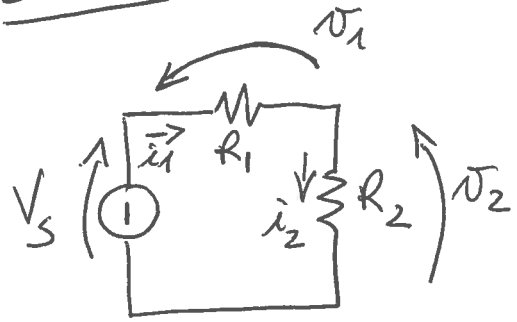
ES 7



$V_S = 20V$

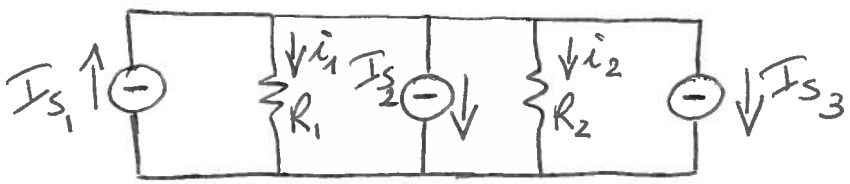
$R_1 = 2\,\Omega$

$R_2 = 3\,\Omega$

$$i_1 = i_2 = \frac{V_S}{R_1+R_2} = 4\,A$$

$$v_1 = R_1 i_1 = \frac{R_1}{R_1+R_2} V_S = 8V \qquad v_2 = R_2 i_2 = \frac{R_2}{R_1+R_2} V_S = 12V$$

ES 8



$I_{S_1} = 2A$ $\quad R_1 = 2\,\Omega$

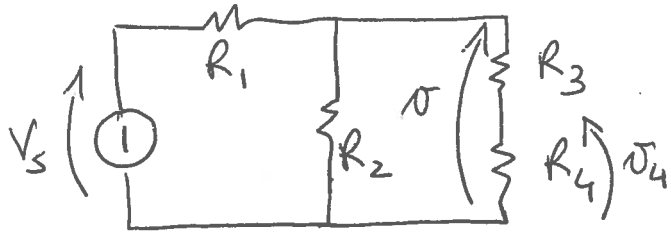
$I_{S_2} = 3A$ $\quad R_2 = 3\,\Omega$

$I_{S_3} = 4A$

$$I_S = I_{S_2} + I_{S_3} - I_{S_1} = 5A$$

$$i_1 = \frac{R_2}{R_1+R_2}(-I_S) = -3A \qquad i_2 = \frac{R_1}{R_1+R_2}(-I_S) = -2A$$

ES 9



$V_S = 10V$

$R_1 = R_4 = 1\,\Omega$

$R_2 = 2\,\Omega$

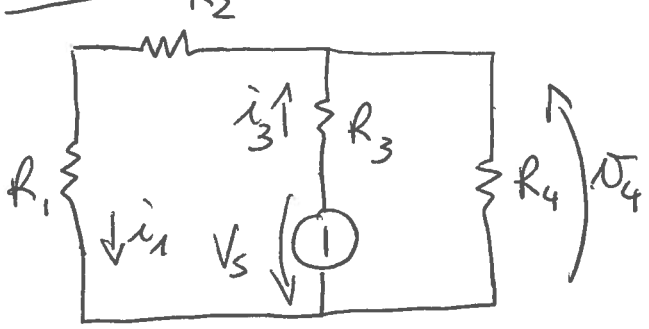
$R_3 = 3\,\Omega$

$$R_0 = R_2 // (R_3+R_4) = \frac{R_2(R_3+R_4)}{R_2+R_3+R_4} = \frac{4}{3}\,\Omega$$

