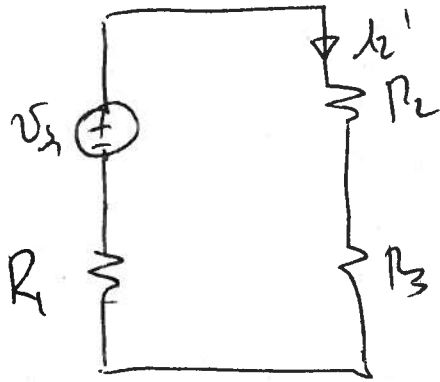
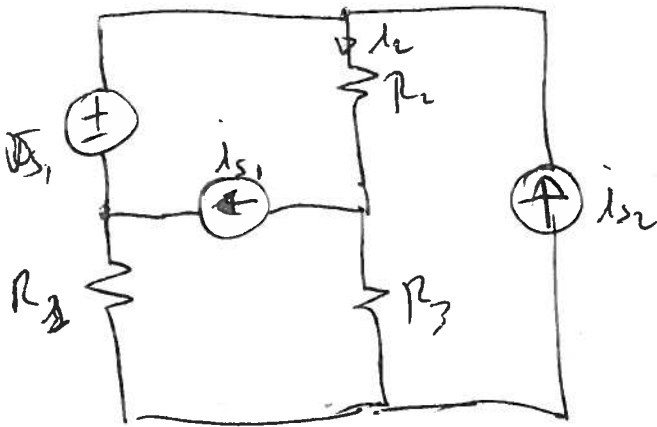
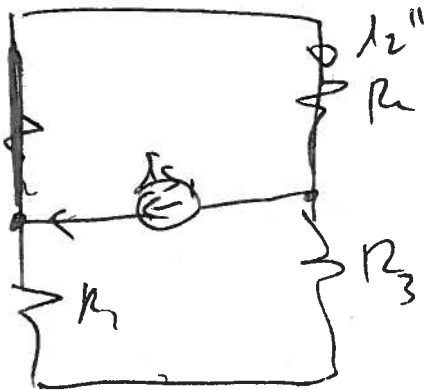


ES:

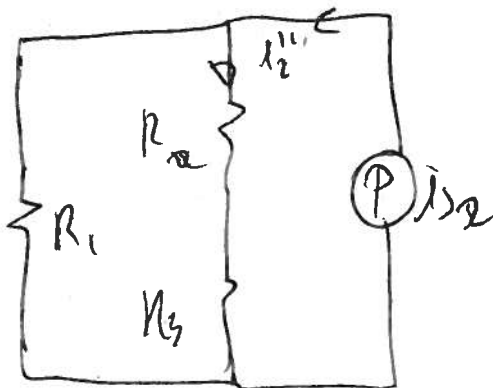
$$\begin{aligned} V_{S_2} &= 50V & R_1 &= 2\Omega \quad \times \\ I_{S_1} &= 3A & R_2 &= 6\Omega \\ I_{S_2} &= 2A & R_3 &= 4\Omega \end{aligned}$$



$$I_2' = \frac{V_{S_1}}{R_1 + R_2 + R_3} = \frac{50}{12} =$$



$$I_2'' = \frac{I_{S_1} (R_1 + R_3)}{R_2 + R_1 + R_3} = \frac{3 \cdot 6}{12} = \frac{18}{12}$$

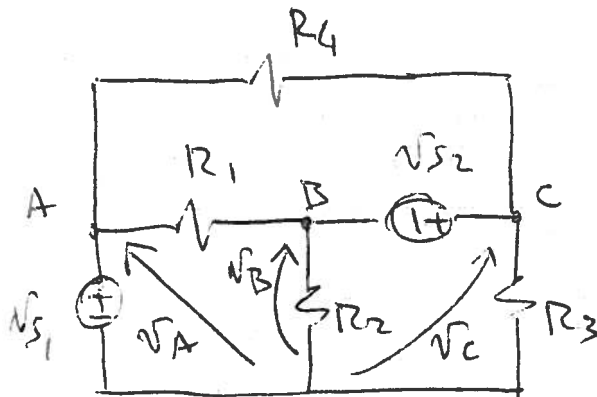


$$I_2''' = I_{S_2} \frac{R_1}{R_1 + R_2 + R_3} = \frac{2 \cdot 2}{12} = \frac{4}{12}$$

$$\begin{aligned} I_2 &= I_2' + I_2'' + I_2''' = \frac{50 + 18 + 4}{12} = \frac{72}{12} \\ &= \frac{36}{6} = 6A \end{aligned}$$

