EXPERIMENT 2

Switching Theory and Logic Design (STLD)

Aim

To verify the truth tables of all logical gates(AND, OR, NOT, NAND, NOR, XOR, XNOR) **using NAND gate** only.

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Aim:

To verify the truth tables of all logical gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) using NAND gate.

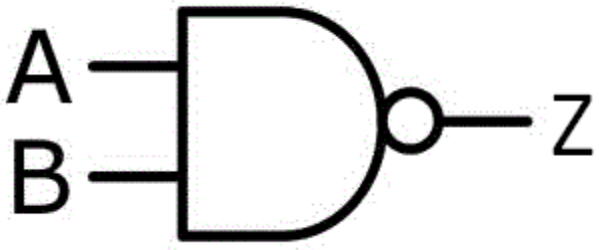
Hardware and Software Apparatus Required

Hardware: Power supply, Bread Board, Connecting Wires, respective IC, LED, Wire Cutter.

- Circuit is designed on bread board using Integrated Chips (ICs), Voltage supply and LEDS.
- The set-up of apparatus and working of the circuit were demonstrated via recorded videos.

Software Simulation: The schematic models of the desired circuits will be stimulated on MULTISIM (Free Software), easily accessible at www.multisim.com: Sign Up and create a profile.

Circuit (SYMBOL)

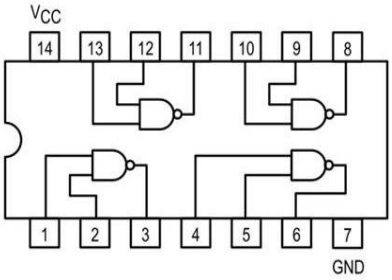


Digital Logic NAND Gate – Universal Gate

Output = $\overline{A.B}$

IC pin diagram

NAND GATE (IC 7400)



Truth Table

NAND GATE

NAND Truth Table		
A	**B**	**Q**
0	0	1
0	1	1
1	0	1
1	1	0

Relevant Theory

NAND Gate

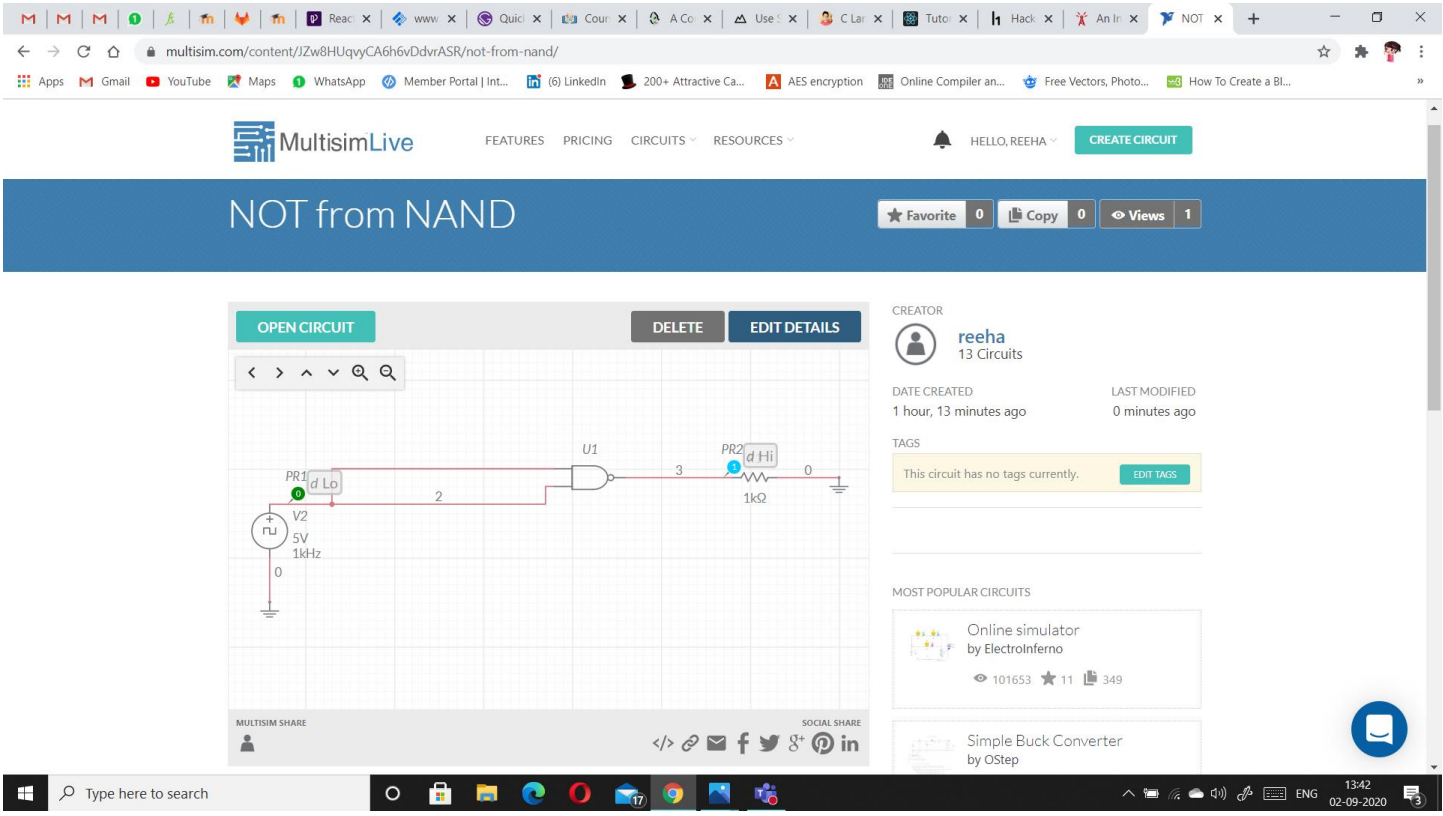
- The Boolean expression for a logic NAND gate is denoted by a single dot or full stop symbol, (.) with a line or Overline, (¯) over the expression to signify the NOT or logical negation of the NAND gate giving us the Boolean expression of: A.B = Q.
- It is a series of AND gate followed by NOT gate. If the output is 0 then any or all inputs are 1. Otherwise, output is 1.
- **It is a universal gate:** Universal Logic gates can be used to produce any other logic or Boolean function with the NAND and NOR gates being minimal.Individual logic gates can be connected together to form a variety of different switching functions and combinational logic circuits.

