

North South University
Department of Electrical & Computer Engineering
LAB REPORT

Course Name: **CSE231L**

Experiment No: 02

Experiment Name: **Universal Gates**

Experiment Date: 17 November 2020

Report Submission Date: 22 November 2020

Section: 05

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Score

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Remarks:

LAB-02: Universal Gates

Objectives:

1. To understand the concept of Universal Gates (NAND & NOR)
2. To learn using universal gates how to implement the basic logic gates
3. To learn using universal gates implementation of Boolean function
4. To understand gate level minimization

Apparatus:

- IC 7400 Quadruple 2-input NAND gates
- IC 7400 Quadruple 2-input NAND gates
- Logisim

Theory:

Universal Gates: The **NAND** (NOT AND) and **NOR** (NOT OR) gates are **universal** gates.

A universal gate is a gate which can implement any Boolean function without need to use any other gate type. That means we can build every possible logic function with NAND gates or NOR gates.

Circuit Diagram:

Figure F1: Implementation of XOR and XNOR using NAND gates

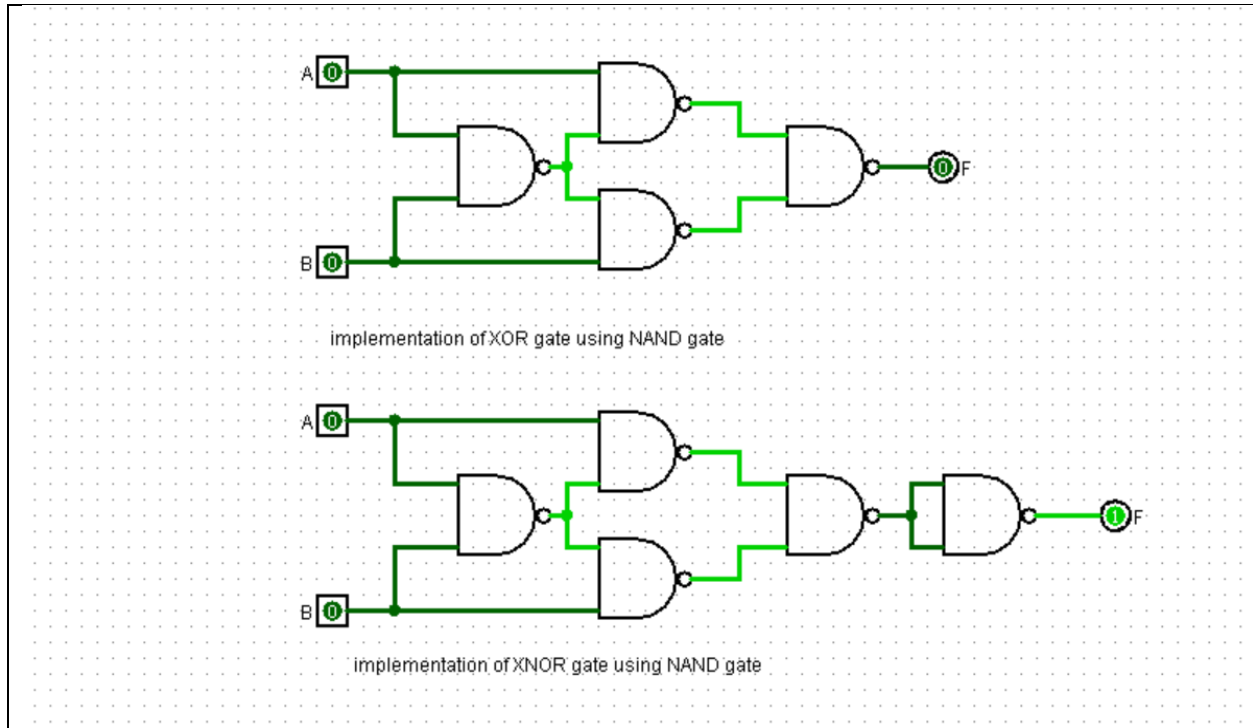
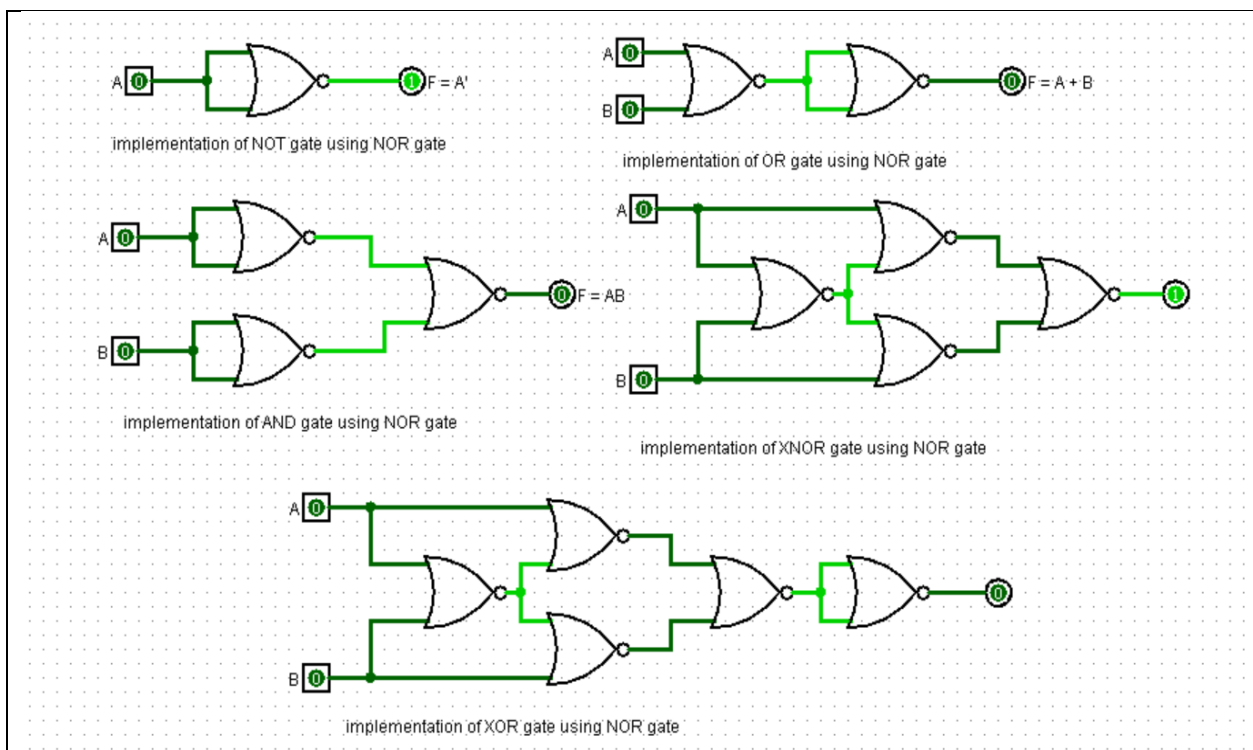


