EXPERIMENT NO.7

Title of experiment: Design of subtractor and comparator in Proteus.

Equipments required: Proteus 8

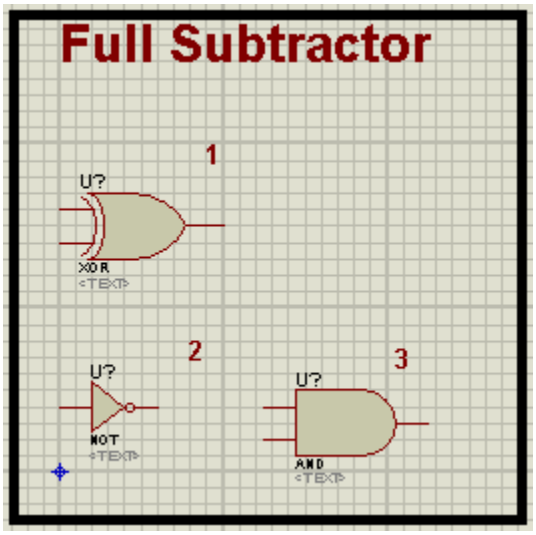
Theory:

1) A **digital comparator or magnitude comparator** is **a** hardware electronic device that takes two numbers as input in binary form and determines whether one number is greater than, less than or equal to the other number. Comparators are used in central processing units (CPUs) and microcontrollers (MCUs).

2) **Subtractor** circuits: take two binary numbers as input **and** subtract one binary number input from the other binary number input. Similar to adders, it gives out two outputs, difference and borrow (carry-in the case of Adder).

Implementation:

- Arrange the XOR Gate, AND Gate and NOT Gate at the working area according to the arrangement given below:



- This will form a Half Subtractor. Select the devices through a square selection area.
- Copy the whole arrangement through left click>copy to clip board.
- Paste the arrangement in the side of the circuit.
- Add an OR gate at the right side of the system.

- Add three Logic Toggles at the left most side of the arrangement.
- Connect the Whole circuit through connecting wires by matching the circuit with the following image:
- This is the Full Subtractor circuit. Change the values of the Probes according to the Truth Table and record your observation.

1)2 bit full subtractor:

If you know about the Concept of binary subtraction, you can use your knowledge to generate a Truth Table of 2 bit Full Subtractor so that one can design a feasible Circuit of 2 bit Full Subtractor. The Table contain all the records that can be possible for our experiment and its result into the bargain. Thus the Truth Table for the Full Subtractor is shows as:

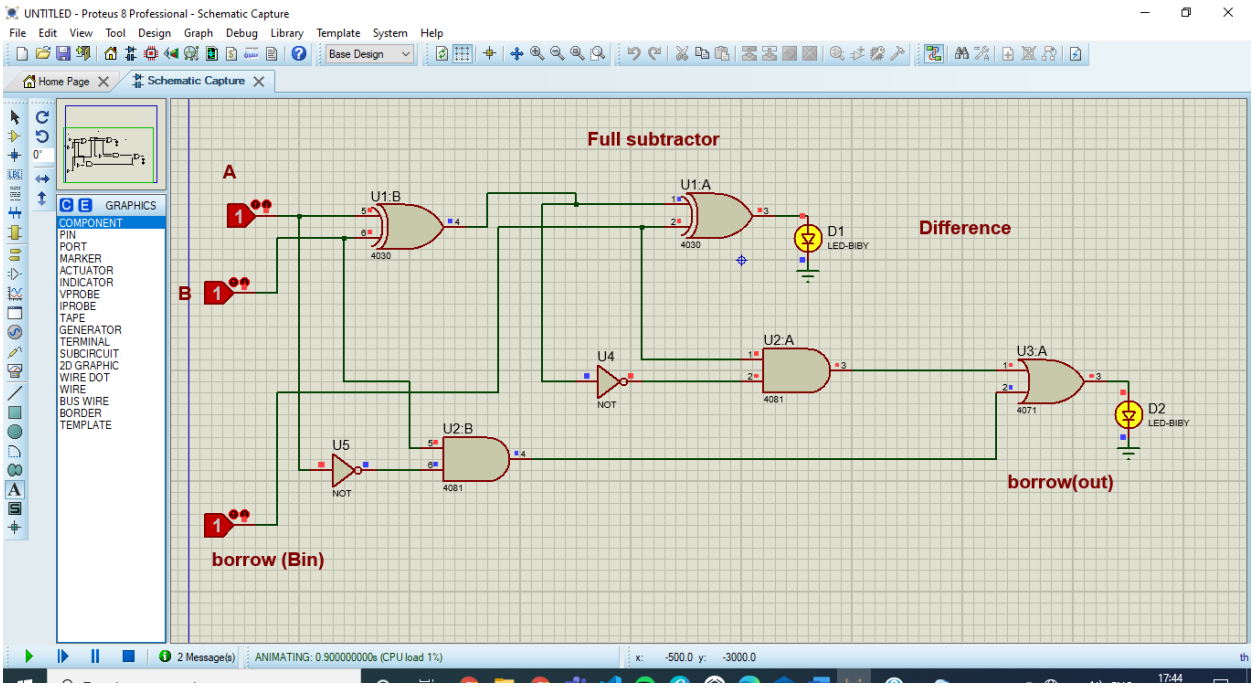
Minuend	Subtrahend	B(in)	Difference	B(out)
0	0	0	0	1
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