Procedure followed on MULTISIM

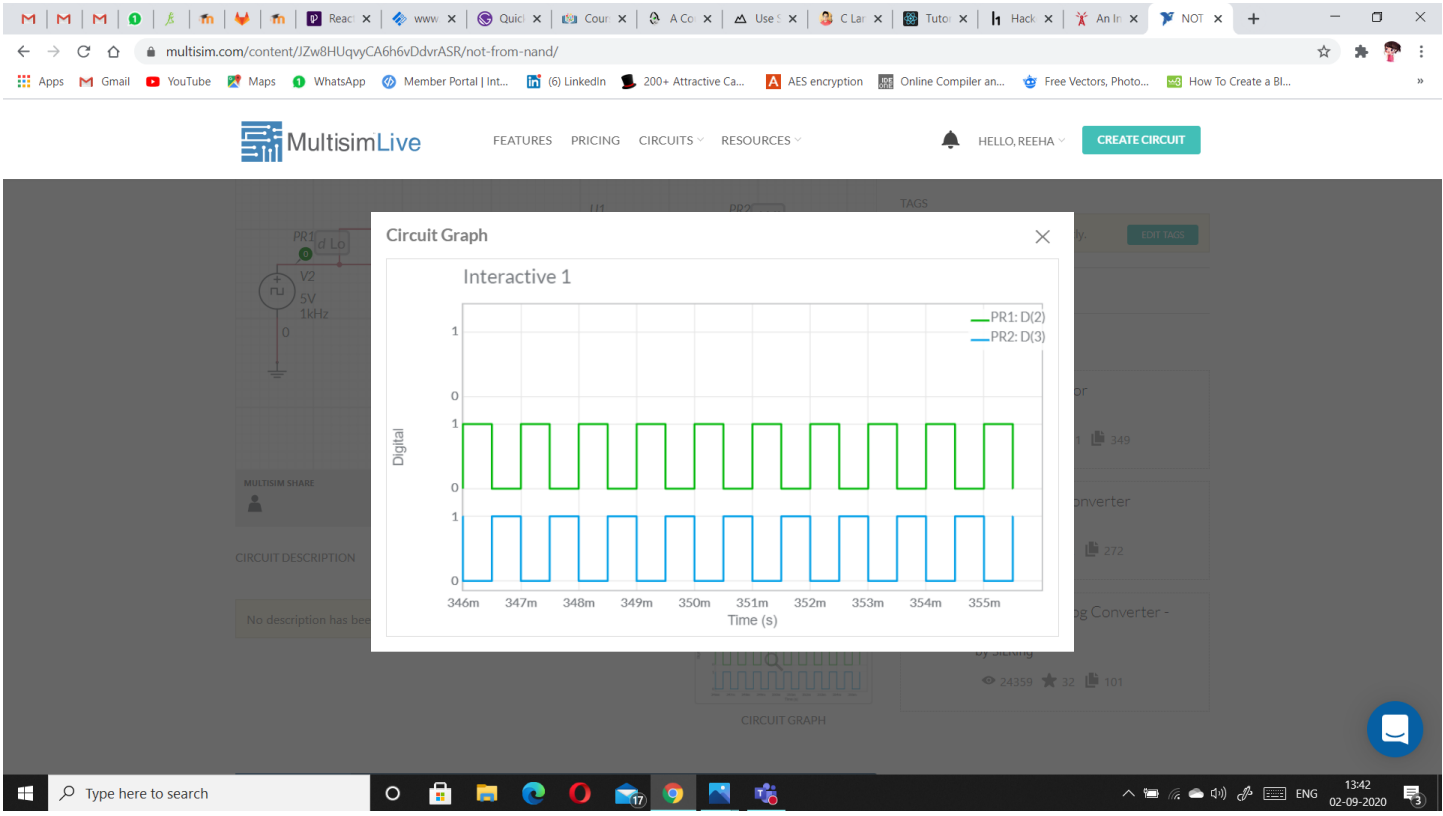
1. LOG IN ON www.multisim.com
2. CREATE THE CIRCUIT
3. SAVE THE CIRCUIT

4. SAVE THE SCREENSHOTS FOR
    i. INPUT & OUTPUT WAVEFORMS (ALONG WITH YOUR ID ON TOP LEFT)
    ii. CIRCUIT (ALONG WITH YOUR ID ON TOP LEFT)