$$v = \frac{R_0}{R_1+R_0} V_S = \frac{40}{7} V$$

$$v_4 = \frac{R_4}{R_3+R_4} v = \frac{10}{7} V$$

ES 10

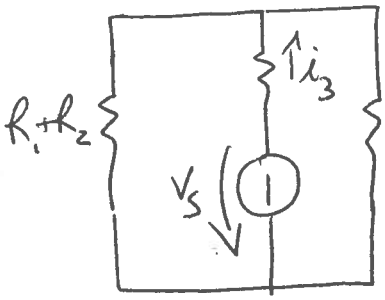


$V_s = 6\,V$

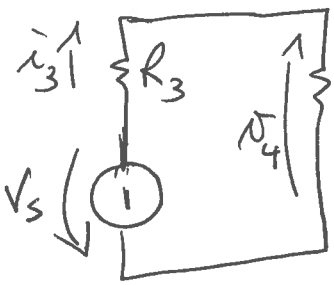
$R_1 = R_2 = 1\,\Omega$

$R_3 = 3\,\Omega$

$R_4 = 2\,\Omega$



$\rightarrow$



$R_0 = R_4 // (R_1+R_2)$

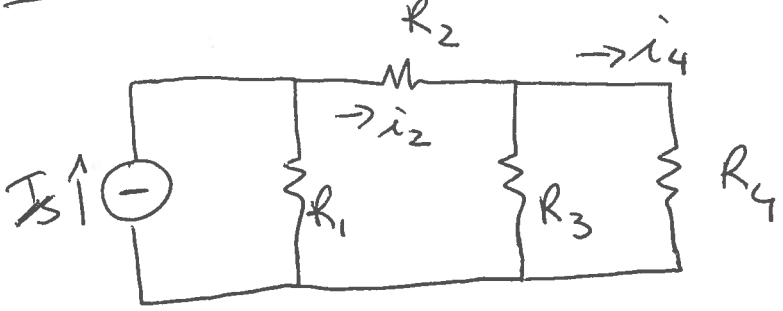
$= \dfrac{R_4(R_1+R_2)}{R_1+R_2+R_3} = 1\,\Omega$

$$v_4 = \frac{R_0}{R_0+R_3}(-V_s) = -\frac{3}{2}\,V$$

$$v_3 = \frac{R_3}{R_0+R_3}(-V_s) \Rightarrow i_3 = \frac{v_3}{R_3} = -\frac{V_s}{R_0+R_3} = -\frac{3}{2}\,A$$

$$i_1 = \frac{v_4}{R_1+R_2} = -\frac{3}{4}\,A$$

ES 11

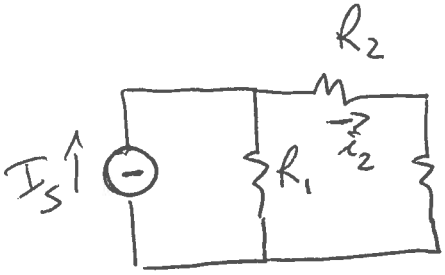


$I_S = 5A$

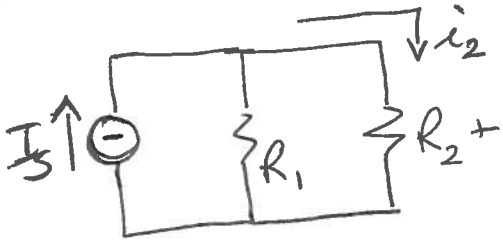
$R_1 = 3\Omega$

$R_2 = 1\Omega$

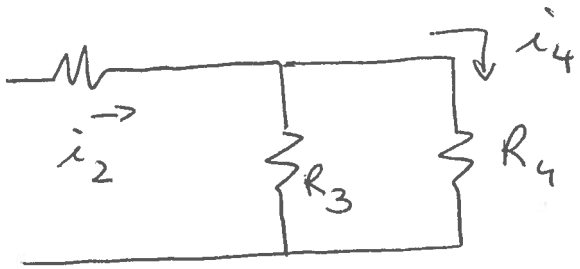
$R_3 = R_4 = 2\Omega$



$R_3 // R_4 = \dfrac{R_3 R_4}{R_3 + R_4} = 1\,\Omega$ $\left[\Rightarrow = \dfrac{R_3}{2} = \dfrac{R_4}{2}!\right]$

