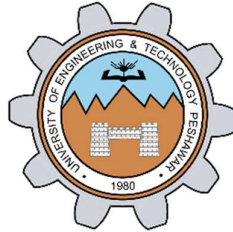# ADDER AND SUBTRACTOR

LAB # 05

Fall 2023

CSE-202L: Digital Logic Design Lab

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LAB NO. 05:

ADDER AND SUBTRACTOR

Objectives of lab:

- To design and construct half and full adder and subtractor.
- Verify the truthtables.

Components:

- Power Supply
- Breadboard. ICs 7408 (quad 2-input AND gate)
- 7432 (quad 2-input OR gate)
- 7404 hex inverter
- DIP Switch
- LED's

Half Adder:

A half adder is a fundamental digital circuit that adds two single-bit binary numbers to produce the sum and the carry.

$$S = A \oplus B$$
$$C = A \cdot B$$

Truth Table:

A	B	Sum (S)	Carry (C)
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Full Adder:

A full adder can handle three inputs: two operands (A and B) and a carry input (Cin), producing a sum output (S) and a carry output (Cout).

$$S = A \oplus B \oplus Cin$$

$$Cout = (A \cdot B) + Cin(A \oplus B)$$

Truth Table:

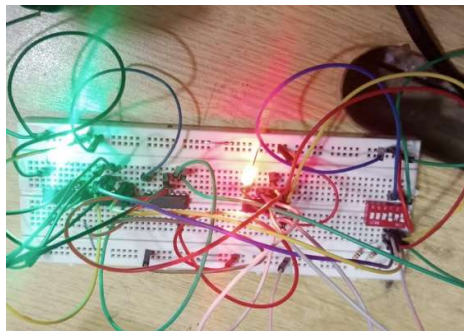| A	B	Cin	Sum (S)	Cout (Cout)
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Figure 1:Full Adder

Half Subtractor:

A half subtractor is a combinational logic circuit that subtracts two single-bit binary numbers and computes both the difference (D) and the borrow (Borrow) output.

$$D = A \oplus B$$

$$Borrow = A' \cdot B$$

Truth Table:

A	B	Difference (D)	Borrow (Borrow)
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Full Subtractor:

It's an extension of the half subtractor, capable of handling three inputs: minuend bit (A), subtrahend bit (B), and borrow input

$$D = A \oplus B \oplus Bin$$

$$Borrow = (A \cdot B) + (A \cdot Bin) + (B \cdot Bin)$$

Truth Table:

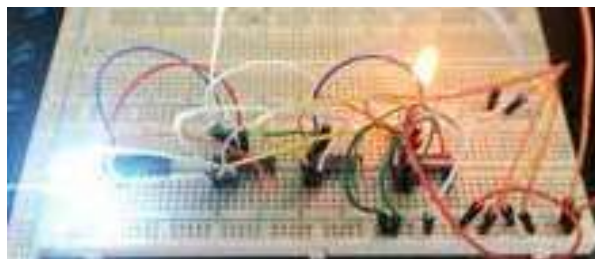| A	B	Bin	Difference (D)	Borrow (Borrow)
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Figure 2:Full subtractor