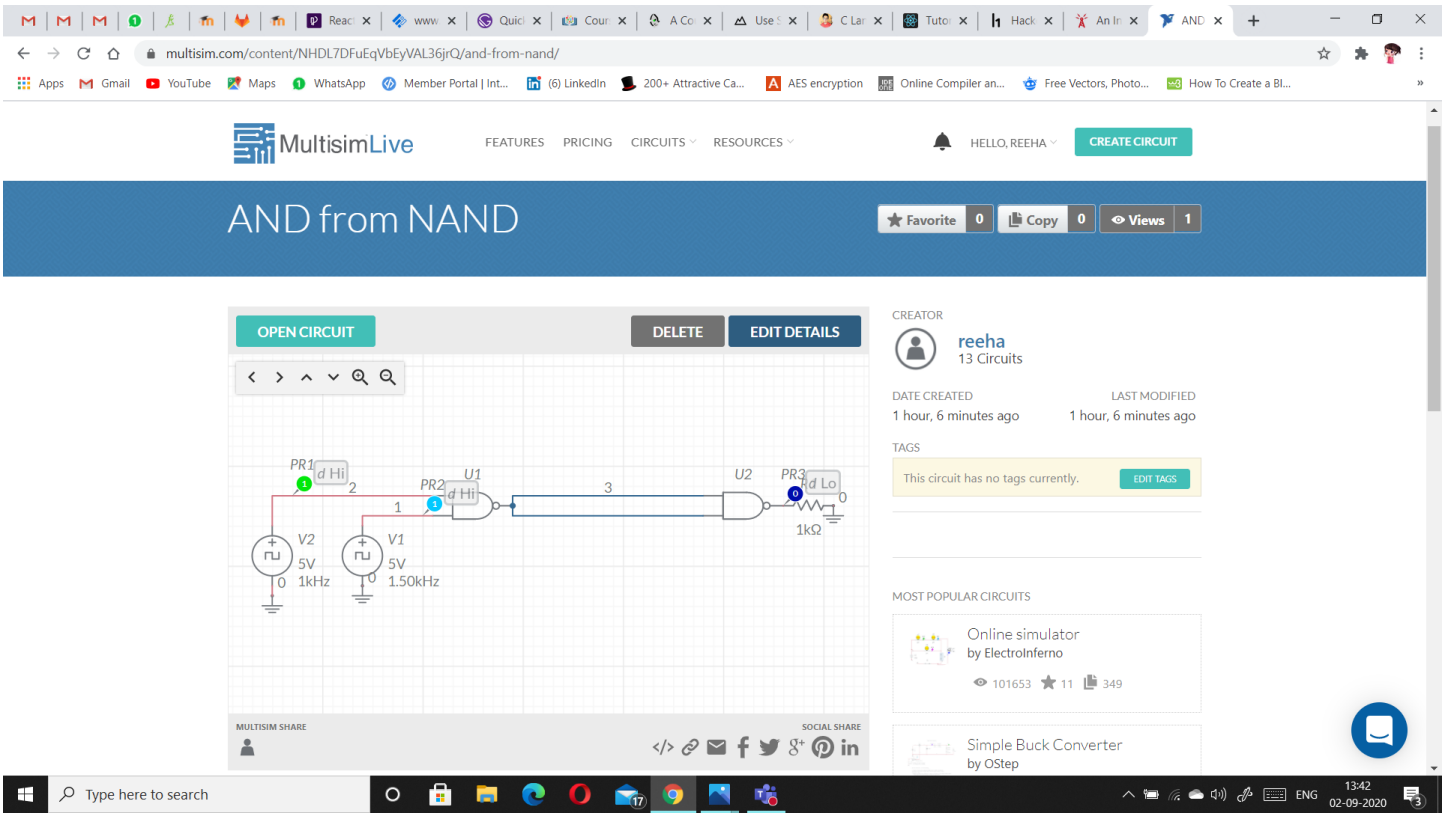
Screenshot of Circuit: *NOT(INVERTER) USING NAND*



