

CE2120-Digital Systems Lab

Lab 1

I. Objectives

The objective of this lab is to give the students a good experience in working with logic gates (AND, OR, inverter) for designing, wiring, and testing logic circuits.

II. Pre-requisite

Please watch the following video to prepare for this lab:

<https://gjuedujo.sharepoint.com/:v:/s/CE212-DigitalSystems-Section1-Summer2021/EXxtl8jPU8BDsvq6lhgl7JYBGblc439g1Ju6jl13lqspDw?e=3rh9IU>

III. Theory

A Boolean variable can take one value at a time, specifically either 1 (true) or 0 (false). By applying the basic set of operations (AND, OR, and Invert) to one or more Boolean variables we can construct a Boolean expression. The values of a Boolean expression for every possible inputs combination and its output are usually shown in a table called **truth table**.

For example, the truth table for an inverter gate that has an input variable **X** and output **X'** is shown in Table 1.

X	X'
0	1
1	0

Table 1: Truth table for an inverter gate

IV. Preparations

1. Write down the truth table for each of the following:

- 3-input **OR** gate. $(A+B+C)$
- 3-input **NAND** gate. $(A.B.C)'$
- $(A \text{ AND } B) \text{ OR NOT } C$.
- $(\text{NOT } A \text{ OR NOT } B) \text{ AND } C$

Where A, B, and C are Boolean variables.

2. Given the following Boolean expression:

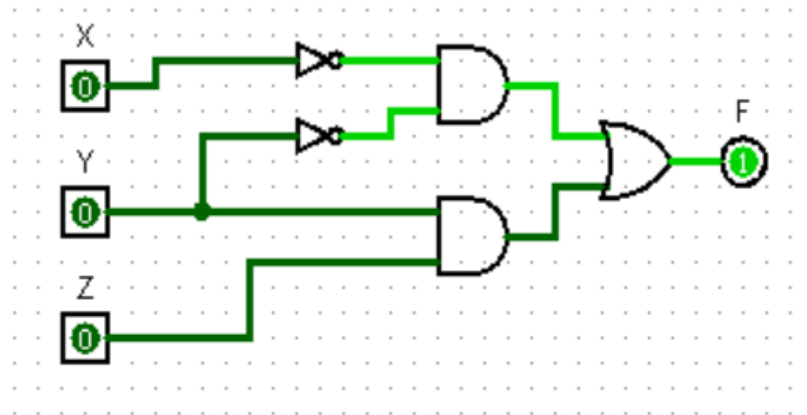
$$F(X,Y,Z) = X.Z + X.Y' + X'.Y.Z$$

- Write the truth table for the expression above.
- Plot the logic gate circuit for the expression.
- Build the circuit in part b using the Logisim software.

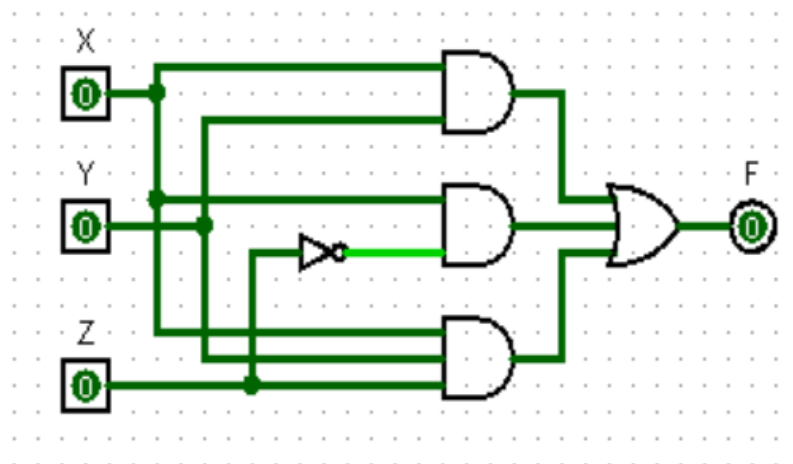
V. Lab work

In this experiment:

1. Build the circuit below on the breadboard.



2. Build the circuit below on the breadboard.



3. Build the circuit in part 2.b on the breadboard.