Department of Computer Science and Engineering
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Electrical Circuits - CSE209(2)

Topic: Mini-Project

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Theory: A capacitor is a device that stores electrical energy in the form of an electric field. A capacitor contains two conductors that are adjacent to one other but separated by an insulator or non-conductive area. A capacitor has two plates, one positive and one negative. The capacitor accumulates energy at the positive plate while electrical current goes through the circuit. An equal quantity of electrical charge flows from the negative plate at the same time, ensuring that both plates have equal charges. When the electrical circuit is turned off, the capacitor stores the energy that was gathered.

Circuit Diagram:

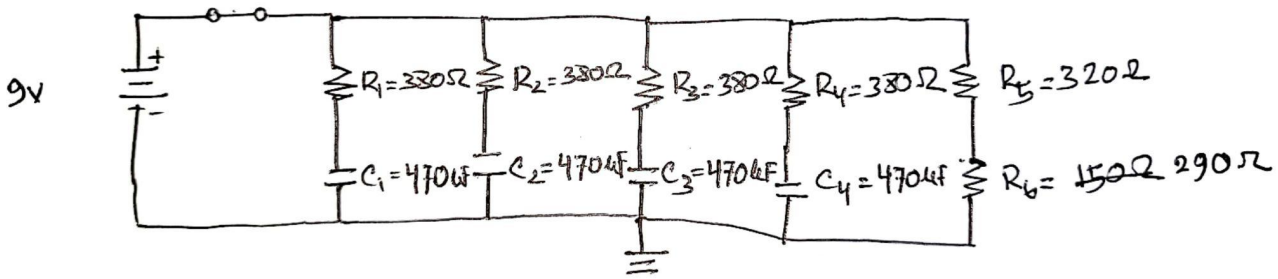


Figure 1: A switch closed circuit.

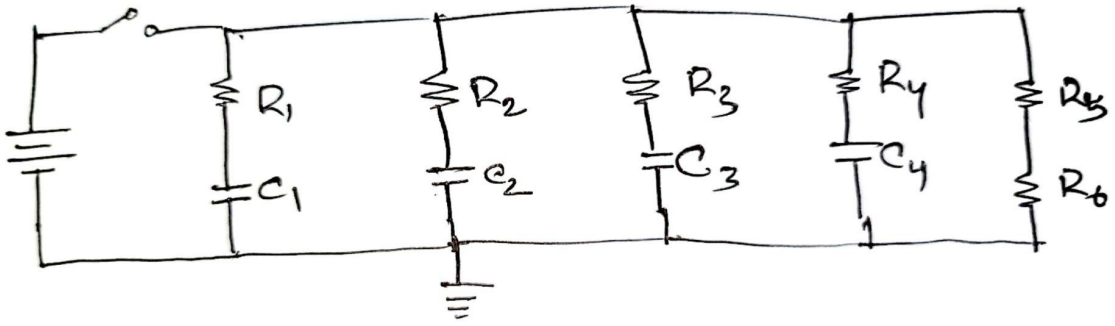
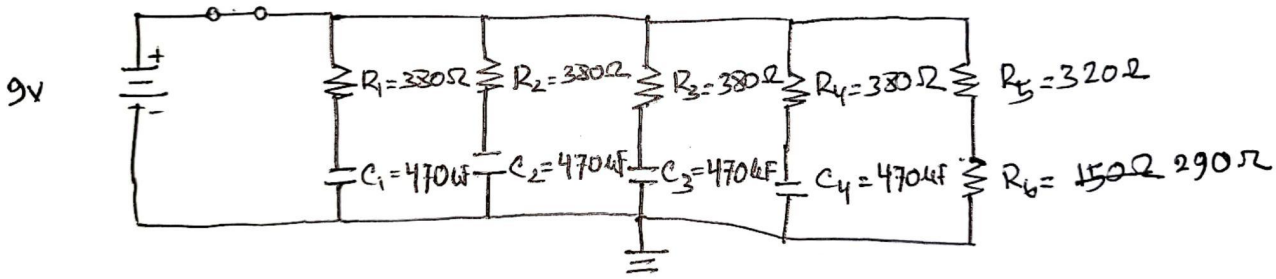


Figure 2: A switch opened circuit.