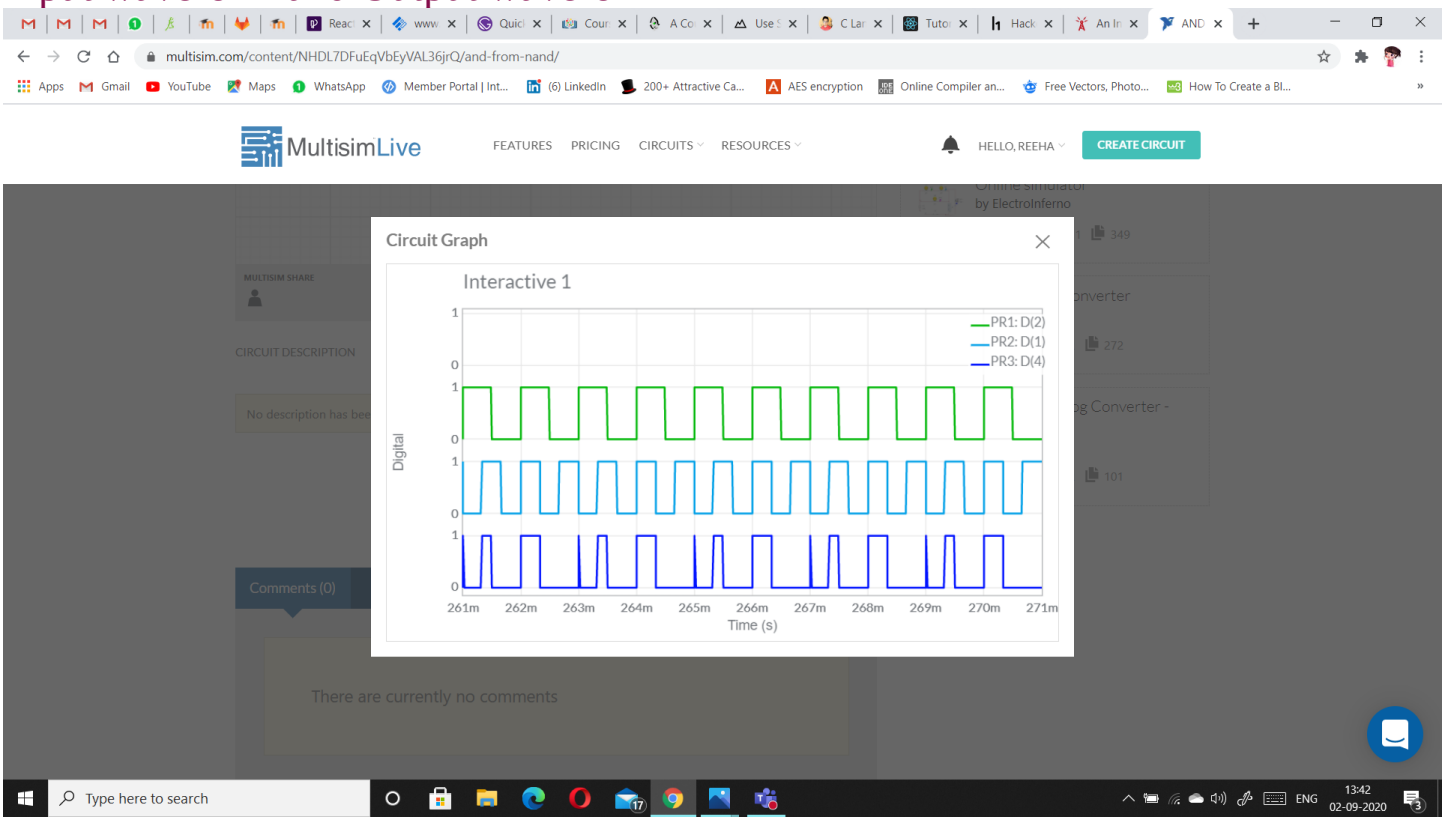
Input waveform and Output waveform



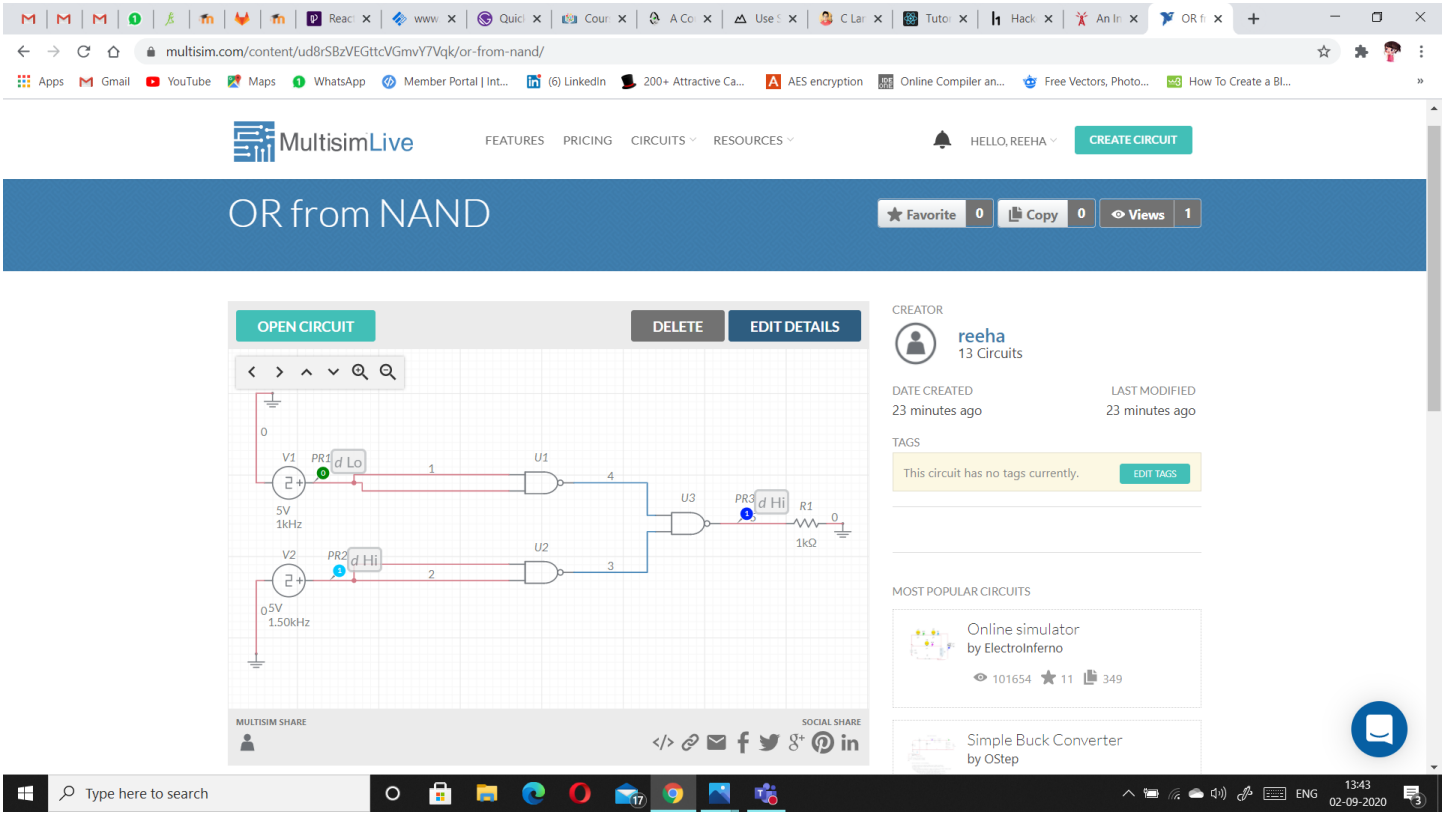
Screenshot of Circuit: *AND USING NAND*



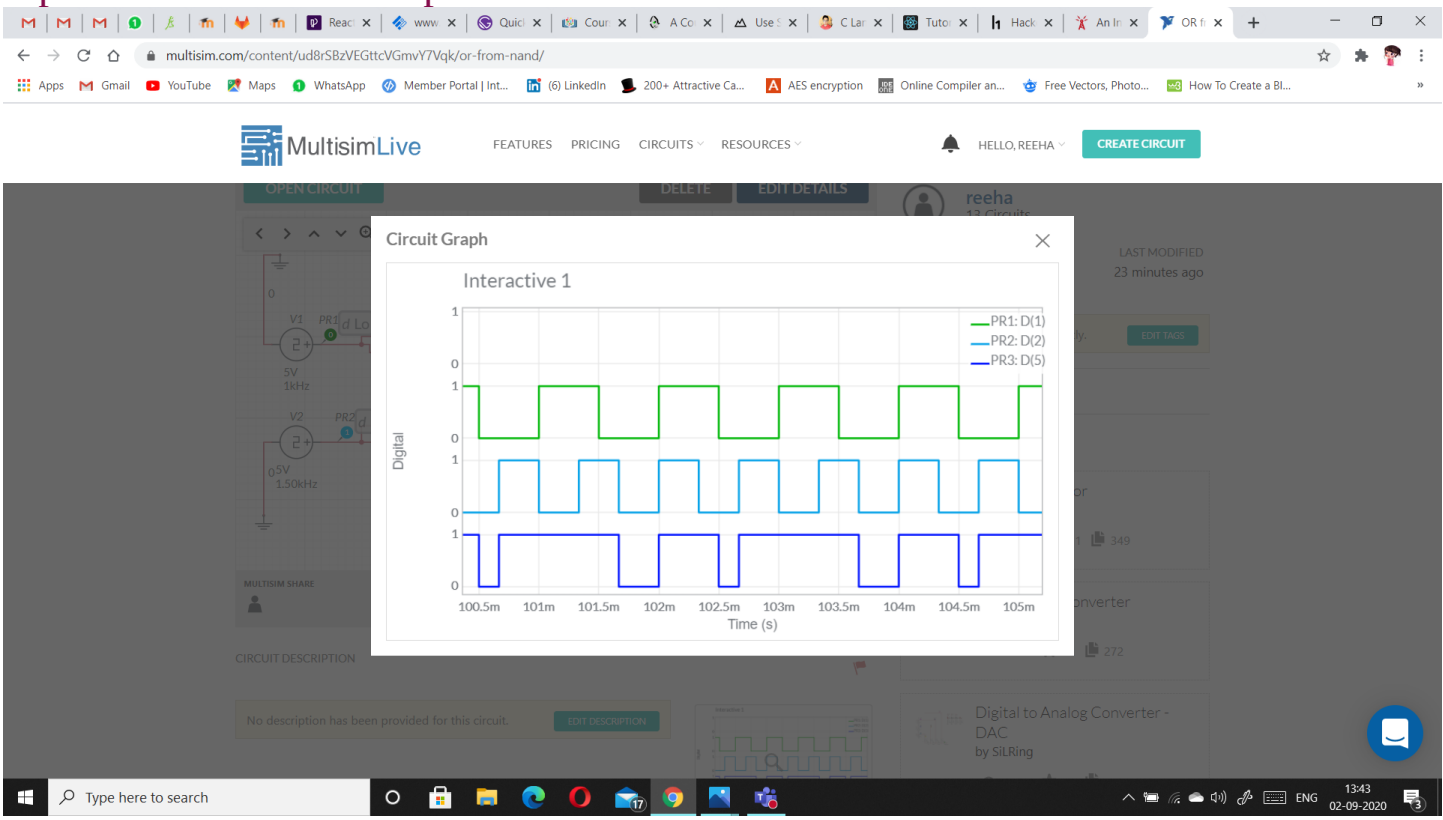
