EXPERIMENT - II

ANALYSIS OF FULL AND HALF ADDERS AND SUBTRACTORS USING LT SPICE

SLOT: L37+L38

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EXPERIMENT - II

AIM:

To analyse the Adders and Subtractors in LT spice and verify theoretical outputs with simulated outputs.

Materials Required

Latest version of LT Spice on with the (Digital Logic) Library.

PRE-PREQUIST KNOWLEDGE:

Know how logic gates works and how the output varies depending on the input from the voltage source.

How to construct and use Halt and full adder and subtractors.

How to use LT spice and install the necessary libraries.

Procedure:

1. Download and install LT Spice with the correct libraries.
2. Once operational create a new simulation profile and name it.
3. Drag and drop all necessary components to complete the circuit completed make sure to add ground and voltage sources.
4. Configure the voltage sources as such.
   a. Go to advance settings and select PULSE as the function.
      i. Vinitial = 0
      ii. Von = 5
      iii. Vdelay = 0
      iv. Trise = 1n
      v. Tfall = 1n
      vi. And depending on number of inputs
         1. First input
            a. Tfall = 1m

b. Ton = 2m

2. Second input
   a. Tfall = 1m
   b. Ton = 2m
3. Third input
   a. Tfall = 4m
   b. Ton = 8m

b. Connect them accordingly and make sure to ground all -ves.

5. Once done run a simulation under trans for 10m and plot all corresponding values.

THEORY:

Circuit that takes the logical decision and the process are called logic gates. Each gate has one or more input and only one output. OR, AND and NOT are basic gates. NAND, NOR and X-OR are known as universal gates. Basic gates form these gates.

In digital circuits, an adder-subtractor is a circuit that is capable of adding or subtracting numbers (in particular, binary). Below is a circuit that adds or subtracts depending on a control signal. It is also possible to construct a circuit that performs both addition and subtraction at the same time.

ADDER:

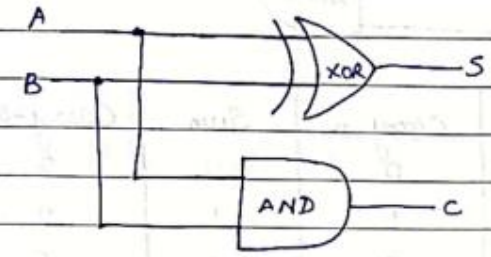
ADDER:

In electronics adder is digital circuit that perform addition of numbers. In modern computer adder reside in the arithmetic logic unit (ALU). Adders are important not only in the computer but also in many types of digital systems in which the numeric data are processed.

HALF ADDER:

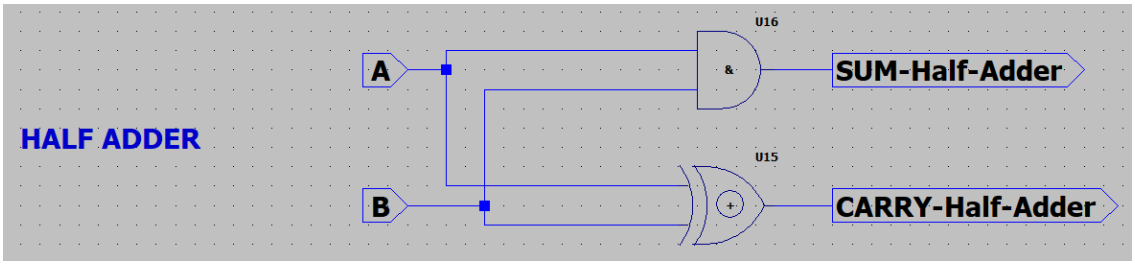
HALF ADDER:

The half adder accepts two binary digits on its inputs and produce two binary digits output, a sum bit and a carry bit. The half adder is an example of a simple, functional digit circuit built from two logic gates. The half adder adds to one-bit binary numbers (AB). The output is the sum of the two bits (S) and carry (C).

