Homework Assignment 1 (9/17, before class)

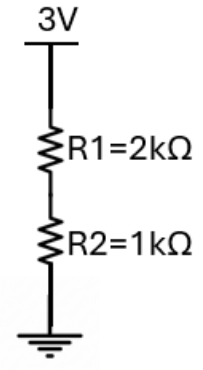
Instructions: Answer the following questions based on the circuits and concepts discussed in class. Be sure to show all work where applicable.

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

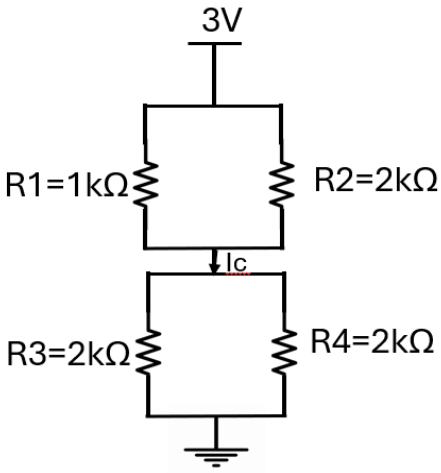
Problem 2: Define the following electrical quantities and their units, Draw their corresponding circuit symbols.

- Voltage
- Current
- Resistance
- Capacitance
- Inductance

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:

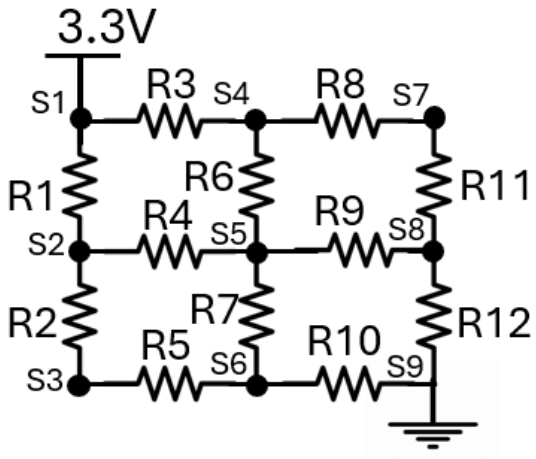


- $V_{R1}, I_{R1}, V_{R2}, I_{R2}, V_{R3}, I_{R3}, V_{R4}, I_{R4}$.
- What is the value of the I_C?

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.

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

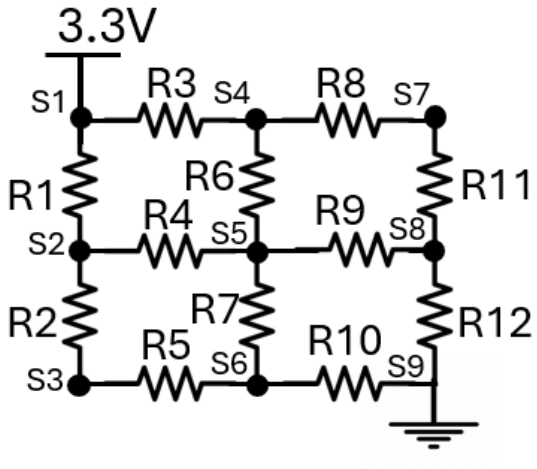


b) If

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

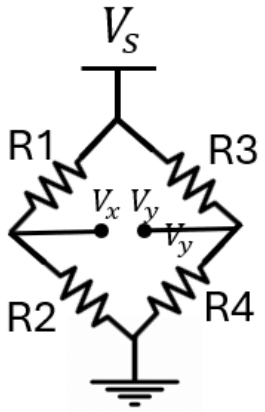
$R_3 = R_4 = R_5 = R_8 = R_9 = R_{10} = 50\Omega$

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.

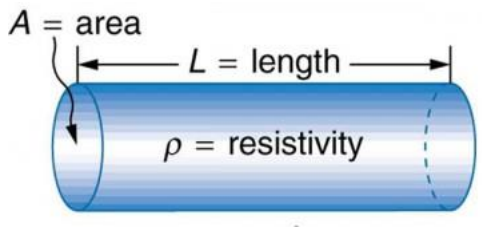


c) What is the difference between the circuit in a) and b). Which one should you use for the touchpad application and why?

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



Problem 7: Consider a cylindrical resistance of length l=10 cm, radius r=1 mm, and resistance of R=0.54mΩ. Pick the resistivity of the cylindrical resistance from below.

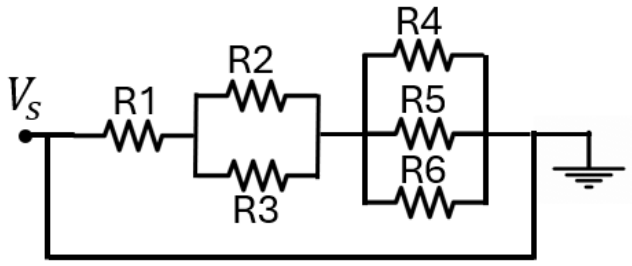


a) $1.7\times10^{-5}\Omega m$
b) $1.7\times10^{-6}\ \Omega m$
c) $1.7\times10^{-8}\ \Omega m$
d) $5.4\times10^{-9}\Omega m$

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.