Input waveform and Output waveform



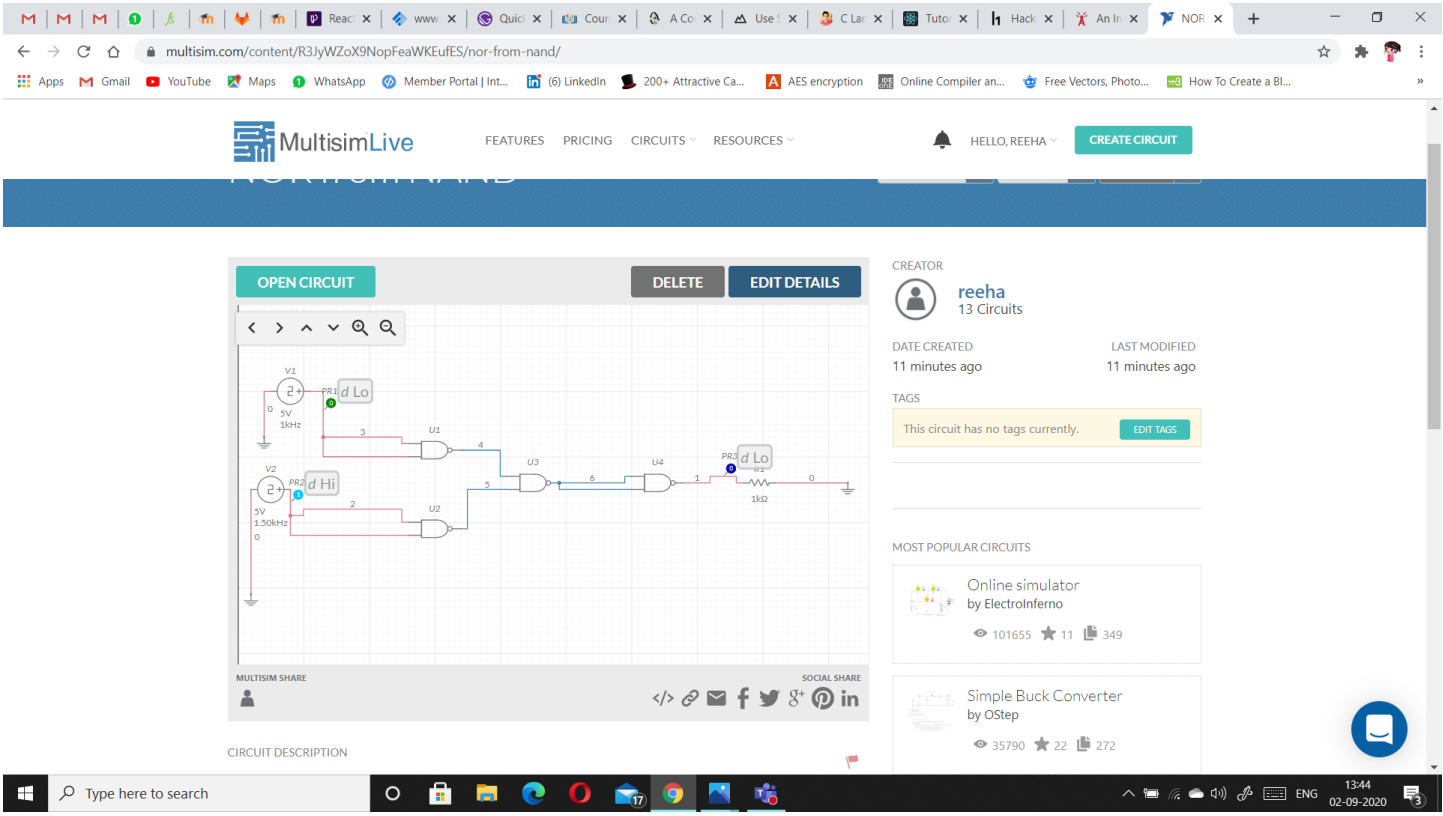
Screenshot of Circuit: *OR USING NAND*



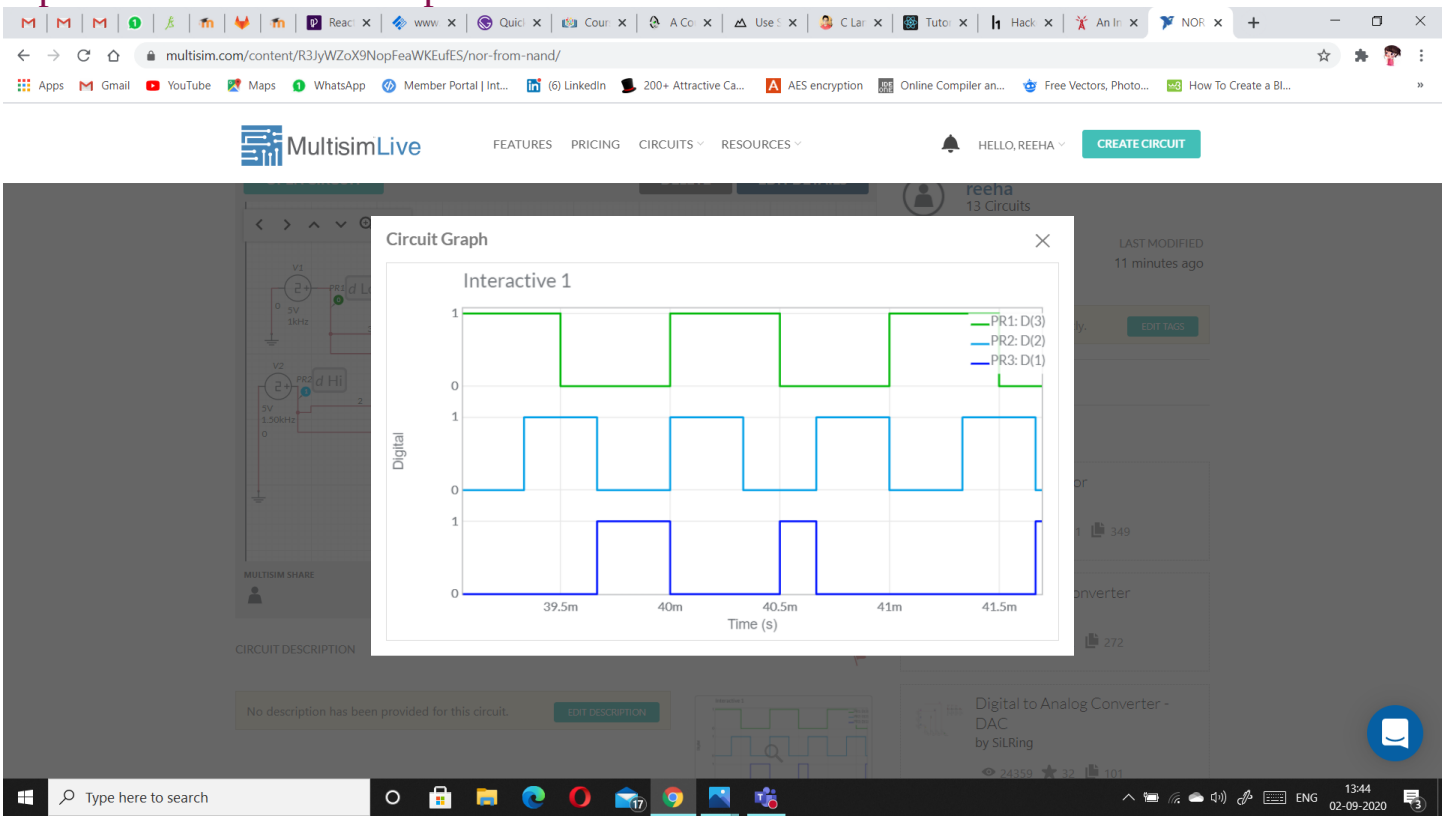
Input waveform and Output waveform



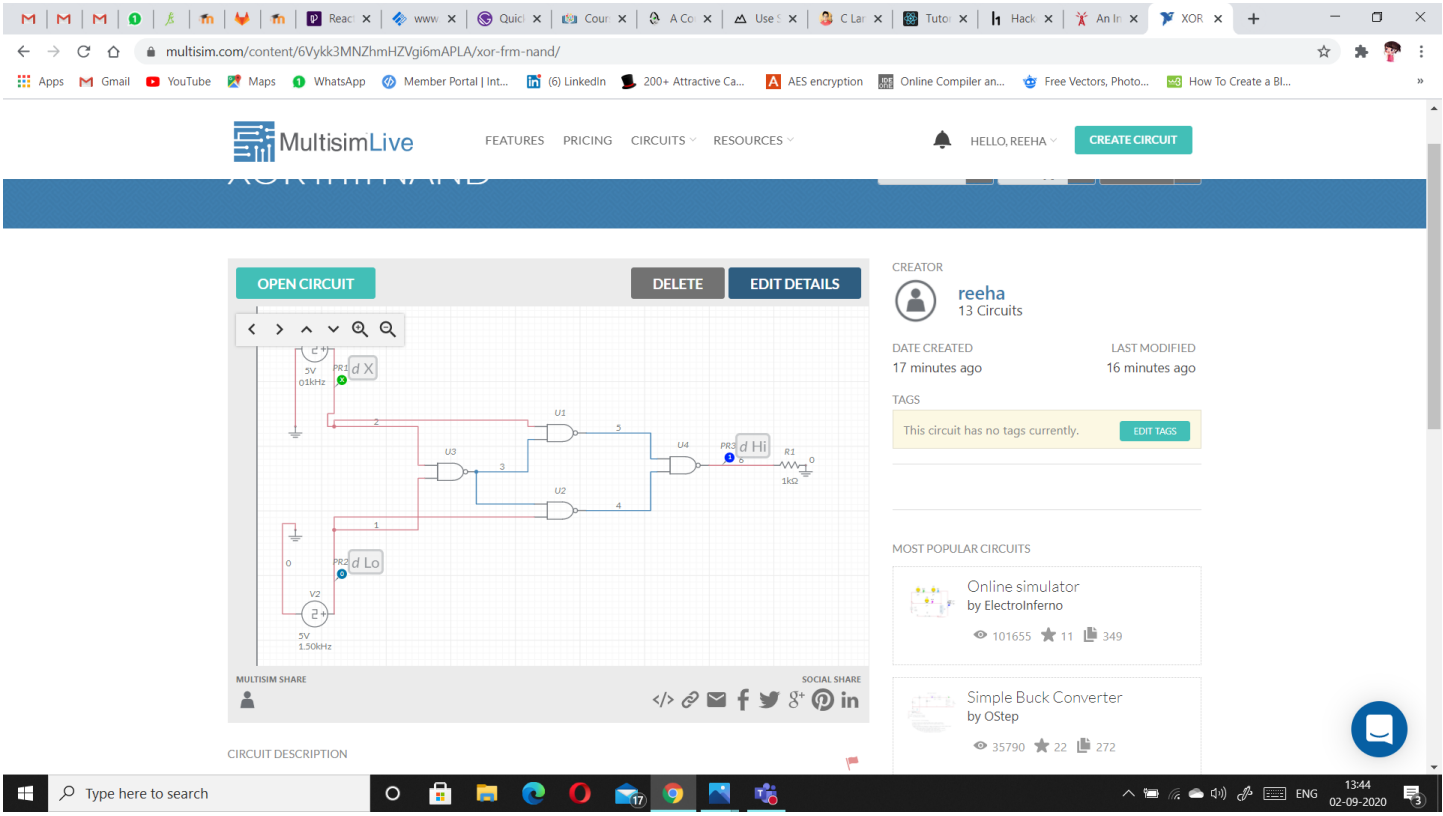
