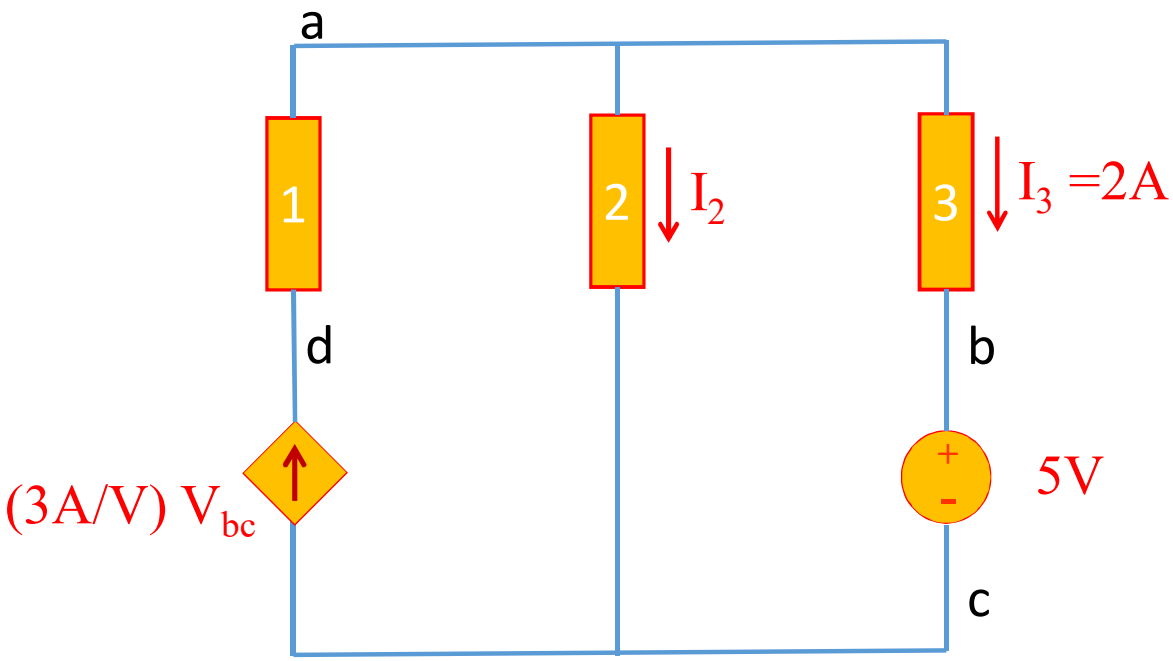
EECS/CSE 70A Network Analysis I

Homework #2

Due on or before
4/19/2018, Thursday 10 am
(You can submit your homework in any of the Tuesday Thursday discussions before or on 4/19/2018)

Problem 1: (VCCS) Find I_2. **1.5 points**



Solution:

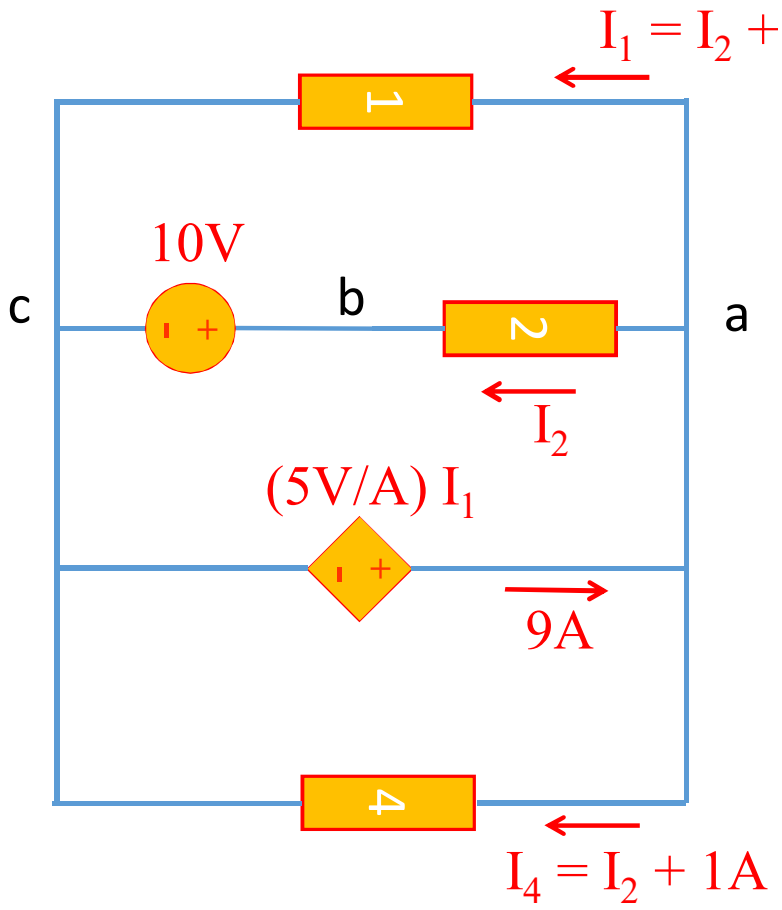
$V_{bc} = 5V$

VCCS current = I_{VCCS} = (3A/V) V_{bc} = 15A

KCL @ node a: $I_2 + I_3 = I_{VCCS}$ **0.5**

→ I_2 = 13A **0.5** **0.5**

Problem 2: (CCVS) Find I_2, I_4 and V_{ac} **3.5 points**



Solution:

$V_{bc} = 10$ V

KCL @ node a: $I_1 + I_2 - 9A + I_4 = 0$ **1**

From the question we know $I_1 = I_2 + 3A$ and $I_4 = I_2 + 1A$

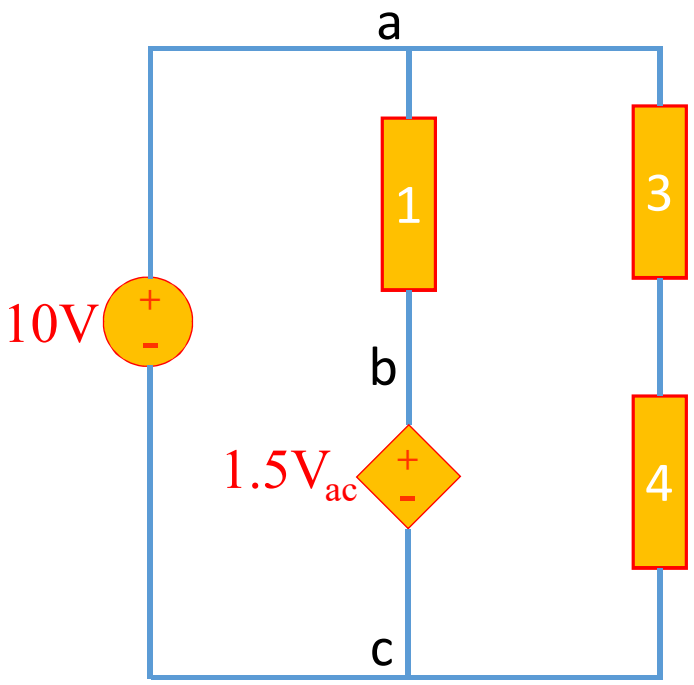
→ $(I_2 + 3A) + I_2 + (I_2 + 1A) - 9 = 0$ → $I_2 = 5/3$ A $= 1.66$A **1**