3)Comparator:

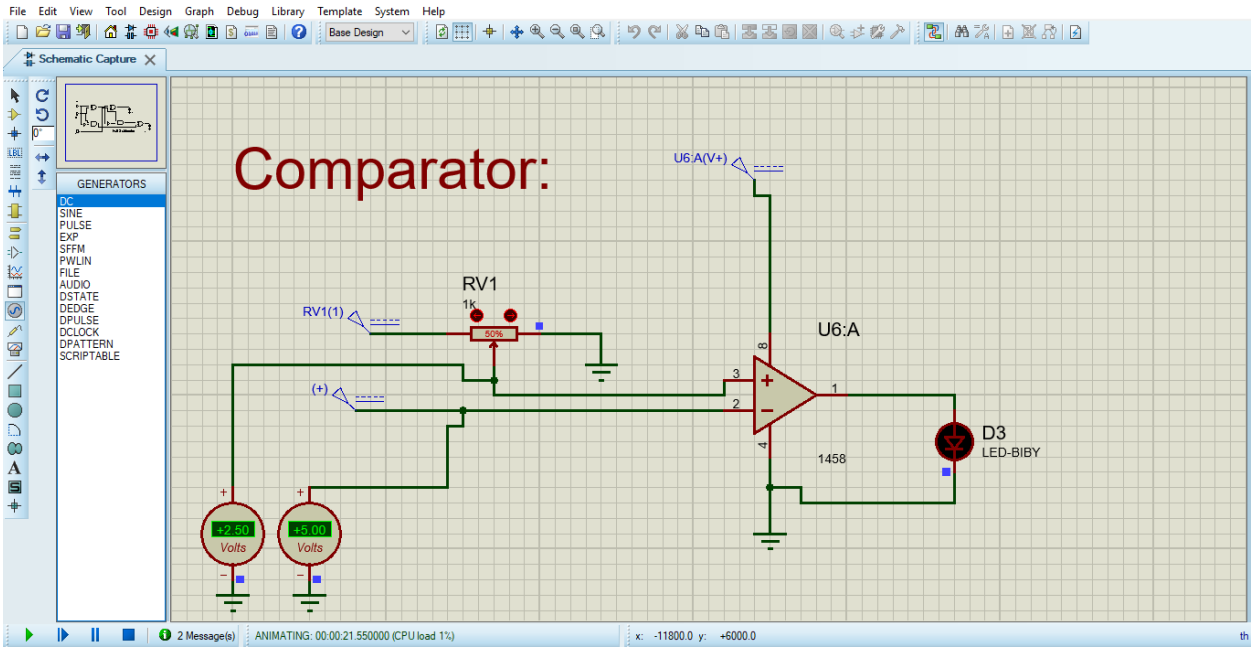
The Op-amp comparator compares one analogue voltage level with another analogue voltage level, or some preset reference voltage, VREF and produces an output signal based on this voltage comparison. In other words, the op-amp voltage comparator compares the magnitudes of two voltage inputs and determines which is the largest of the two