Screenshot of Circuit: *NOR USING NAND*



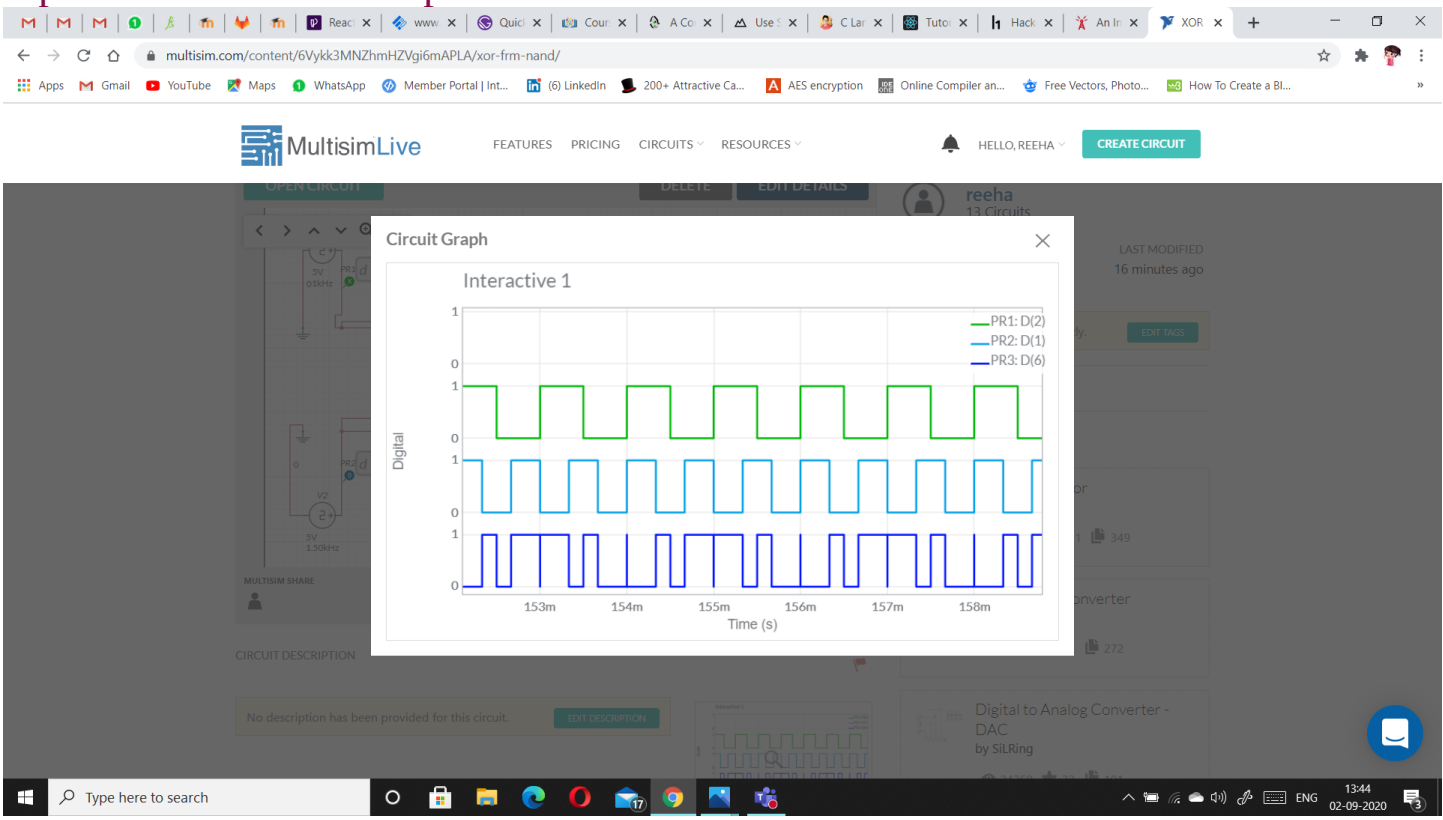
Input waveform and Output waveform



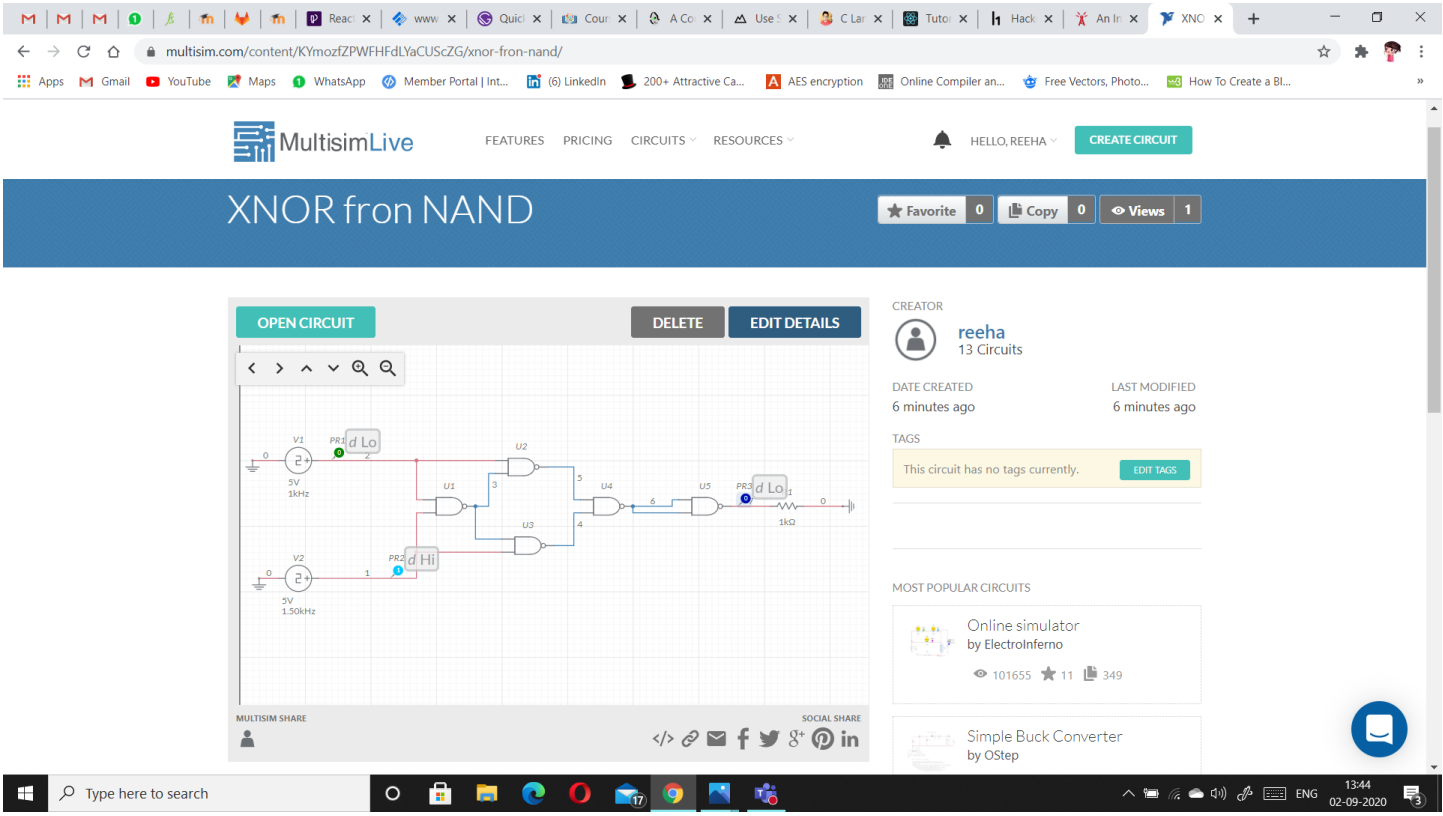
Screenshot of Circuit: *XOR USING NAND*