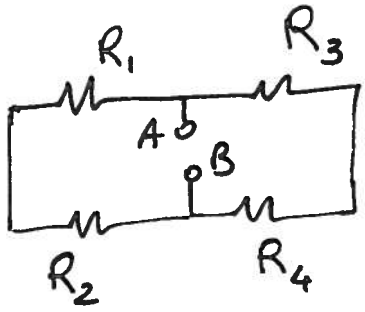


$$i_2 = \frac{R_1}{R_0 + R_1} I_S = 3A$$



$$i_4 = \frac{R_3}{R_3 + R_4} i_2 = \frac{3}{2} A$$

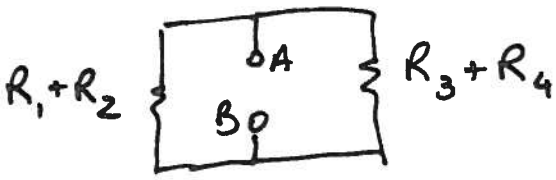
ES 12



$R_1 = R_3 = R_4 = 1\,\Omega$

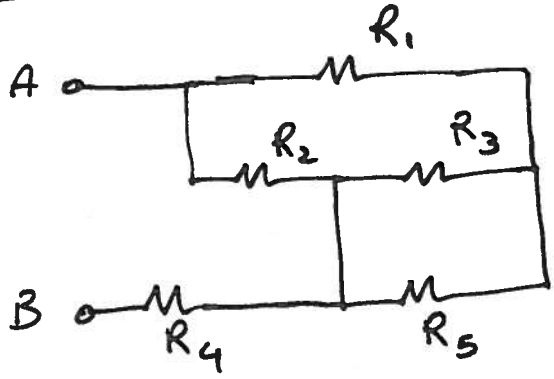
$R_2 = 4\,\Omega$

$R_{eq} = ?$



$$R_{eq} = \frac{(R_1+R_2)(R_3+R_4)}{R_1+R_2+R_3+R_4} = \frac{10}{7}\,\Omega$$

ES 13



$R_1 = \frac{2}{3}\,\Omega$

$R_2 = R_5 = 2\,\Omega$

$R_3 = 4\,\Omega$

$R_4 = 1\,\Omega$

$R_{eq} = ?$

R_3 ed R_5 sono in parallelo

$$R_{35} = R_3 \,//\, R_5 = \frac{R_3 R_5}{R_3+R_5}$$

R_{35} è in serie con $R_1 \rightarrow R_{135} = R_1 + R_{35}$

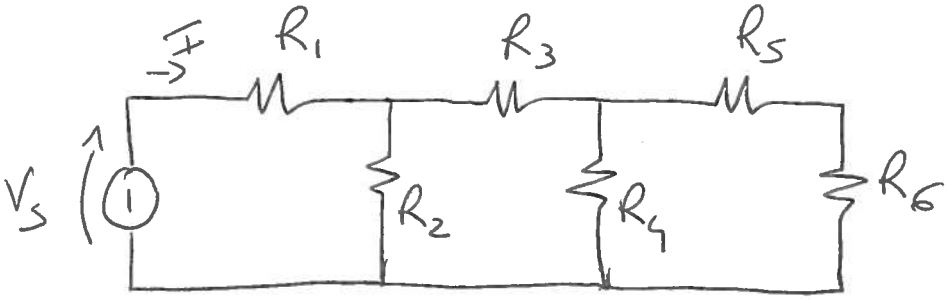
R_{135} è in parallelo con R_2

$$R_0 = \frac{R_2\left(R_1 + \frac{R_3 R_5}{R_3+R_5}\right)}{R_1+R_2+\frac{R_3 R_5}{R_3+R_5}} = \frac{R_1 R_2 (R_3+R_5) + R_2 R_3 R_5}{(R_1+R_2)(R_3+R_5) + R_3 R_5}$$