Experiments:



For closed switch circuit,

When t=0,

There is no voltage in the capacitor.

1/Rp=1/380 + 1/380 + 1/380 + 1/380 + 1/(320+290)=0.01216Ω

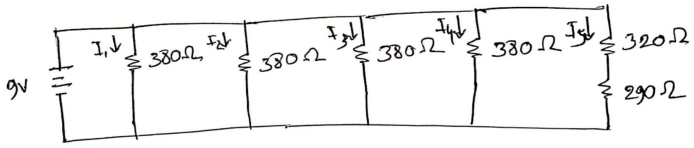
Rp=82.1985Ω

I(when t=0)=0.10949A=109.49mA

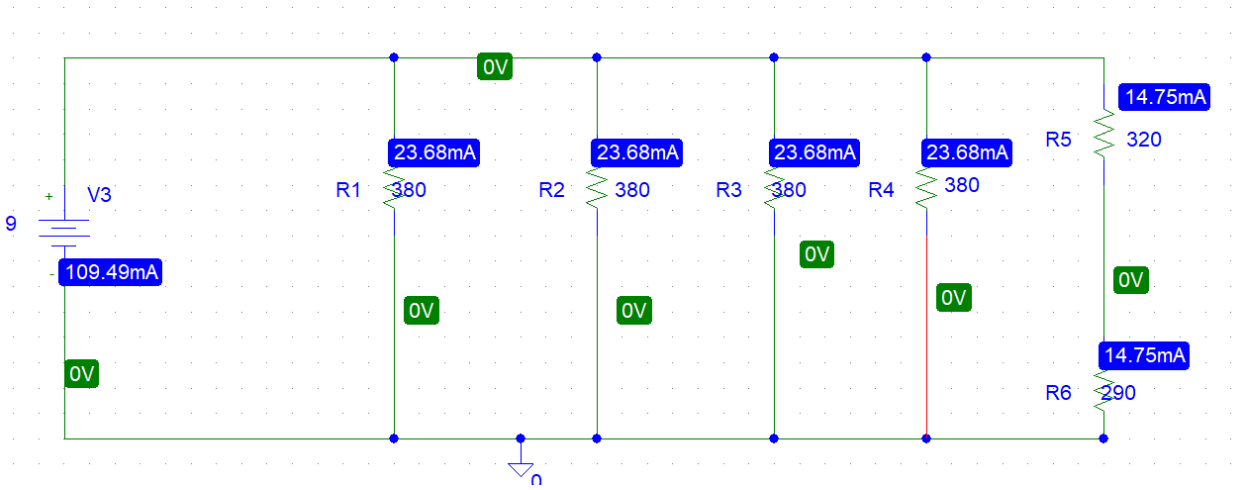
I_1=(109.49*82.1985)/380 mA=23.683mA

Similarly I_1=I_2=I_3=I_4=23.683mA

I_5 =109.49-94.7359=14.75mA



PSpice 1:



Comparison with Theoretical values:

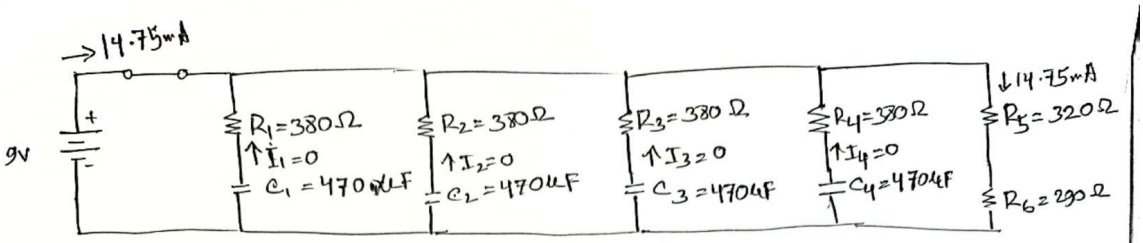
	Theoretical values	**PSpice values**
I	109.49mA	109.49mA
$I_1=I_2=I_3=I_4$	23.683mA	23.68A
$I_5=I_6$	14.75mA	14.75mA
$Vc_1=Vc_2=Vc_3=Vc_4$	0V	0V
V_6	0V	0V

There are no discrepancies between theoretically calculated values and pspice values.