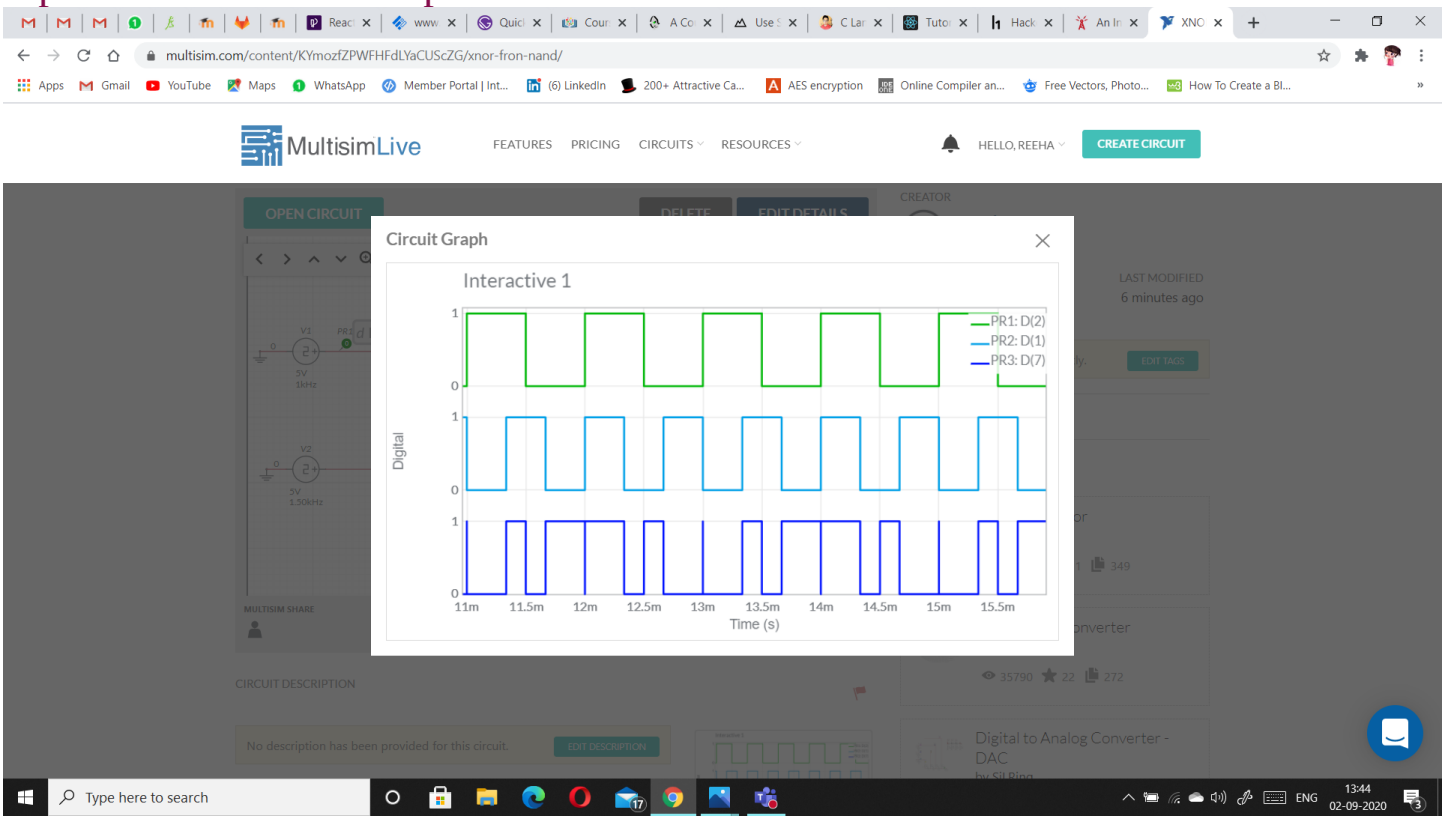
Input waveform and Output waveform



Screenshot of Circuit: *XNOR USING NAND*



Input waveform and Output waveform



Precautions (MULTISIM):

1. Frequency of clock voltage source should be different for both inputs.
2. Place the probes carefully only at the input and output sources.
3. Use digital analyzer probe.
4. Set the type to transient.
5. Ground both the voltage sources(clock) and the resistor.