R_0 è in serie con R_4

$$R_{eq} = R_4 + R_0 = 2\,\Omega$$

ES 14

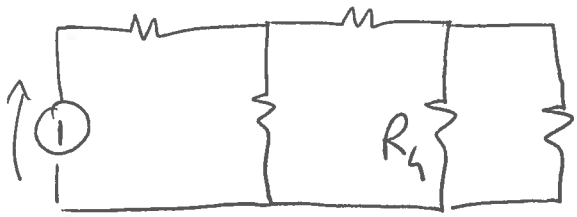


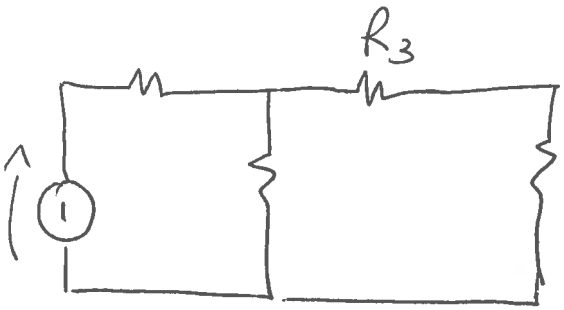
$V_S = 50\,V$

$R_1 = R_3 = R_5 = R_6 = 2\,\Omega$

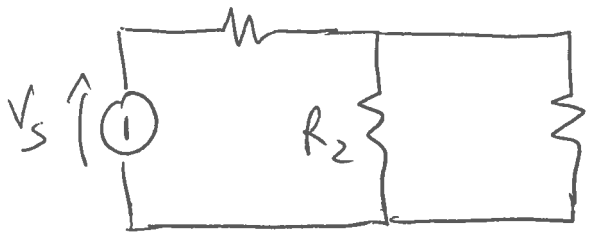
$R_2 = R_4 = 4\,\Omega$

$I = ?$

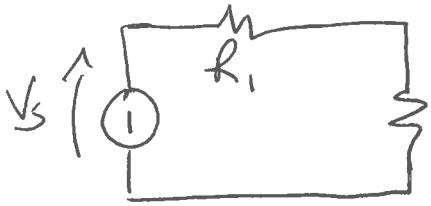




$$\frac{R_4(R_5+R_6)}{R_4+R_5+R_6}$$



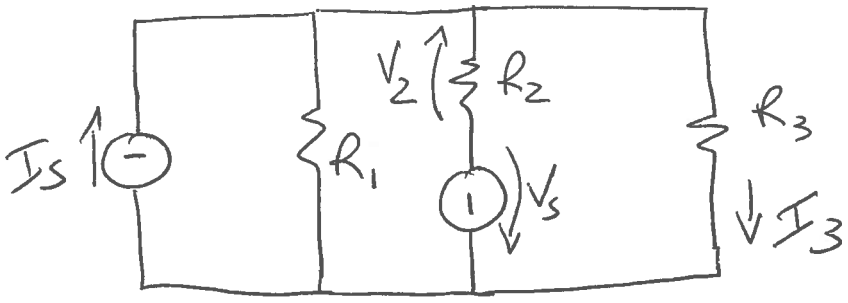
$$R_3 + \frac{R_4(R_5+R_6)}{R_4+R_5+R_6} = R_0$$