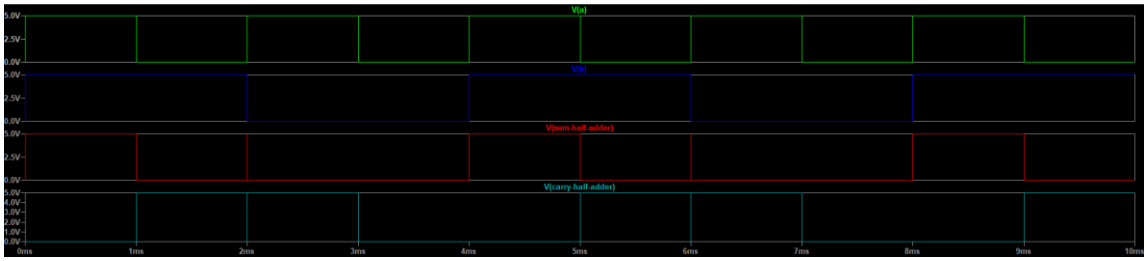


A	B	Sum	Carry-out
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

SCHEMATIC DIAGRAM:



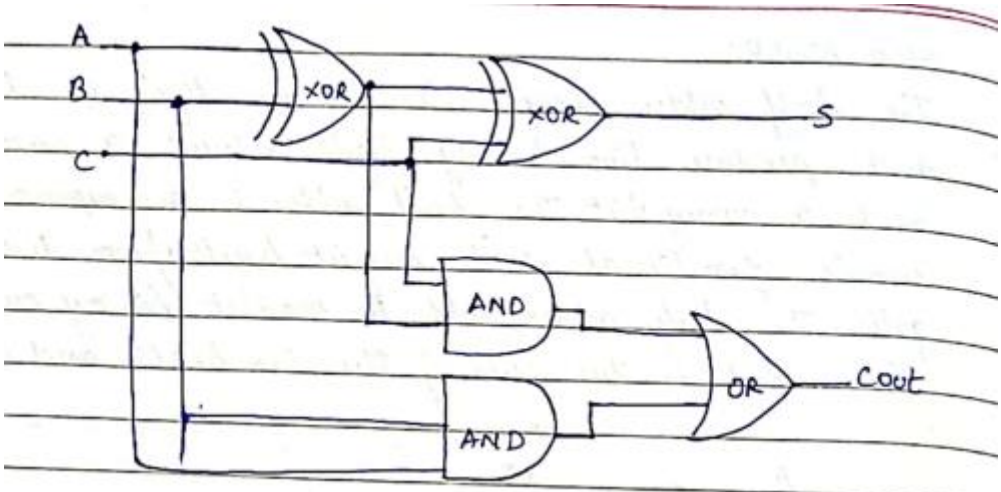
OUTPUT WAVEFORMS



FULL ADDER:

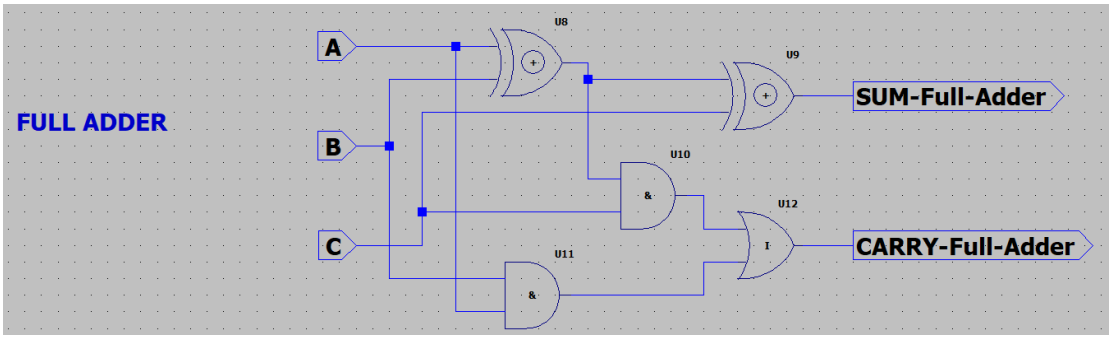
FULL- ADDER :

The full adders accepts two inputs bits and an input carry and generates a sum output and an output carry. The full-adder circuit adds three one-bit binary numbers (C in, A, B) and outputs two one-bit binary nimbers, a sum (S) and a carry (C out). The full-adder is usually a component in a cascade of adders, which add 8, 16, 32 etc binary numbers. If you look closely, you'll see the full adder is simply two half adders joined by an OR.

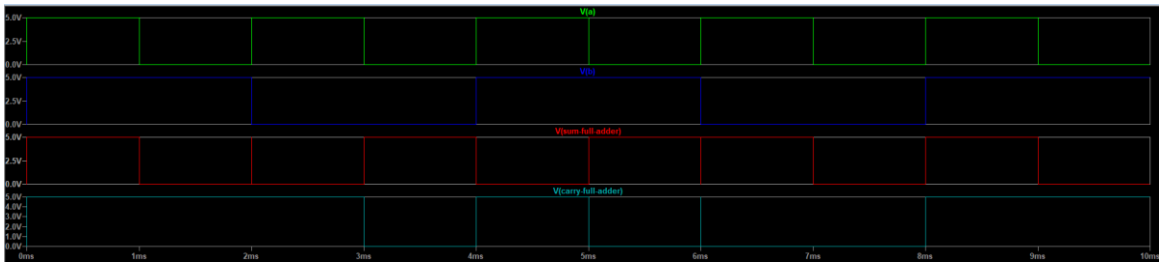


A	B	Carry-in	Sum	Carry-out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

SCHEMATIC DIAGRAM:



OUTPUT WAVEFORMS



SUBTRACTOR

SUBTRACTOR

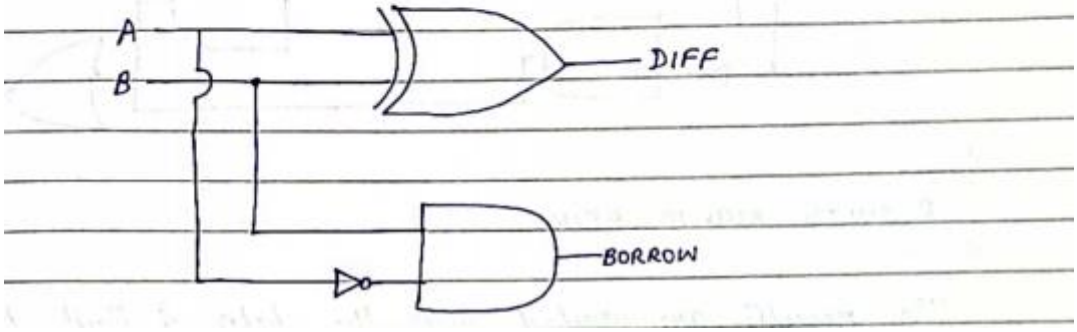
Subtractor is an electronic logic circuit for calculating the difference between two binary numbers which provides the difference and borrow as output.

HALF-SUBTRACTOR:

HALF SUBTRACTOR

Half subtractor is used for subtracting one single bit binary number from another single bit binary number. It has two inputs: Minuend (A) and Subtrahend (B) and two outputs: Difference (D) and Borrow (Bout)

Input		Output	
A	B	Difference (D)	Borrow (Bout)
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0



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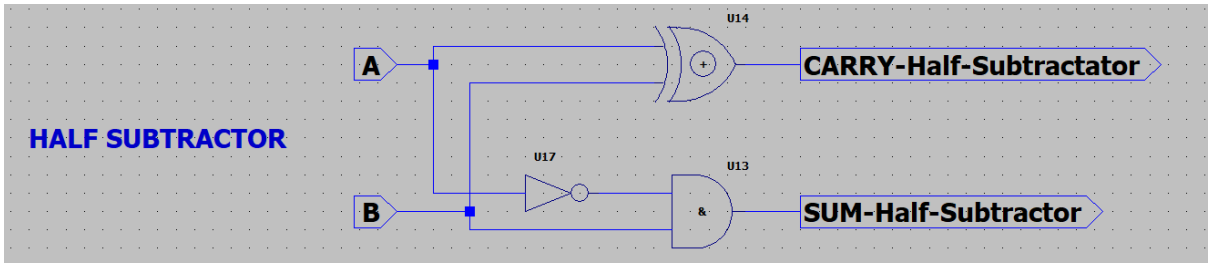
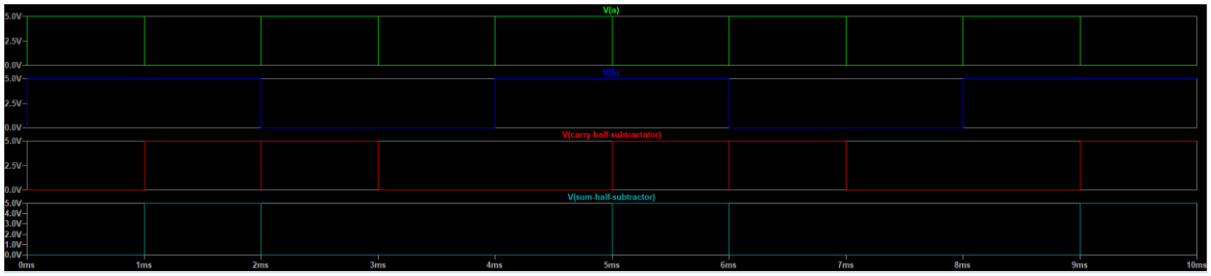