For closed switch circuit,

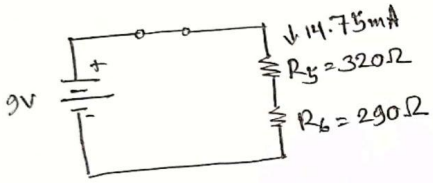
When t=∞,

When the capacitor is fully charged, there's no more current that goes through its branch.



Equivalent

Redrawing the circuit ignoring capacitor branch,



$R_s = 320 + 290 = 610\Omega$

$I = \frac{9V}{610\Omega} = 0.01475A = 14.75mA$

If $I_1 = 0$, $V_{R_1} = 0$

So $V_{C_1} = 9V$

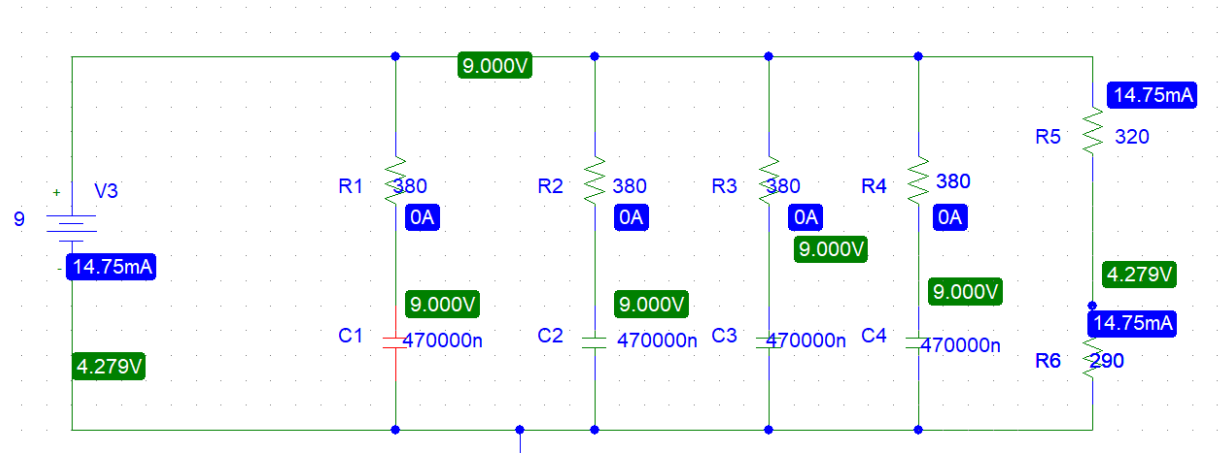
Similarly $V_{C_2} = V_{C_3} = V_{C_4} = 9V$

$I_1=I_2=I_3=I_4=0$

$I=I_5=I_6=14.75mA$

$V6=(0.01475*290)=4.2775V$

PSpice 2:



Comparison with Theoretical values:

	Theoretical values	**PSpice values**
I	14.75mA	14.75mA
$I_1=I_2=I_3=I_4$	0mA	0A
$I_5=I_6$	14.75mA	14.75mA
$Vc_1=Vc_2=Vc_3=Vc_4$	9V	9V
V_6	4.2775V	4.279V

There are no discrepancies between theoretically calculated values and pspice values.

For an open circuit capacitors will be fully charged. That is why it will keep the light for some time.

Discussion: This project taught us how to work with circuits. Also, we learned to deal with capacitors. If there had been more time, the project would have been more precise. We tried to learn quickly and apply these things in our report. In addition, we have tested our results with PSpice. There are no discrepancies between theoretically calculated values and PSpice values. While completing this project, we faced some difficulties. One of the significant difficulties was lab equipment. Laboratory equipment was down. That's why this has taken us so long. Second, there is a lack of resources at home. For this reason, we always depend on the laboratory during this experiment. Third, we were never given the right to visit the university lab anytime, which cost us time. But we overcame it and reported back on the project. It was a new experiment and we really liked it.