$$R_2 /\!/ R_0 = \frac{R_0 R_2}{R_0 + R_2}$$

$$I = \frac{V_S}{R_1 + \dfrac{R_0 R_2}{R_0 + R_2}} = \frac{25}{2}\,A$$

ES 15

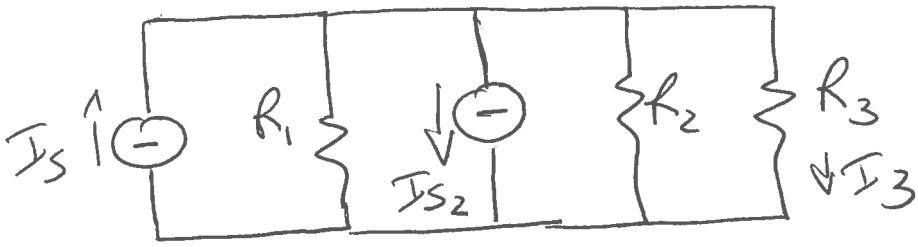


$I_S = 4\,A$

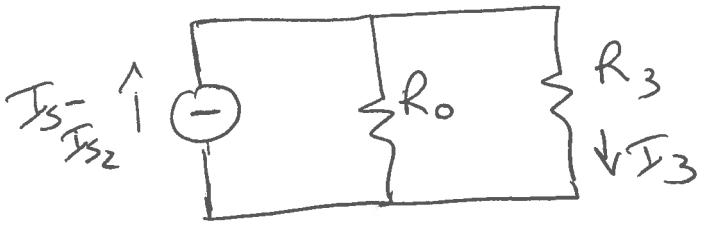
$V_S = 3\,V$

$R_1 = R_2 = 2\,\Omega$

$R_3 = 1\,\Omega$



con $I_S = \dfrac{V_S}{R_2} = \dfrac{3}{2}\,A$



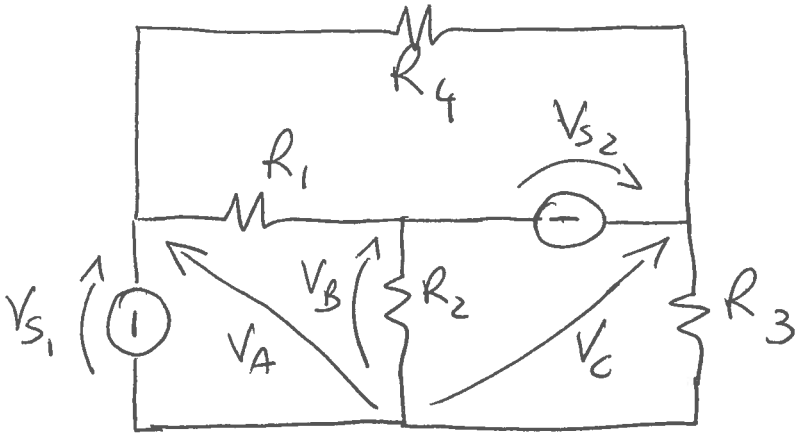
$$R_0 = \frac{R_1 R_2}{R_1 + R_2}$$

$$I_3 = (I_S - I_{S_2}) \frac{\dfrac{R_1 R_2}{R_1 + R_2}}{R_3 + \dfrac{R_1 R_2}{R_1 + R_2}}$$

