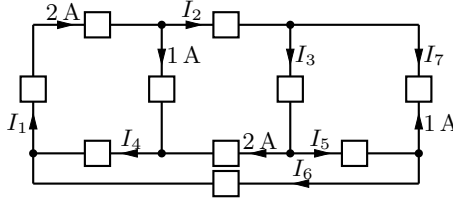


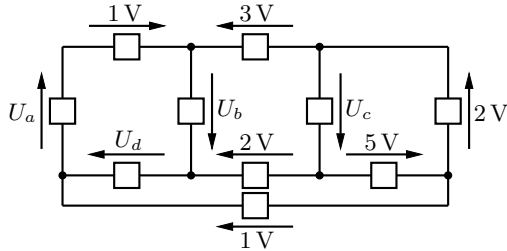
Problem Set 1

Problem 1. Determine the values of the labelled currents.



Answer. $I_1 = 2 \text{ A}$, $I_2 = 1 \text{ A}$, $I_3 = 2 \text{ A}$, $I_4 = 3 \text{ A}$, $I_5 = 0 \text{ A}$, $I_6 = -1 \text{ A}$,

Problem 2. Determine the values of the labelled voltages.

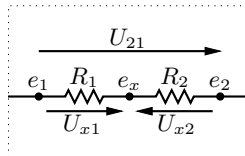


Answer. $U_a = 3 \text{ V}$, $U_b = -8 \text{ V}$, $U_c = -7 \text{ V}$, $U_d = 4 \text{ V}$.

Problem 3. For the following subcircuit:

- Find electric potential e_x as a function of potentials: e_1 , e_2 , and resistances: R_1 , R_2 ,
- Express voltages U_{x1} and U_{x2} in terms of voltage U_{21} and the resistances.

What would be the above quantities for $R_1 = R_2$?

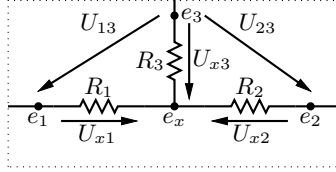


Answer. $e_x = e_1 \frac{R_2}{R_1 + R_2} + e_2 \frac{R_1}{R_1 + R_2}$; $U_{x1} = U_{21} \frac{R_1}{R_1 + R_2}$; $U_{x2} = -U_{21} \frac{R_2}{R_1 + R_2}$. For $R_1 = R_2$:
 $e_x = \frac{e_1 + e_2}{2}$, $U_{x1} = \frac{U_{21}}{2}$, $U_{x2} = -\frac{U_{21}}{2}$.

Problem 4. For $R_1 = 1\text{ k}\Omega$, $R_2 = 2\text{ k}\Omega$, $R_3 = 3\text{ k}\Omega$:

- Find electric potential e_x as a function of potentials e_1 , e_2 and e_3 ,
- Express voltages U_{x3} in terms of voltages U_{13} and U_{23} .

What would be the above quantities for $R_1 = R_2 = R_3$?



Answer. $e_x = \frac{G_1}{G_1+G_2+G_3}e_1 + \frac{G_2}{G_1+G_2+G_3}e_2 + \frac{G_3}{G_1+G_2+G_3}e_3$ and $U_{x3} = \frac{G_1}{G_1+G_2+G_3}U_{13} + \frac{G_2}{G_1+G_2+G_3}U_{23}$, where $G_1 = \frac{1}{R_1}$, $G_2 = \frac{1}{R_2}$, $G_3 = \frac{1}{R_3}$, $e_x = \frac{6}{11}e_1 + \frac{3}{11}e_2 + \frac{2}{11}e_3$ and $U_{x3} = \frac{6}{11}U_{13} + \frac{3}{11}U_{23}$ for given values of R_1 , R_2 , R_3 .