Practical No.7: Implement 2 input, 3 input Subtractor Circuit.

I Practical Significance

Subtractor is used in systems where subtraction operations are required, such as in arithmetic units of microprocessors, calculators, digital signal processing circuits, and other digital systems where subtraction is needed.

II Industry/Employer Expected Outcome(s)

Students will be able to test the functionality of the digital circuits/system.

III Course Level Learning Outcome(s)

Develop combinational logic circuits for given applications.

IV Laboratory Learning Outcome(s):

1. Verify the truth table of Half and Full subtractor using Boolean expressions.

V Relevant Affective Domain related outcome(s)

Identify PIN configuration of IC.
Handle the components and equipment carefully.
Follow all safety precautions.

VI Relevant Theoretical Background

A half subtractor is a combinational circuit used in digital electronics for subtracting two single-bit binary numbers. It has two inputs - minuend (A) and subtrahend (B) - and two outputs - the difference (D) and the Borrow (B).It is made of EX-OR gate, NOT gate (Inverter), and AND gate. The B output is 1 only when the subtrahend (B) is greater than the minuend (A).

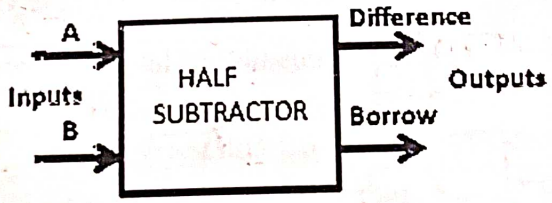


Fig 7.1: Block diagram of Half subtractor

Full subtractor is a combinational circuit that performs subtraction of two bits, one is minuend and other is subtrahend. In full subtractor '1' is borrowed by the previous adjacent lower minuend bit. Hence these three bits are considered at the input of a full subtractor. There are two outputs that are DIFFERENCE (D) and BORROW (Bo).