Figure F2: implementation of NOT, AND, OR, XOR and XNOR using NOR gates



Data Table:

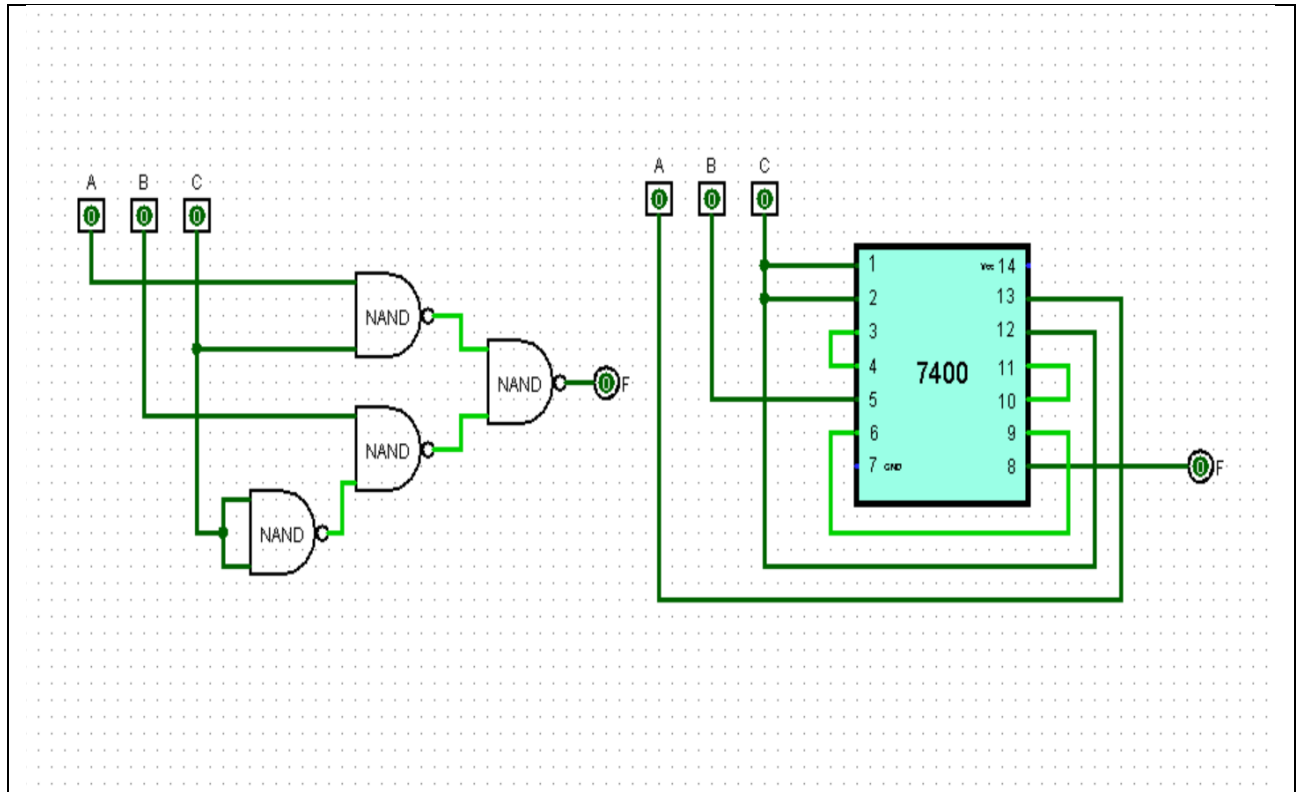
Table 01: Truth table of the given circuit using universal gates

