Problem Statement #1

Circuit Designing
IEEE - DELHI TECHNOLOGICAL UNIVERSITY

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Problem 1

A *multivibrator* circuit is a circuit which switches it's output between a "HIGH" state
and a "LOW" state. How fast the state changes depends on the frequency of multivibrator. Another important parameter for this circuit is "Duty Cycle" which is the defined as:

$$Duty\ Cycle = \frac{t_{HIGH}}{t_{LOW}} \cdot 100\ \%$$

Basic Principle
The circuit works by charging a capacitor C through a charging resistor $R_{charging}$. When
the voltage across the capacitor reaches a certain threshold value $Threshold$ 1, output
state is switched to "LOW" and the discharging circuit is switched on. Now, the capacitor
is discharged through resistor $R_{discharging}$. When valtage across capacitor reaches lower
threshold value $Threshold$ 2, output state is switched to "HIGH" and the charging circuit
is switched on. Both circuits will have different value of time constants, and hence will
determine the time to rise/sink to respective threshold value. This time will determine
the frequency of the *multivibrator* circuit and it's duty cycle:

$$Frequency\ (\nu) = \frac{1}{t_{T1} + t_{T2}}$$

where, t_{T1} is time to reach $Threshold$ 1 and t_{T2} is time to reach $Threshold$ 2.
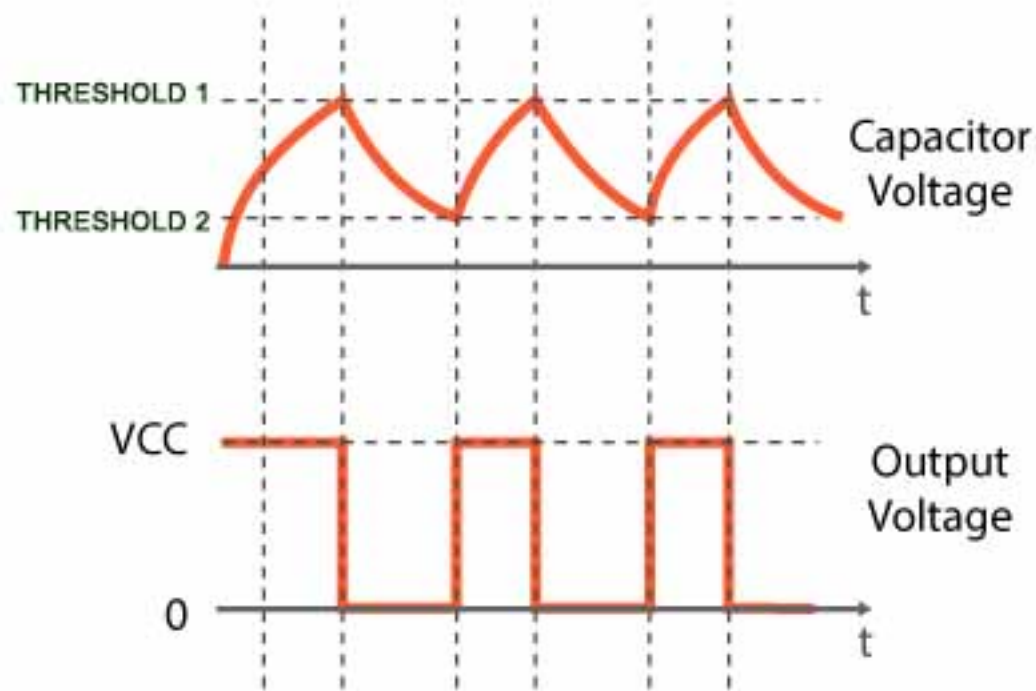
Problem Statement

Your task is to design a *multivibrator* circuit using principles described above. You will need to make the circuit on LTSpice (free), and submit circuit, along with simulation of your circuit. You'll also have to submit a report explaining how your circuit works . Follow the following guidlines:

a) Circuit should be made using passive components (like Resistor, Capacitors), switching devices (like Transistor, MOSFET) and/or Operational Amplifiers only

b) You cannot use digital gates/flip-flops etc directly in circuit. If you need it, implement it using dicrete components from scratch. (Although digital logic if used, can be used in your block diagram to explain the working of your circuit in your final report)

c) In your report, attach the simulation of Output of circuit and Voltage across the capacitor C.

d) *(Optional)* Implement a feedback loop which can correct duty cycle/ frequency of circuit. How this is implemented is left to the imagination and creativity of designer.

Judgement Criteria

a) Originality of design.

b) Innovativeness in designing and implementing of circuit.

c) Practicality of design.