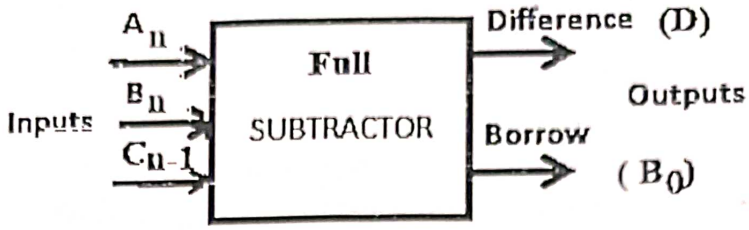


Fig 7.2: Block diagram of Full subtractor

VII Circuit diagram

a) Sample circuit

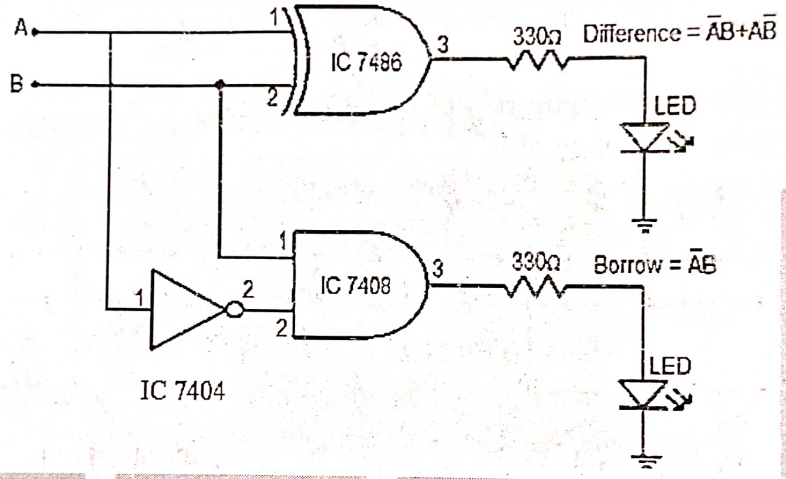


Fig 7.3:Half subtractor Circuit Diagram

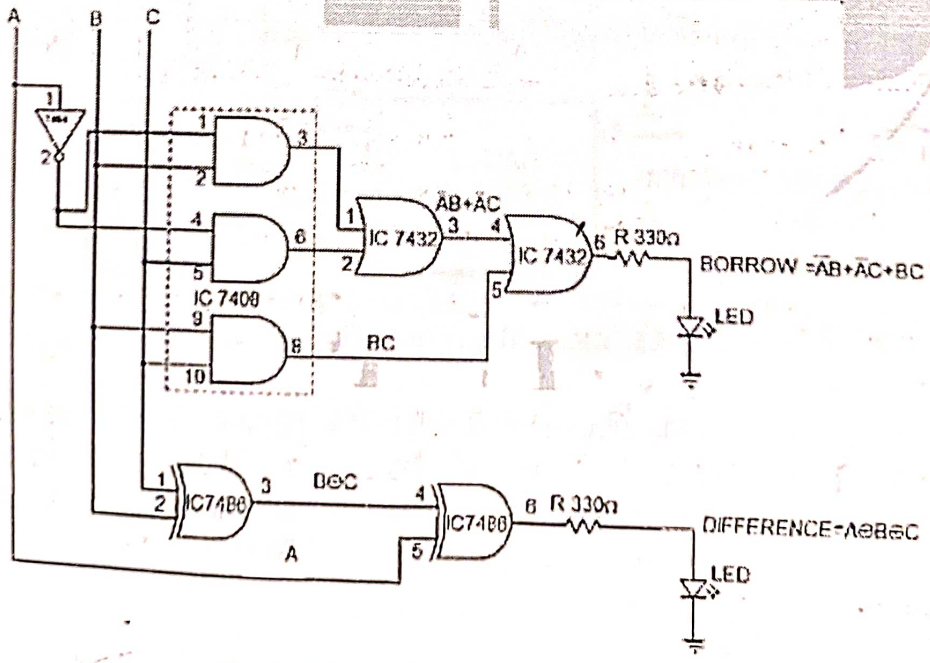
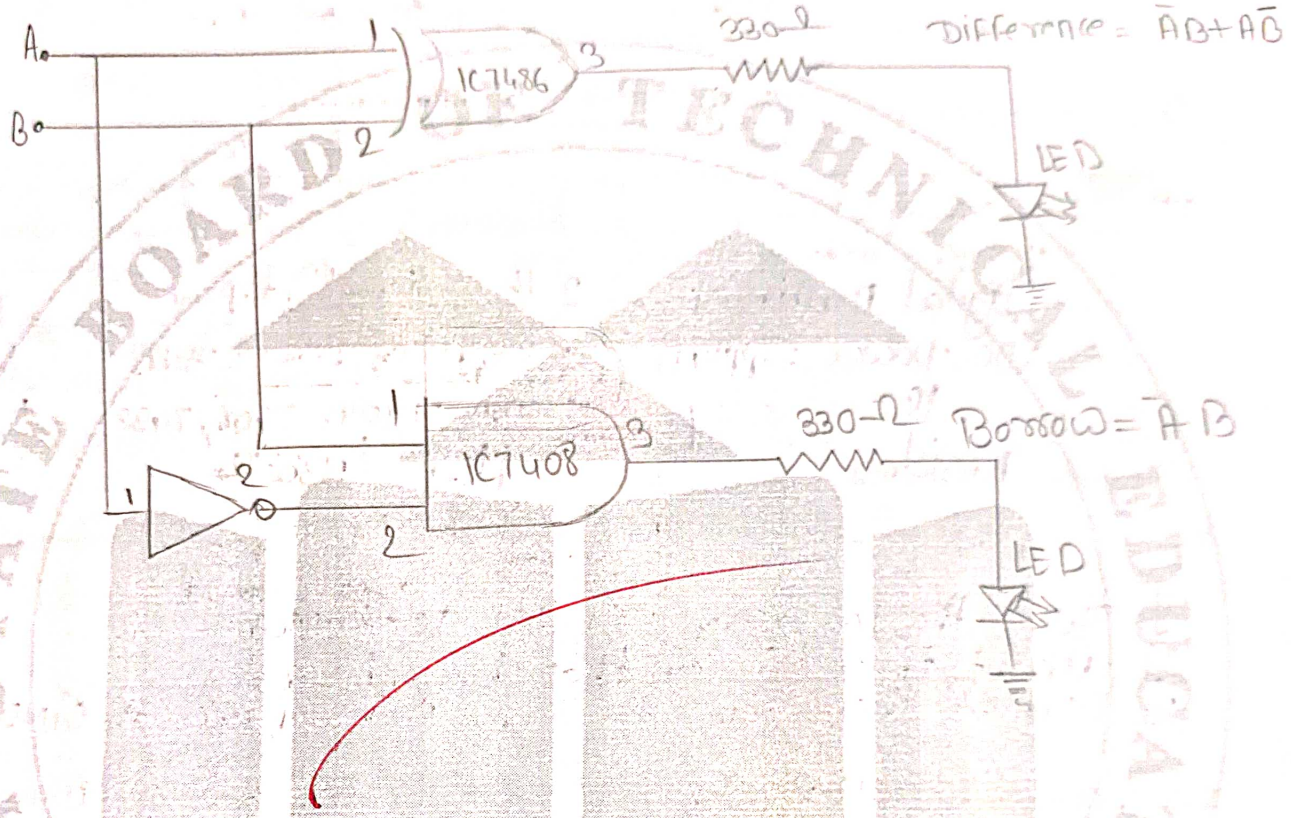