A	B	C	$I_1 = AC$	$I_2 = BC'$	$F = I_1 + I_2$
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	0	1	1
0	1	1	0	0	0
1	0	0	0	0	0
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	1	0	1

Question and Answer:

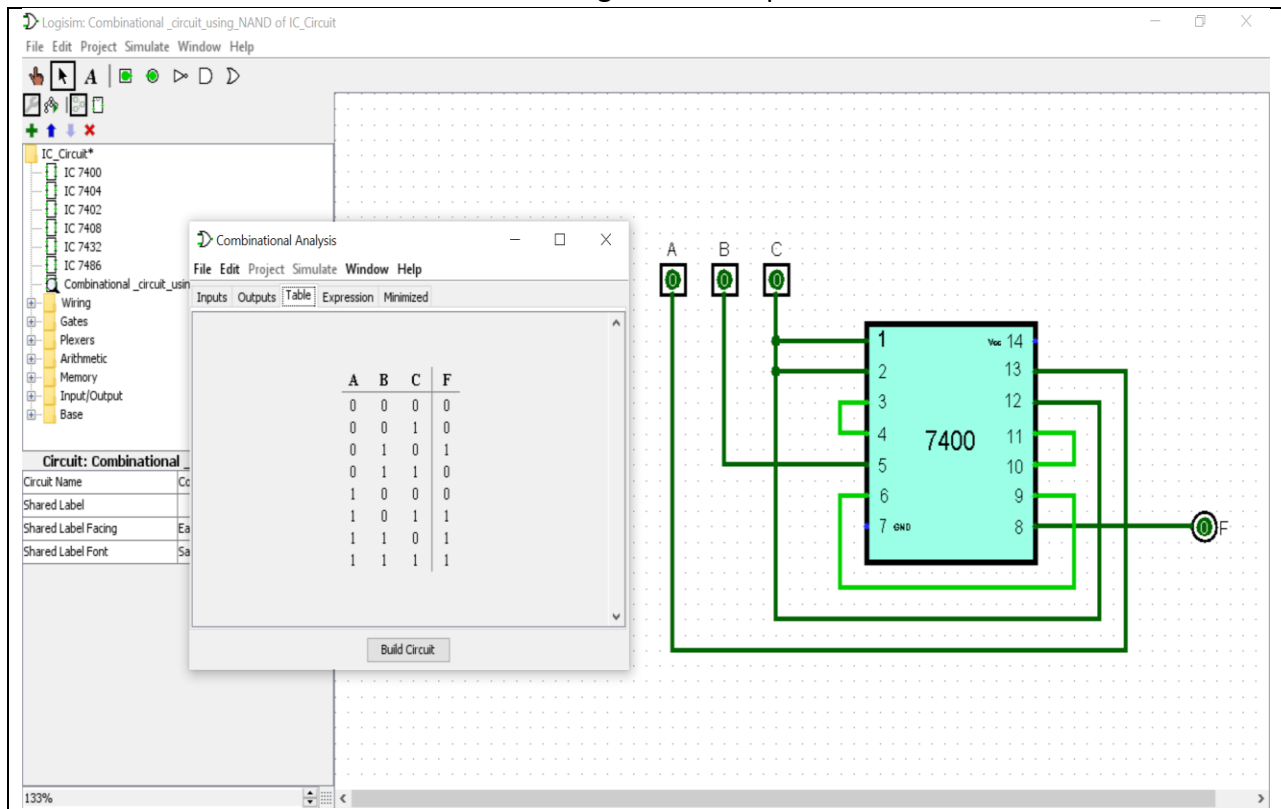
Answer to Question No. 01:

IC diagram from the circuit in Figure F3 –Step 2 in Lab Manual



Answer to Question No. 02:

Simulation of the circuit in Figure F3 – Step 2 from Lab Manual



Experiment-03:

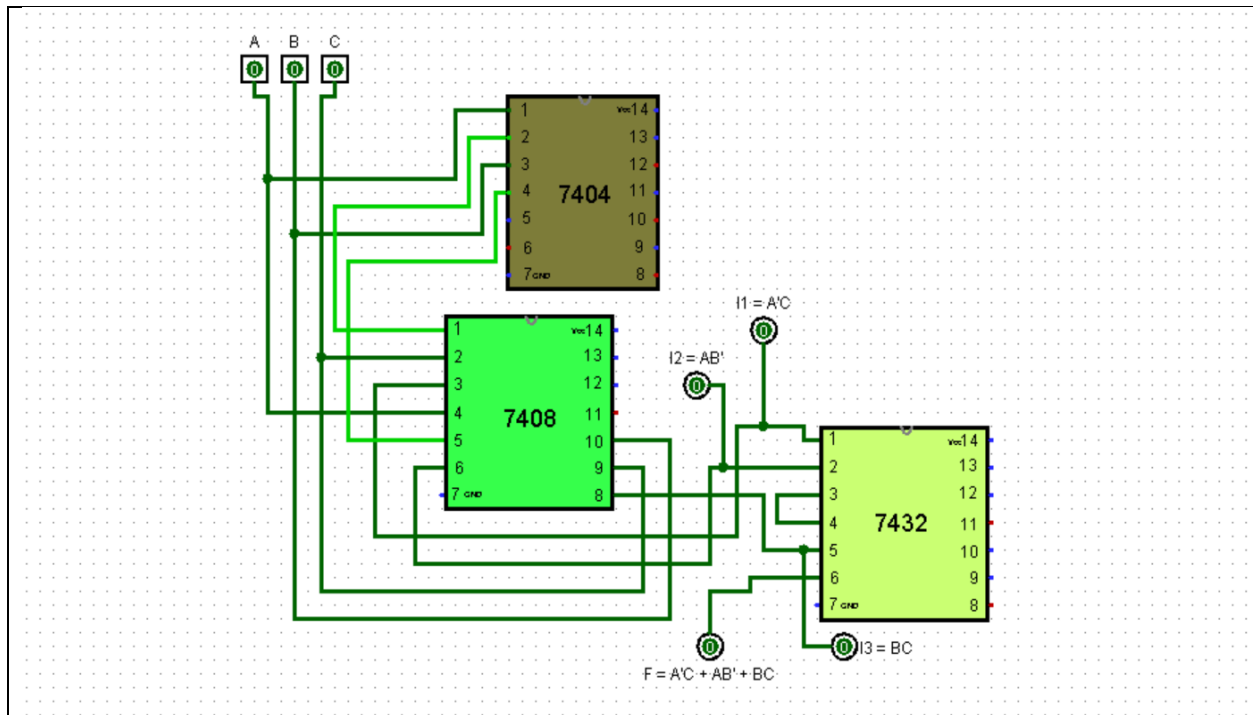
Truth table for the given Boolean function $F = A'C + AB' + BC$.

A	B	C	$I_1 = A'C$	$I_2 = AB'$	$I_3 = BC$	$F = I_1 + I_2 + I_3$
0	0	0	0	0	0	0
0	0	1	1	0	0	1
0	1	0	0	0	0	0
0	1	1	1	0	1	1
1	0	0	0	1	0	1
1	0	1	0	1	0	1
1	1	0	0	0	0	0
1	1	1	0	0	1	1

Experiment-03:

Attach Screenshot of the IC circuit of the Boolean function $F = A'C + AB' + BC$

IC diagram of the (Circuit)



Discussion: First, we build an IC circuit of the Boolean function $F = A'C + AB' + BC$ using 7404, 7408, and 7432 IC for our previous lab (Lab 01).

Then, we started working on Lab 02. The experiment name was universal gates. We discussed the concept of universal gates and build the basic logic gates using the universal gates (NAND & NOR) in Logisim. We did some gate-level minimization to make those gates. At last, we finished our lab by building the same combinational circuit from figure D2 using the NAND gate.