$I_4 = I_2 + 1A = 2.66$A **0.5**

$I_1 = I_2 + 3A = 4.66$A **0.5**

$V_{ac} = 5V/A * I_1 = 23.3$V **0.5**

Problem 3: (VCVS) Find V_{bc} and V_{ab} . **1 points**

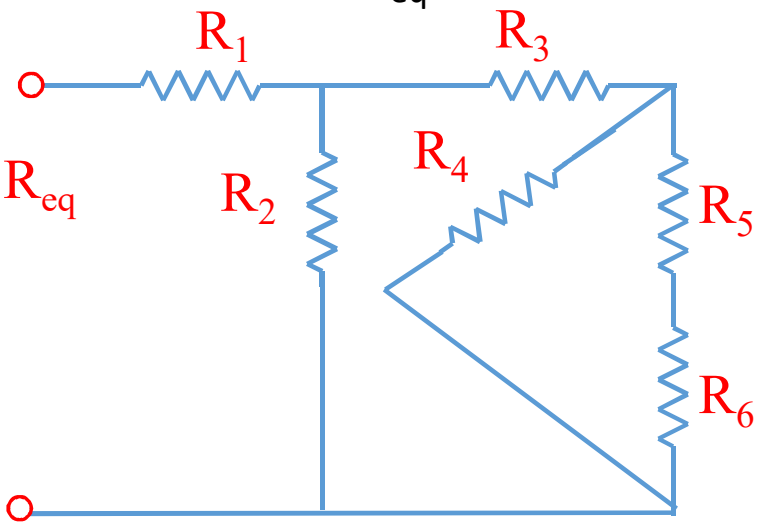


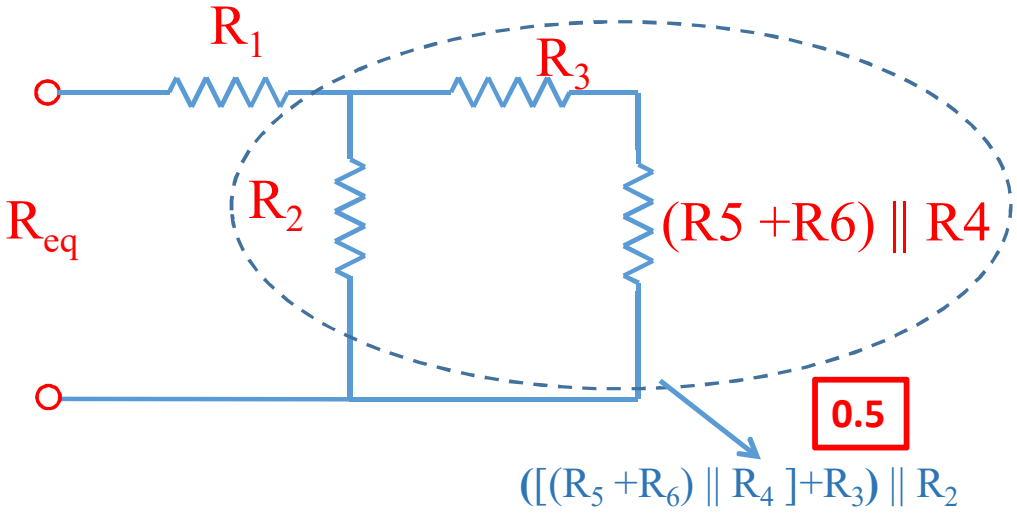
Solution:

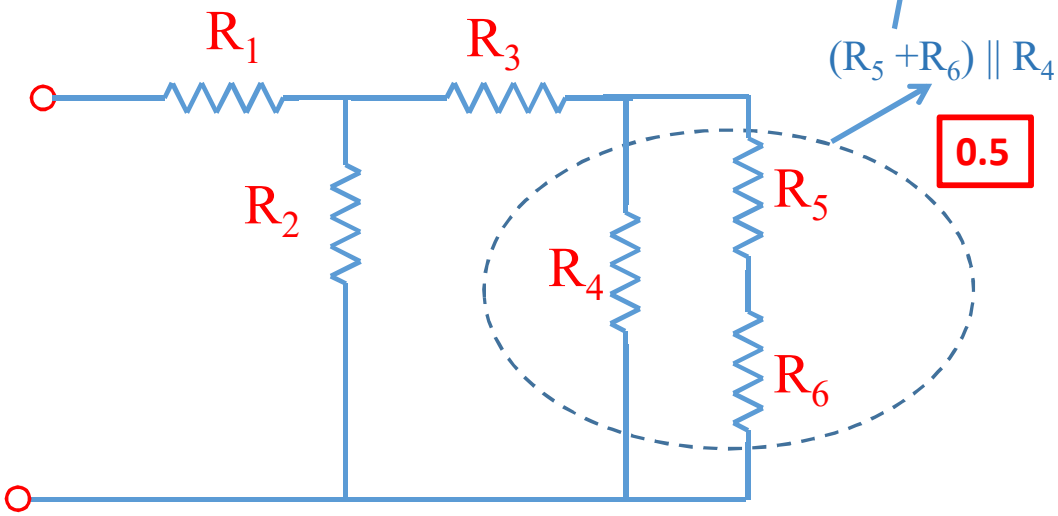
$V_{ac} = 10V \rightarrow V_{bc} = 1.5 \times V_{ac} = 15V$ **0.5**

$V_{ac} = V_{ab} + V_{bc} \rightarrow V_{ab} = V_{ac} - V_{bc} = -5V$ **0.5**

Problem 4: Find R_{eq} . Please use the parallel sign "//" as discussed in class. **2 points**



