

Homework Assignment 1 (2/14 before midnight)

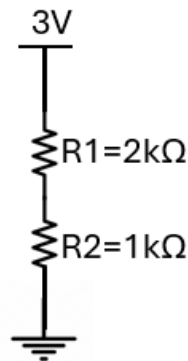
Instructions: Answer the following questions based on the circuits and concepts discussed in class. Be sure to show all work where applicable.

Problem 1: Describe the function of the touchpad used in class. What are the sensor and processing components involved?

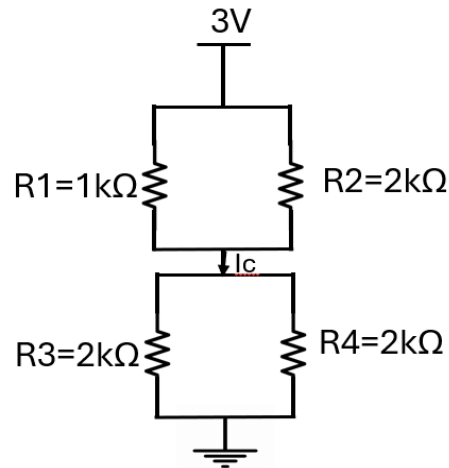
Problem 2: Define the following electrical quantities and their units, Draw their corresponding circuit symbols.

- Voltage
 - Current
 - Resistance
 - Capacitance
 - Inductance
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Problem 3: Analyze the following circuits and calculate the voltage and current across R_1 and R_2 . V_{R1} , I_{R1} , V_{R2} , I_{R2} =?



Problem 4: Given the circuit below, calculate the voltage and current across the R1, R2, R3 and R4:

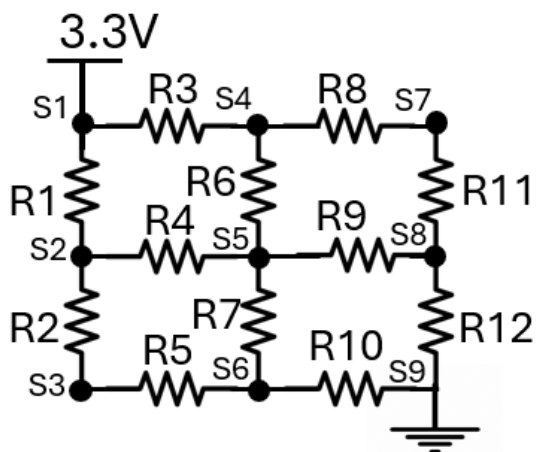


- $V_{R1}, I_{R1}, V_{R2}, I_{R2}, V_{R3}, I_{R3}, V_{R4}, I_{R4}$.
- What is the value of the I_C ?

Problem 5:

- a) In the given circuit, calculate the voltage values at each node (S_1 to S_9), and the current through each branch (I_1 to I_{12}) using python.

$$R_1 = R_2 = R_3 = R_4 = R_5 = R_6 = R_7 = R_8 = R_9 = R_{10} = R_{11} = R_{12} = 100\Omega$$

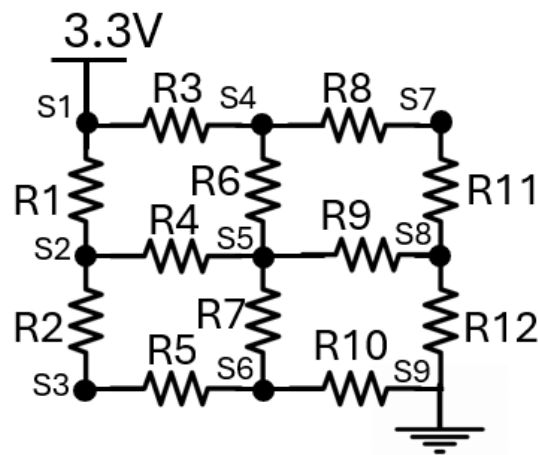


b) If

$$R_1 = R_2 = R_6 = R_7 = R_{11} = R_{12} = 100\Omega$$

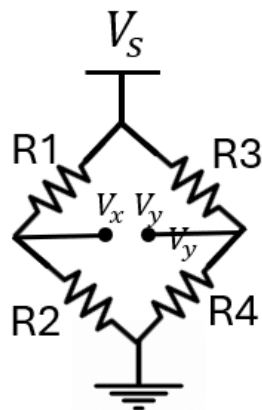
$$R_3 = R_4 = R_5 = R_8 = R_9 = R_{10} = 50\Omega$$

calculate the voltage values at each node (S_1 to S_9), and the current through each branch (I_1 to I_{12}) using python.

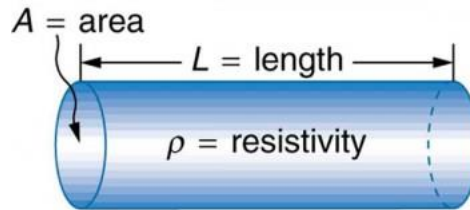


c) What is the difference between the circuit in a) and b). Which one should you use for the touchpad application and why?

Problem 6: Derive the equation for $V_x - V_y$.



Problem 7: Consider a cylindrical resistance of length $l=10\text{ cm}$, radius $r=1\text{ mm}$, and resistance of $R=0.54\text{ m}\Omega$. Pick the resistivity of the cylindrical resistance from below.

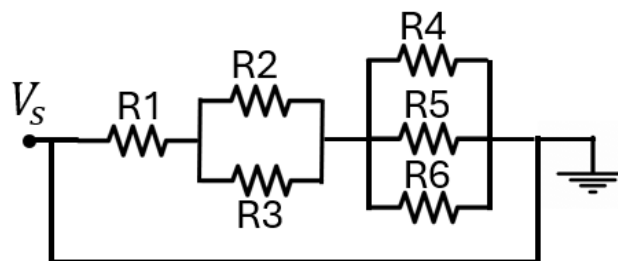


- a) $1.7 \times 10^{-5} \Omega m$
- b) $1.7 \times 10^{-6} \Omega m$
- c) $1.7 \times 10^{-8} \Omega m$
- d) $5.4 \times 10^{-9} \Omega m$

Problem 8: By what factor does the resistance of a rectangular block change if you double each dimension of the block?

- ☐ a) 1
- ☐ b) 2
- ☐ c) $\frac{1}{2}$
- ☐ d) $\frac{1}{4}$

Problem 9: Given the circuit below, calculate the voltage values of V_{R1} , V_{R2} , V_{R3} , V_{R4} , V_{R5} , V_{R6} .



Please submit your answers by the due date. Ensure all your work is clearly presented.