$$= \frac{R_1 R_2}{R_3(R_1 + R_2) + R_1 R_2} (I_S - I_{S_2}) = \frac{5}{4}\,A$$

$V_2 \Rightarrow$ $\qquad V_2 = R_3 I_3 + V_S = \dfrac{17}{4}\,V$

ES 16



$V_{S_1} = 12\,V$

$V_{S_2} = 10\,V$

$R_1 = 2\,\Omega$

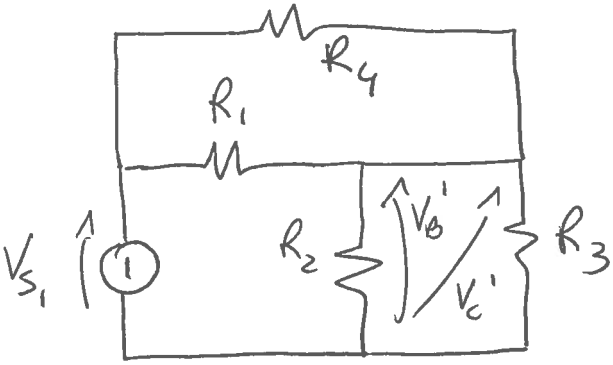
$R_2 = 12\,\Omega$

$R_3 = R_4 = 8\,\Omega$

$V_A = ?\quad V_B = ?\quad V_C = ?$

$V_A = V_{S_1} = 12\,V$

SOVRAPPOSIZIONE

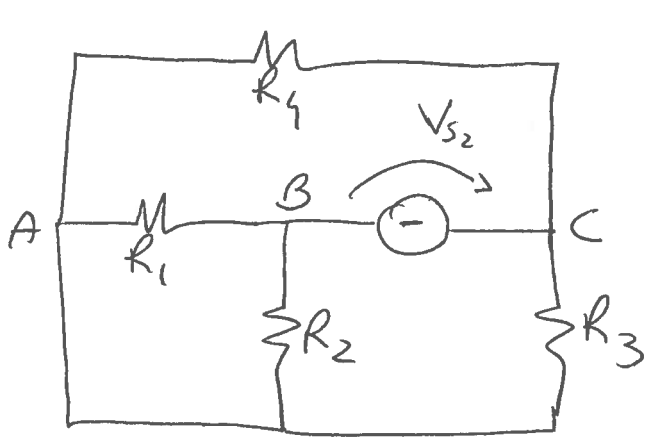


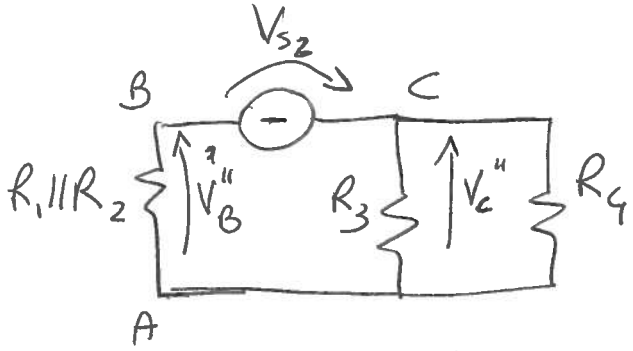
$V_B' = V_C'$

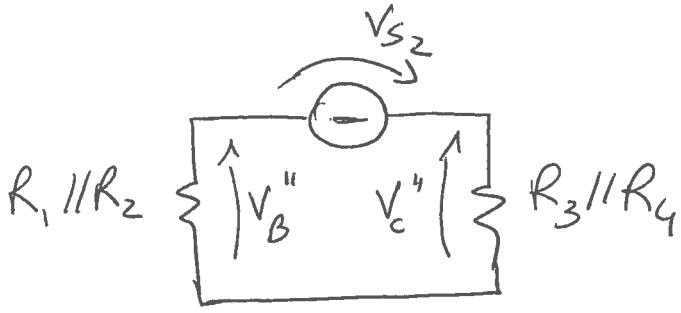
R_1 e R_4 sono in parallelo

$$V_B' = V_C' = \frac{R_2 /\!/ R_3}{R_1 /\!/ R_4 + R_2 /\!/ R_3} V_{S_1}$$

$$= \frac{R_2 R_3 (R_1 + R_4)}{R_1 R_4 (R_2 + R_3) + R_2 R_3 (R_1 + R_4)} V_{S_1} = 9\,V$$







$$V_c'' = \frac{R_3 R_4 (R_1 + R_2)}{R_3 R_4 (R_1 + R_2) + R_1 R_2 (R_3 + R_4)} V_{S_2} = 7V$$

$$V_B'' = -\frac{R_1 R_2 (R_3 + R_4)}{R_3 R_4 (R_1 + R_2) + R_1 R_2 (R_3 + R_4)} V_{S_2} = -3V$$

$$V_B = V_B' + V_B'' = 6V$$

$$V_C = V_C' + V_C'' = 16V$$