# Lab 1 Assignment
# EET 242
# Sequential Circuits and Applications

**Objective:** Implementation of a Half adder and Full adder using logic gates

**Materials Needed:**
7408 Quad 2-Input AND Gate- 1 piece
7432 Quad 2-Input OR Gate-1 piece
7486 Quad 2-Input XOR Gate - 1 piece
330-ohm resistor – 2 pieces
Light Emitting Diodes (LEDs) – 2 pieces
DC Power Supply

## Theory:

**Half Adder:** The half-adder accepts two binary digits on its inputs and produces two binary digits on its outputs—a sum bit and a carry bit.

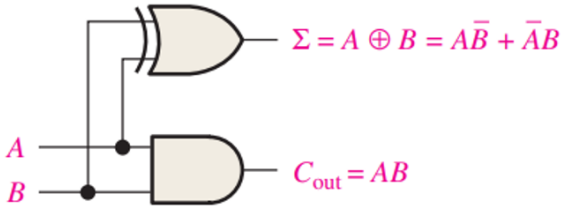


Figure 1: Logic diagram of a Half-Adder

Half-adder truth table.

| $A$ | $B$ | $C_{out}$ | $\Sigma$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 |

$\Sigma$ = sum
$C_{out}$ = output carry
$A$ and $B$ = input variables (operands)

**Full Adder:** The full-adder accepts two input bits and an input carry and generates a sum output and an output carry. The basic difference between a full-adder and a half-adder is that the full-adder accepts an input carry.

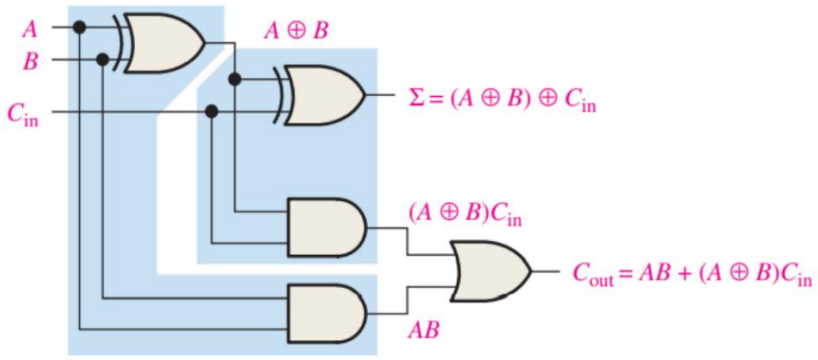


Figure 2: Logic diagram of a Full-Adder

Full-adder truth table.

| $A$ | $B$ | $C_{in}$ | $C_{out}$ | $\Sigma$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 |

$C_{in}$ = input carry, sometimes designated as *CI*
$C_{out}$ = output carry, sometimes designated as *CO*
$\Sigma$ = sum
$A$ and $B$ = input variables (operands)