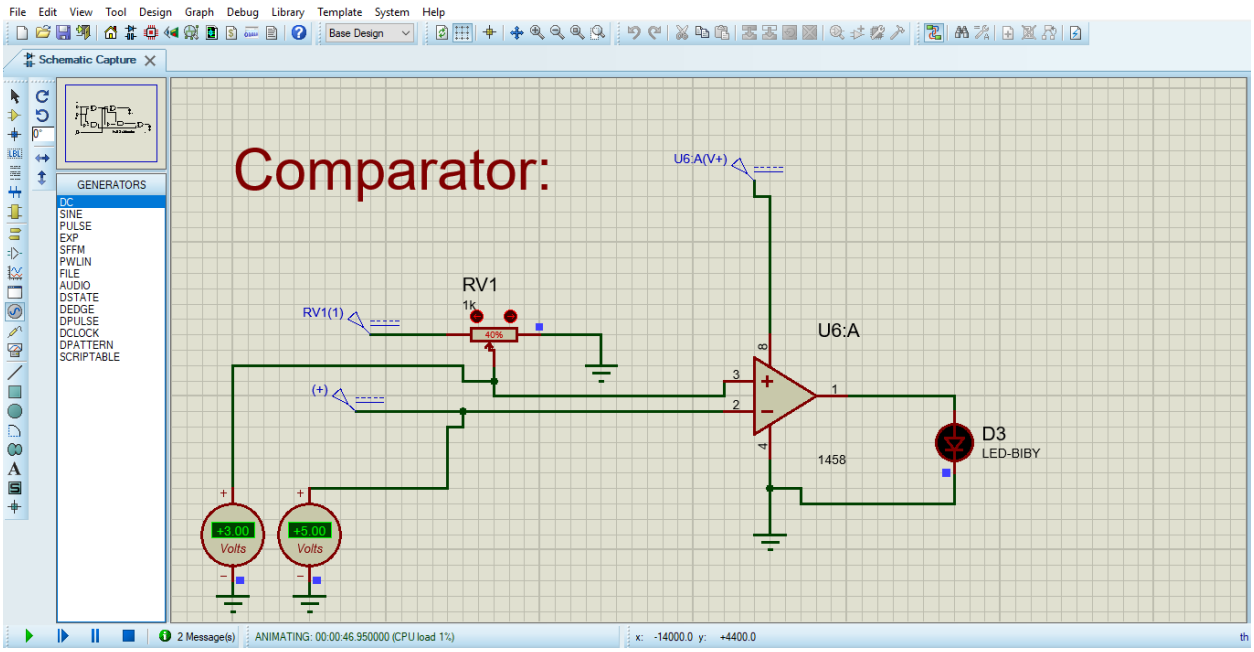
Snapshots:

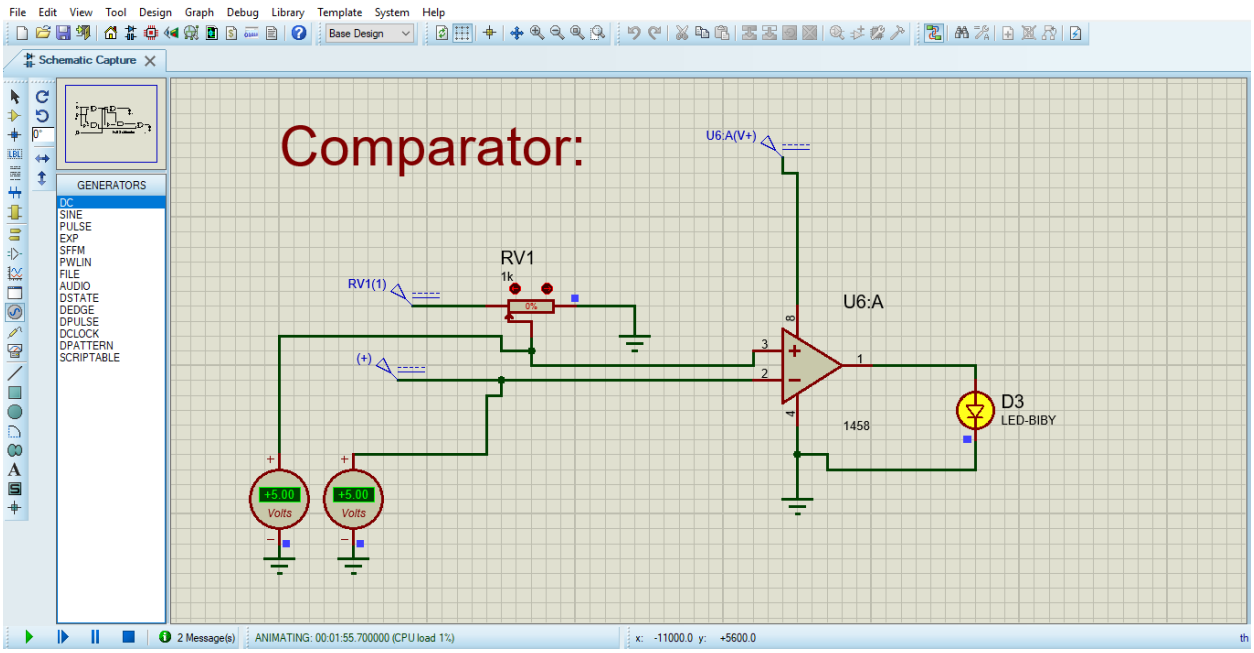
Full subtractor:



COMPARATOR:







Conclusions:

These are ways to design subtractor and comparator in Proteus