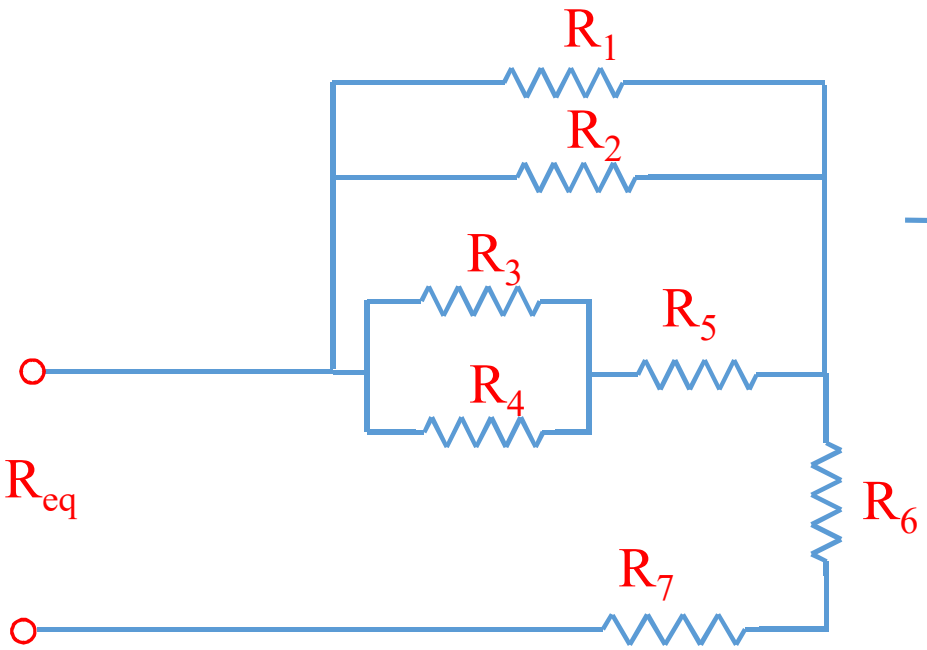


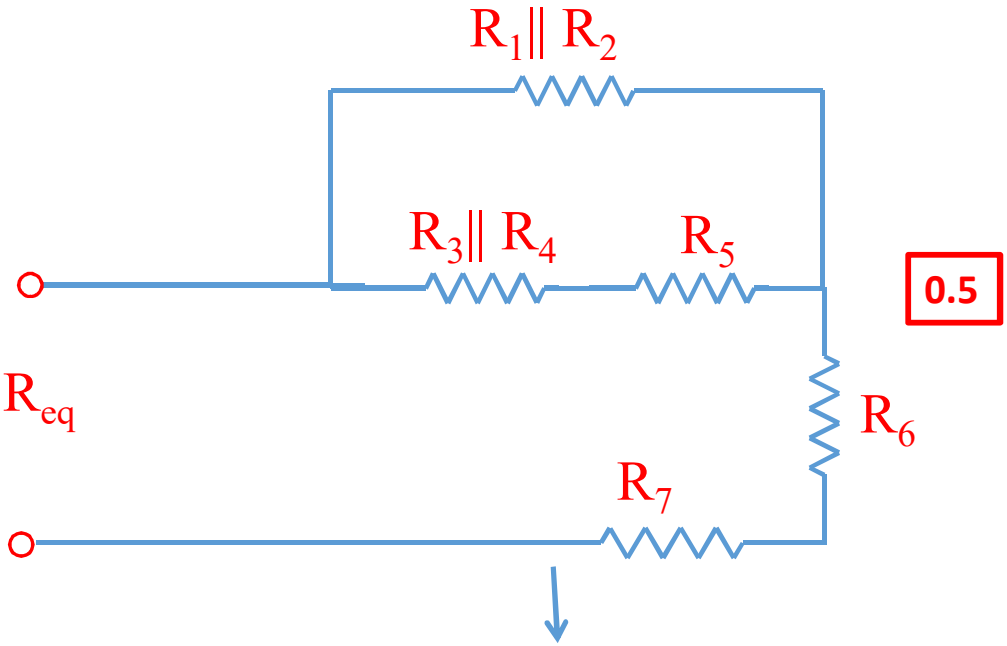


$$R_{eq} = R_1 + \left[\left(\left[(R_5 + R_6) \parallel R_4\right] + R_3\right) \parallel R_2\right]$$