Fig 7.4:Full subtractor Circuit Diagram

b) Actual circuit



VIII Resources Required

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2
2	Digital IC Tester	Tests a wide range of Digital IC's such as 74 Series, 40/45 Series of CMOS IC's.	1
3	DC power supply	+5 V Fixed power supply	1
4	Breadboard	5.5cm X 17 cm	1
5	IC	7486, 7404,7408.7432	1 Each
6	LED	Red /Yellow color 5 mm	1
7	Connecting wires	Single strand 0.6 mm Teflon coating	As required
8	Resistor	1KΩ/330Ω	As required

IX Precautions to be followed

1) Check IC before use.
2) Set power supply to 5V (Variable DC Power Supply) before connecting.
3) Check all the connections as per circuit diagram

X Procedure

1. Test the IC using Digital IC tester
2. Mount the IC on the breadboard
3. Make the connection as per figure 7.3.
4. Connect the +5V to +Vcc pin of IC and GND pin to ground
5. Observe the LED (on or off) for each combination of input as per truth table
6. Verify the truth table
7. Repeat the procedure for figure.7.4.

XI Resources Used

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital multimeter	3 1/2 digital display	1
2	DC Power Supply	+5V fixed Power Supply	1
3	IC	7486, 7404, 7408, 7432	1
4	Resistor	1kΩ / 330Ω	1

XII Actual Procedure

1] Test the IC using Digital IC tester
2] Mount the IC on the breadboard
3] Connect the +5V to +Vcc Pin of IC & GND Pin to groun

XIII Observation:

Table 7.1: Observation Table For Half Subtractor

Inputs		Output			
		Difference		Borrow	
A	B	Logic Level (1/0)	Output voltage (v)	Logic Level (1/0)	Output voltage (v)
0 (0V)	0(0V)	0	0 V	0	0V
0(0V)	1(5V)	1	4.5V	1	4.5V
1(5V)	0(0V)	1	4.5 V	0	0V
1(5V)	1(5V)	0	0 V	0	0V

Table 7.2: Observation Table For Full Subtractor

Inputs			Output			
			Difference		Borrow	
A	B	C	Logic Level (1/0)	Output voltage (v)	Logic Level (1/0)	Output voltage (v)
0 (0V)	0(0V)	0(0V)	0	0V	0	0V
0(0V)	0(0V)	1(5V)	1	4.5V	1	4.5V
0(0V)	1(5V)	0(0V)	1	4.5V	1	4.5V
0(0V)	1(5V)	1(5V)	0	0V	1	4.5V
1(5V)	0(0V)	0(0V)	1	4.5V	0	0V
1(5V)	0(0V)	1(5V)	0	0V	0	0V
1(5V)	1(5V)	0(0V)	0	0V	0	0V
1(5V)	1(5V)	1(5V)	1	4.5V	1	4.5V

XIV Result(s)

In this practical coe learn to implement 2 input, 3 input Substractor circuit.

XV Interpretation of results

In this practical we studied that to implement 2 input 3 input substractor circuit.

XVI Conclusion and recommendation

Hence coe studied to implement 2 input 3 input Substractor circuit.

XVII Practical related questions

Note: Below given are a few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Draw half subtractor using NAND gates only.
2. Design Half subtractor using K-map.
3. Draw a full subtractor using half subtractor circuits.