## Hardware Implementation (Procedure):

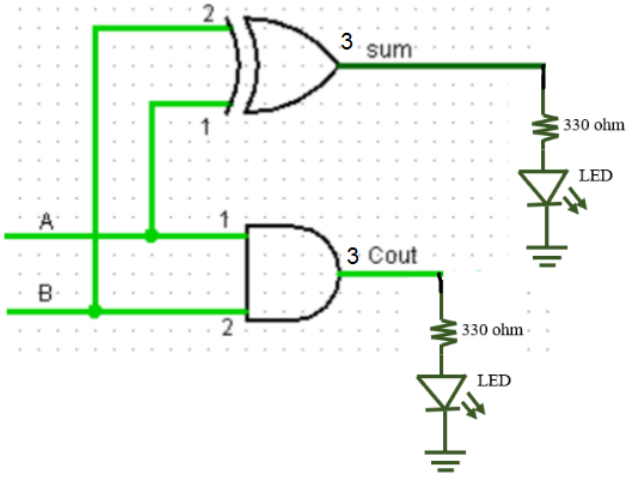


**Figure. Connection Diagram of Half-Adder**

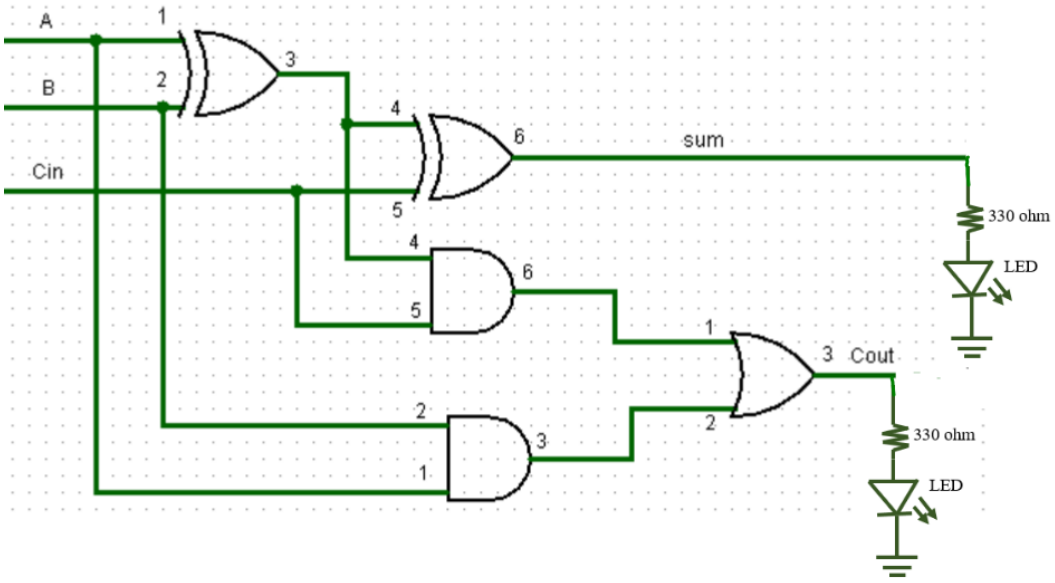


**Figure. Connection Diagram of Full-Adder**

a) Find the pin diagram for the 7408 quad 2 input AND gate, 7432 quad 2 input OR gate, 7486 quad 2 input XOR gate. (Pin diagram has been provided).

b) Apply $V_{cc}$ and ground to the appropriate pins (Connect pin 7 to ground and pin 14 to $V_{cc}$). Connect the circuit according to circuit diagram above.

c) You need to connect output pins (sum and $C_{out}$) to a 330 ohm resistors, and the other end of the 330 ohm resistors will be connected to the positive terminal of LED. Finally, the negative terminal of the LED will connect to ground (OV). If the output is logic 1, LED will turn ON and if the output is logic 0, LED will turn OFF. Show the logic output (1 or 0) as well as the measured output voltage.

d) Test all possible combinations of inputs, as listed in Table 1-1 and Table 1-2 of the report. Apply a logic 1 (connecting to $V_{cc}$) and a logic 0 by connecting directly to ground. Use digital multimeter (DMM) to measure the output voltage. Tabulate your results in Table 1-1 and Table 1-2.

N.B: You can also apply logic 1 through a series 1.0 KΩ resistor (optinal).

# Lab 1 report

Name:

Objective:

Table 1-1 Truth Table for Half Adder

| Inputs | | | | |
|---|---|---|---|---|
| A | B | $C_{out}$ | Σ (sum) | Measured Voltage (Σ) |
| 0 | 0 | 0 | 0 | 0.8V |
| 0 | 1 | 0 | 1 | 1.9V |
| 1 | 0 | 0 | 1 | 1.9V |
| 1 | 1 | 1 | 0 | 0.8V |

Table 1-2 Truth Table for Full Adder

| Input | | | Output | | |
|---|---|---|---|---|---|
| A | B | $C_{in}$ | $C_{out}$ | Σ (sum) | Measured Voltage (Σ) |
| 0 | 0 | 0 | 0 | 0 | 0.8V |
| 0 | 0 | 1 | 0 | 1 | 1.9V |
| 0 | 1 | 0 | 0 | 1 | 1.9V |
| 0 | 1 | 1 | 1 | 0 | 0.8V |
| 1 | 0 | 0 | 0 | 1 | 1.9V |
| 1 | 0 | 1 | 1 | 0 | 0.8V |
| 1 | 1 | 0 | 1 | 0 | 0.8V |
| 1 | 1 | 1 | 1 | 1 | 1.9V |

**Submission Process**

You do not need to submit tutorial or procedure. You just need to submit lab report and screenshot of the circuit/.