OUTPUT WAVEFORMS

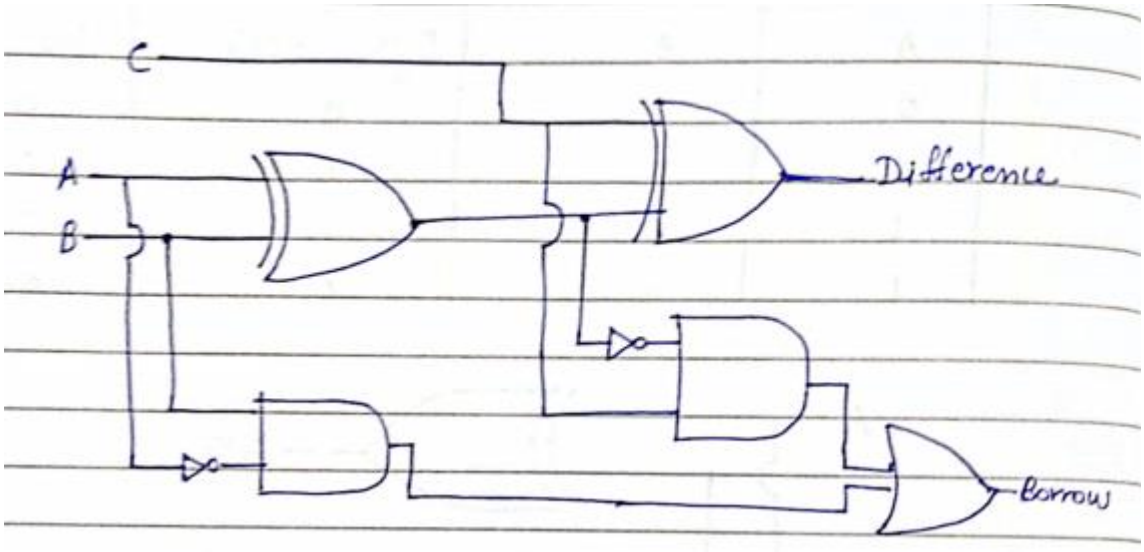


FULL SUBTRACTOR:

FULL SUBTRACTOR:

A logic circuit which is used for subtracting three single bit binary numbers is known as Full Subtractor. It has three inputs; Minuend (A), Subtrahend (B) and following Subtrahend (C) and two outputs; Difference (D) and Borrow (Bout).

Input			Output	
A	B	C	D	B(out)
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



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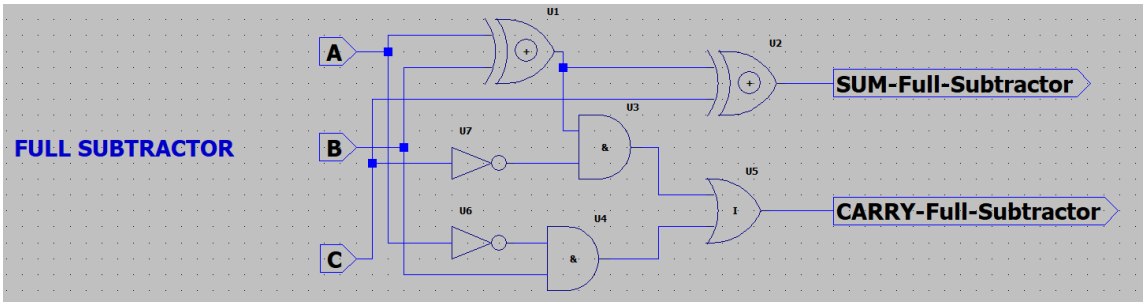
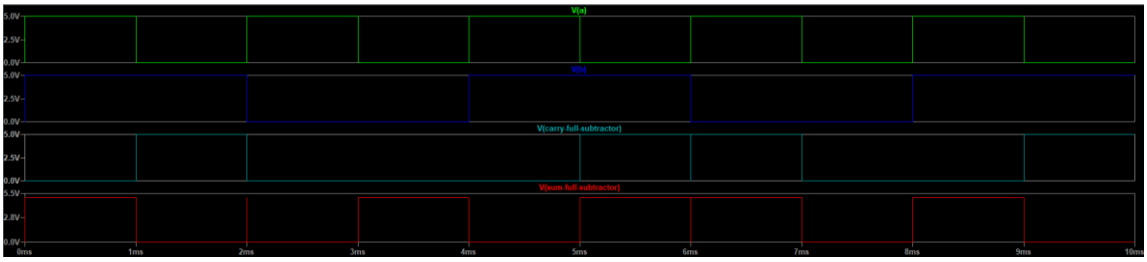


OUTPUT WAVEFORMS



RESULTS AND INFERENCE:

The results are verified with the help of truth tables and LT SPICE results and hence the logic gates are verified.