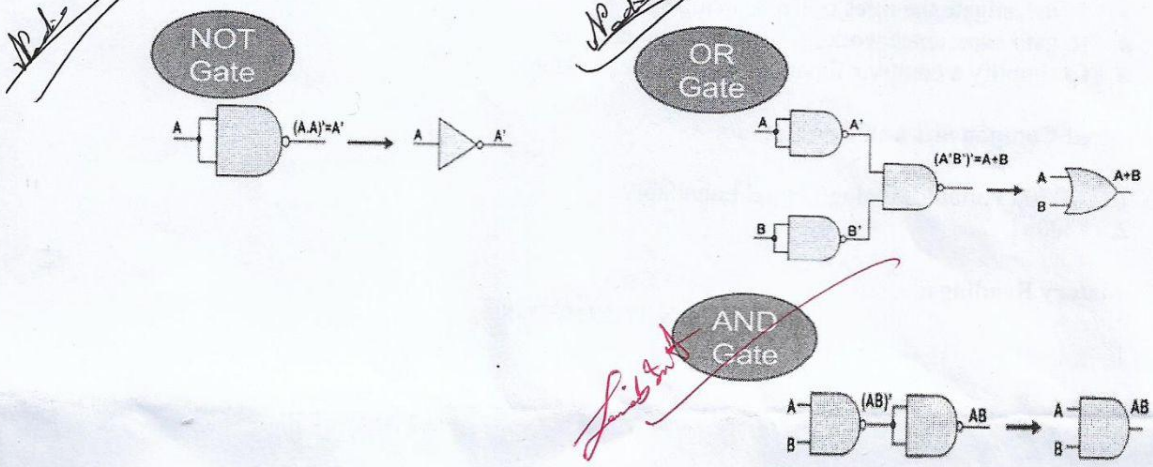
$$\Rightarrow A \oplus B$$

Discussion:

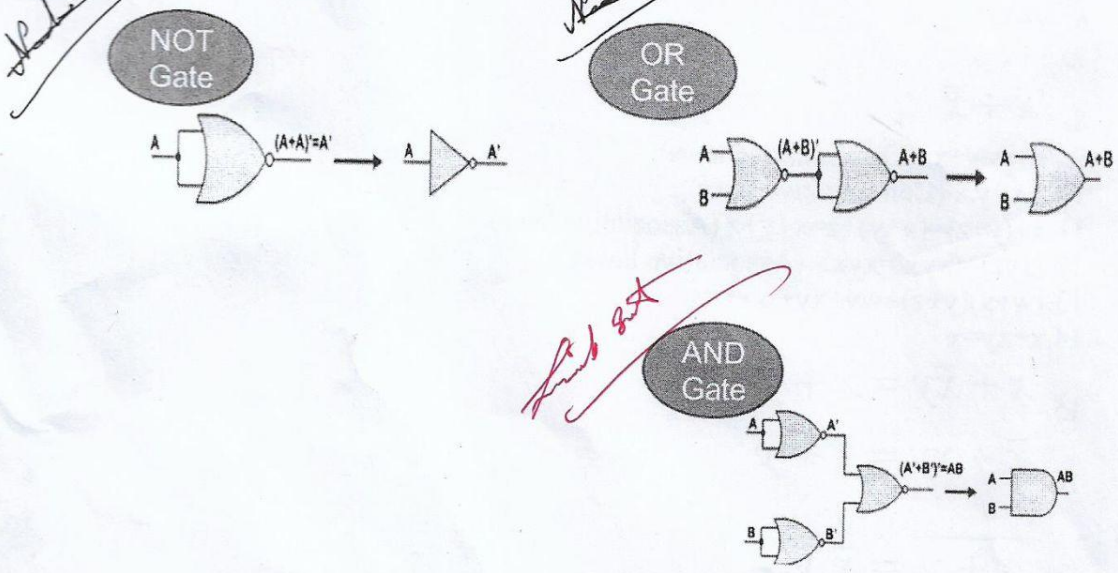
During the experiment, we noticed Nand gates in the IC. Each of it has 2 inputs. The final equation was $(\overline{A.(\overline{A.B})}).(\overline{B(\overline{A.B})})$. and it is identical to x-or gate.

Diagram of Circuit:

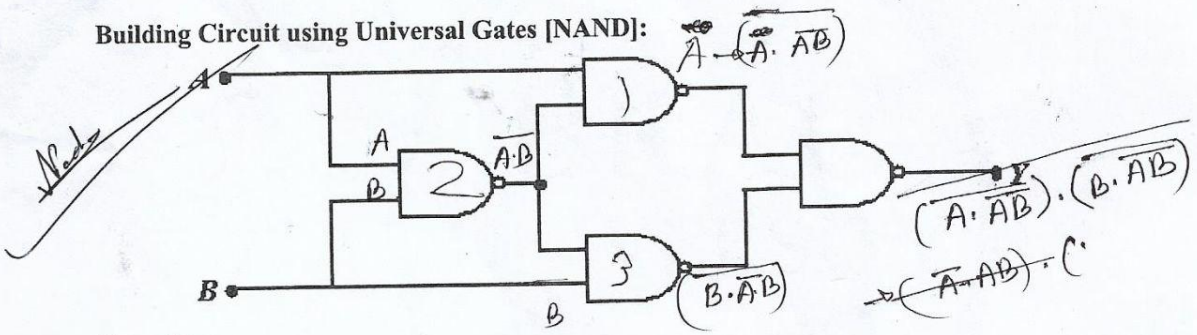
Building Basic Gates using Universal [NAND] Gates:



Building Basic Gates using Universal [NOR] Gates:



Building Circuit using Universal Gates [NAND]:



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 (You must draw the IC configurations)
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?
   - Simplify the Boolean equation.
   - The circuit's function is identical to a single gate. Write down the name of that gate.

$$\overline{(\overline{A\cdot\overline{AB}})\cdot(\overline{B\cdot\overline{AB}})}$$

$$= \overline{\overline{A\cdot\overline{AB}}} + \overline{\overline{B\cdot\overline{AB}}}$$

$$= A\cdot\overline{AB} + B\cdot\overline{AB}$$

$$= \overline{AB}\,\overline{AB}(A+B)$$

$$= (\overline{A}+\overline{B})(A+B)$$

$$= \overline{A}A + \overline{A}B + A\overline{B} + \overline{B}B$$

$$= \overline{A}B + A\overline{B}$$

$$= A \oplus B$$

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0