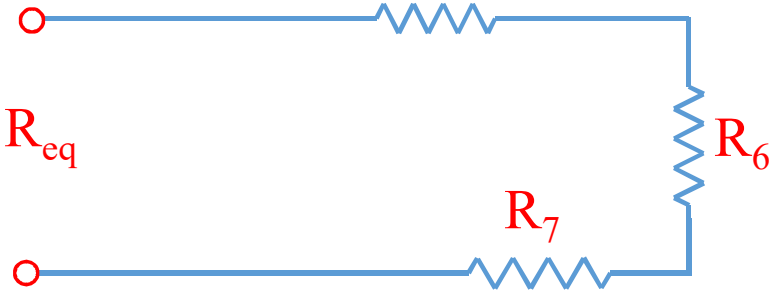
1

Problem 5: Find R_{eq} . Please use the parallel sign "//" as discussed in class. **2 points**





0.5

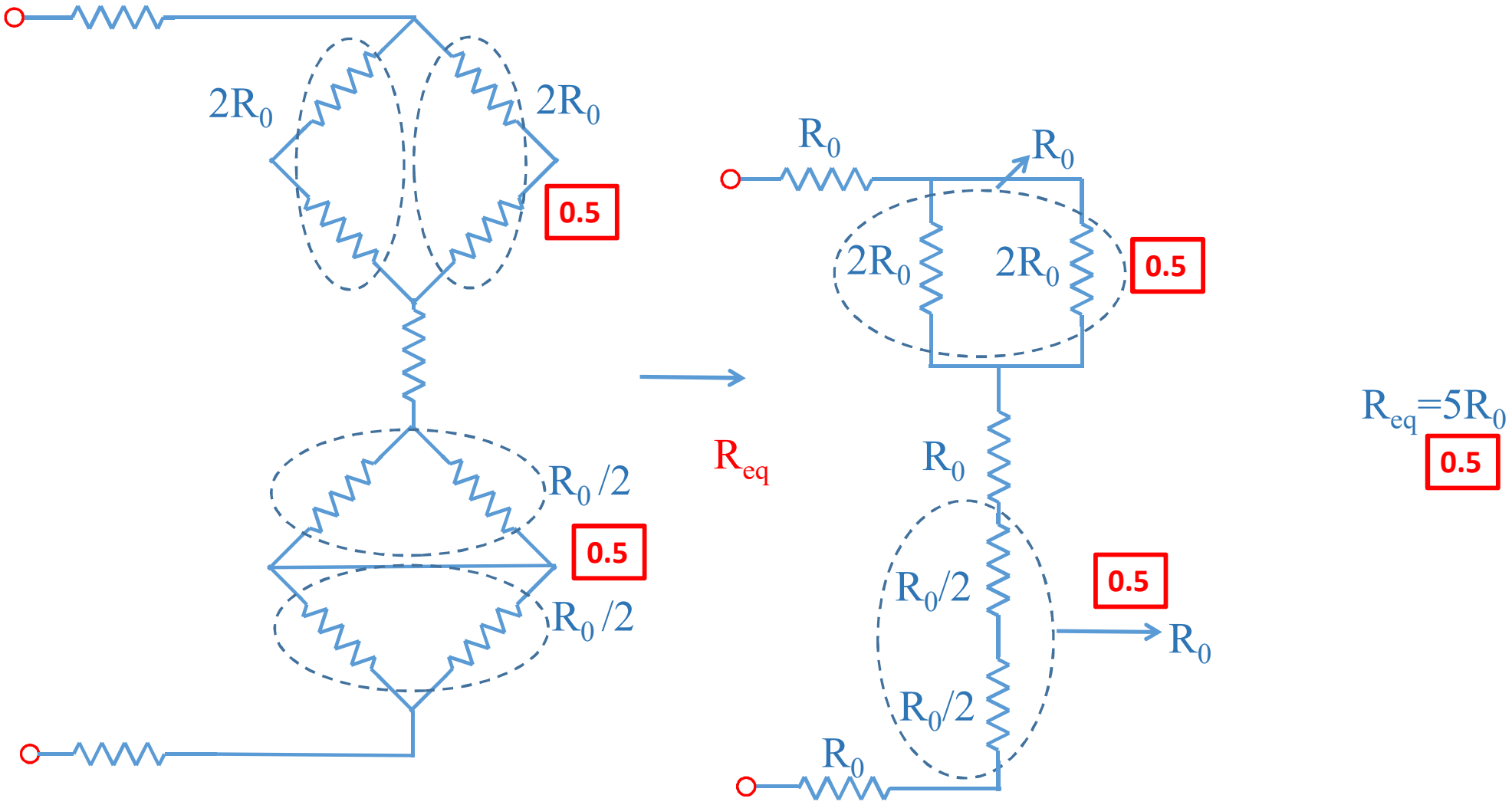


0.5

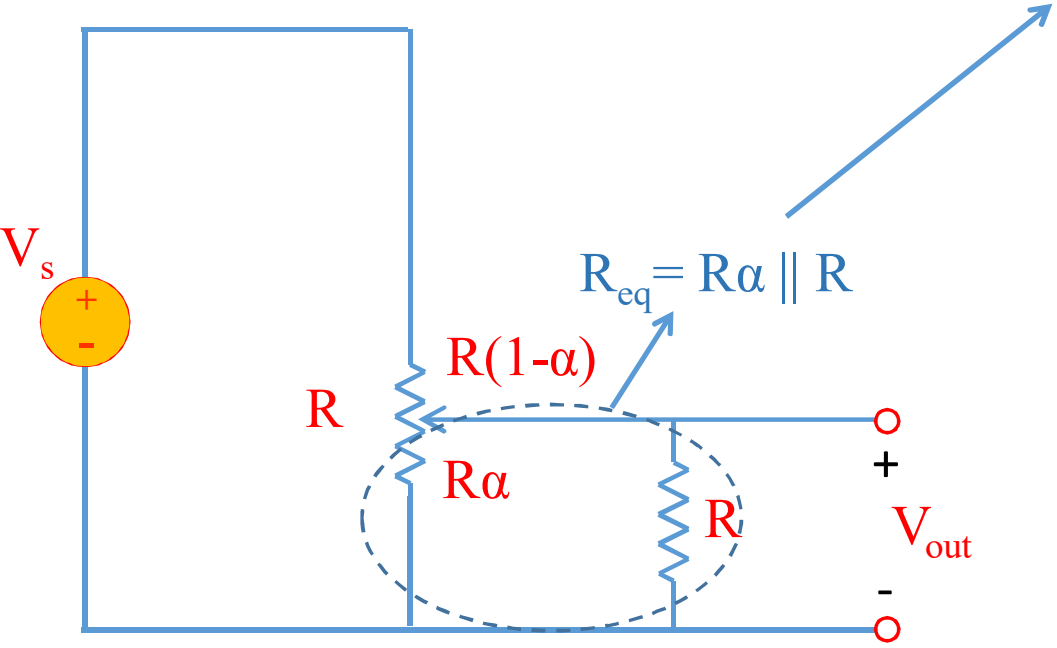
$$R_{eq} = \left([(R_3 \,||\, R_4) + R_5] \,||(R_1 \,||\, R_2) \right) + R_6 + R_7$$

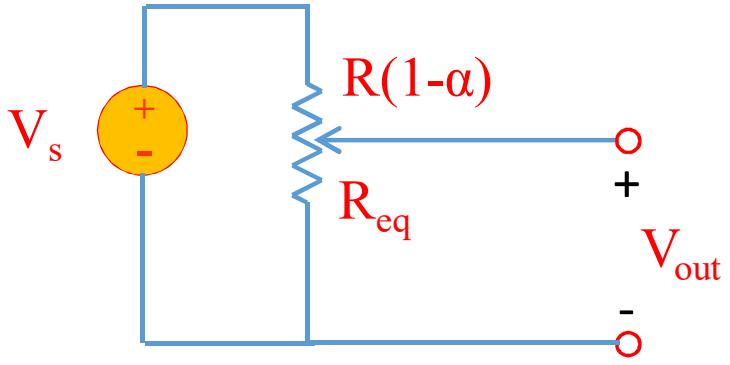
1

Problem 6: All of the resistors below are R_0 Ω. Find R_{eq} . **2.5 points**



Problem 7: (Potentiometer) In the circuit below, the wiper divides the potentiometer resistance R between two resistances R(1-α) and Rα where 0<α<1. α is a parameter modeling the wiper's position. Find the value of voltage V_{out} in terms of V_s if the value of α is ½. **3 points**





$I = V_s / (R_{eq} + R(1-\alpha))$ **0.5**

$V_{out} = R_{eq} \times I = \frac{R_{eq}}{R_{eq}+R(1-\alpha)} V_s$ **0.5**

$R_{eq} = R\alpha \parallel R = \frac{\alpha R * R}{\alpha R + R} = \frac{\alpha}{\alpha+1} R$ **1**

$\rightarrow V_{out} = \frac{\frac{\alpha}{\alpha+1}}{\frac{\alpha}{\alpha+1}+(1-\alpha)} V_s = \frac{\alpha}{\alpha+1-\alpha^2} V_s$ **0.5**

$\alpha = 1/2 \rightarrow V_{out} = 0.4\, V_s$ **0.5**