[Space for Answers]

1] →

Half Substracter using NAND gate

2] → Half Substractor

K- map for Difference

A \ B	0	1
0	0	1
1	1	0

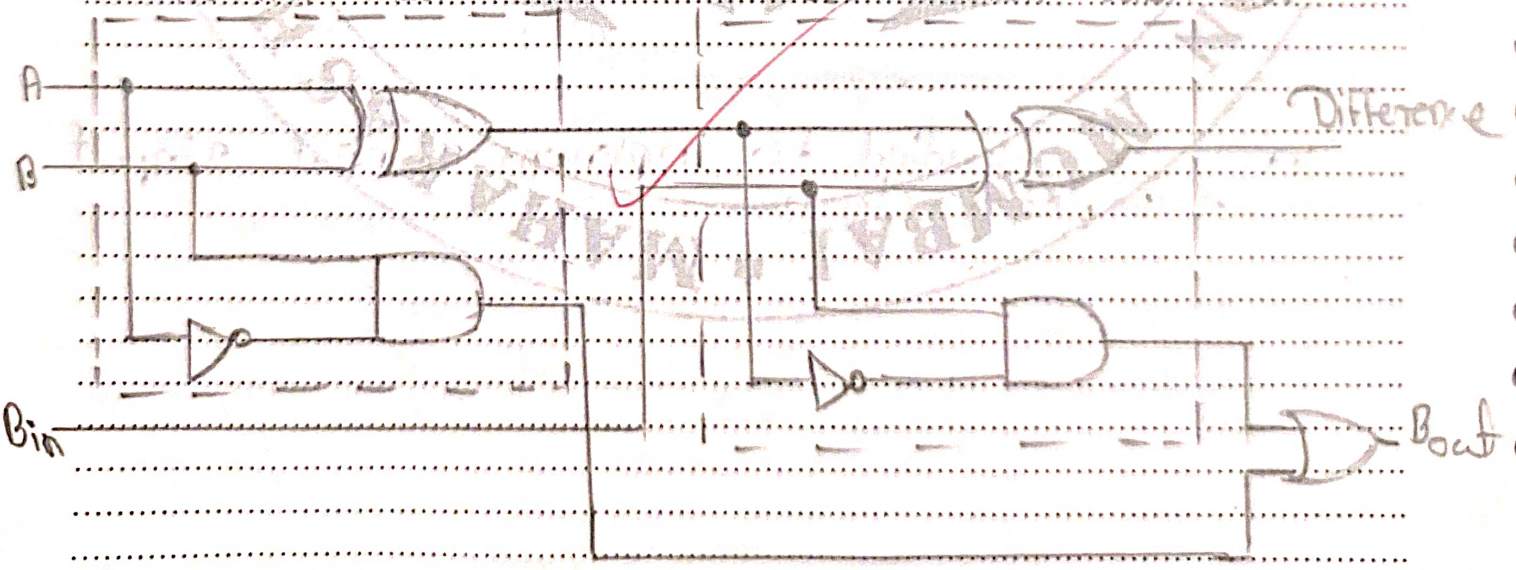
K- map for Borrow

A \ B	0	1
0	0	1
1	0	0

Difference = $A'B + AB'$

Borrow = $A'B$

3] →



Full substractor using half Substractor

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XVIII References/Suggestions for further reading

1. https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/index.html
2. https://www.futurlec.com/74/IC7402.shtml
3. https://www.ntchip.com/electronics-news/ic-7486-chip
4. https://www.ti.com/lit/ds/symlink/sn5432.pdf?ts=1720330546912&ref_url=https%253A%252F%252Fwww.google.com%252F
5. https://www.futurlec.com/74/IC7404.shtml

XIX Assessment Scheme

	Performance Indicators	Weightage
	Process Related : 15 Marks	**60 %**
1	Handling of the components	10%
2	identification of components	20%
3	Measuring value using suitable instrument	20%
4	working in teams	10%
	Product Related: 10 Marks	**40%**
5	Calculated theoretical values of given component	10%
6	Interpretation of result	05%
7	Conclusion	05%
8	Practical related questions	15%
9	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Marks Obtained			Dated signature of Teacher
Process related (15)	**Product related (10)**	**Total (25)**	
12	10	22	