TEOREMA DI
SOVRAPPOSIZIONE

Calcolare V_A , V_B e V_C



$$V_{S1} = 12 \text{ V}$$

$$V_{S2} = 10 \text{ V}$$

$$R_1 = 2 \Omega$$

$$R_2 = 12 \Omega$$

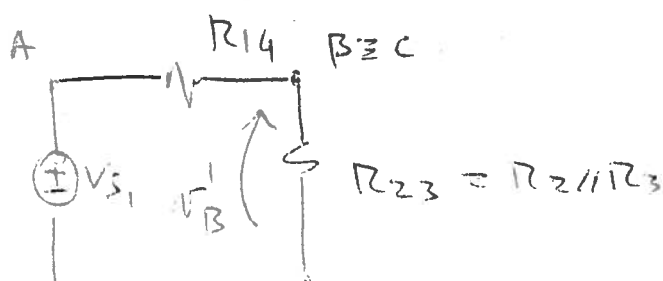
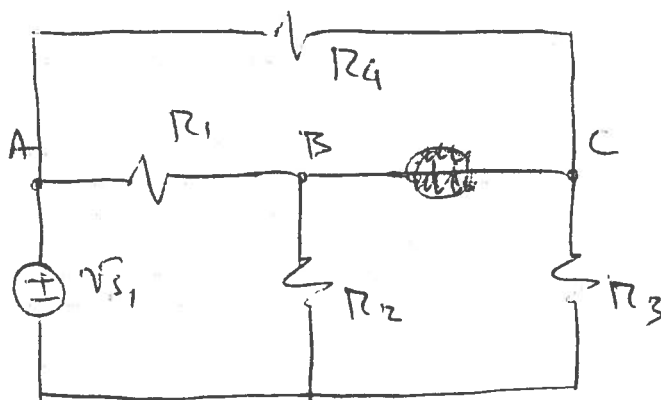
$$R_3 = 8 \Omega$$

$$R_4 = 8 \Omega$$

$$V_A = V_{S1} = 12 \text{ V}$$

Applicando il teorema di sovrapposizione

$$1^\circ \text{ caso } V_{S2} = 0$$



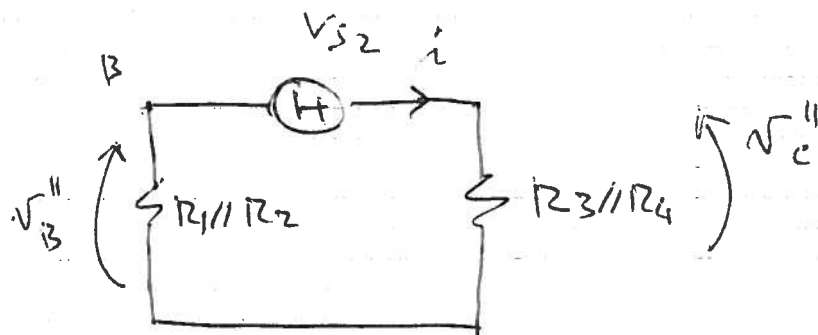
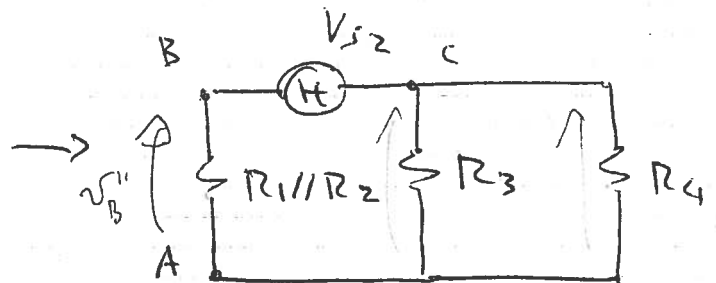
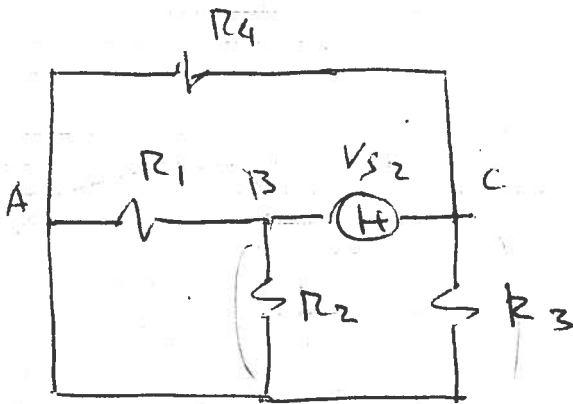
$$R_{23} = R_2 \parallel R_3$$

$$R_{14} = R_1 // R_4 = \frac{8}{5} \Omega$$

$$R_{23} = R_2 // R_3 = \frac{24}{5} \Omega$$

$$V_B' = V_C' = V_{S1} \frac{R_{23}}{R_{14} + R_{23}} = 12 \frac{\frac{24}{5}}{\frac{8}{5} + \frac{24}{5}} = 9V$$

2. circuit) $V_{S1} = 0$



$$R_1 // R_2 = \frac{12}{7} \Omega$$

$$R_3 // R_4 = 4 \Omega$$

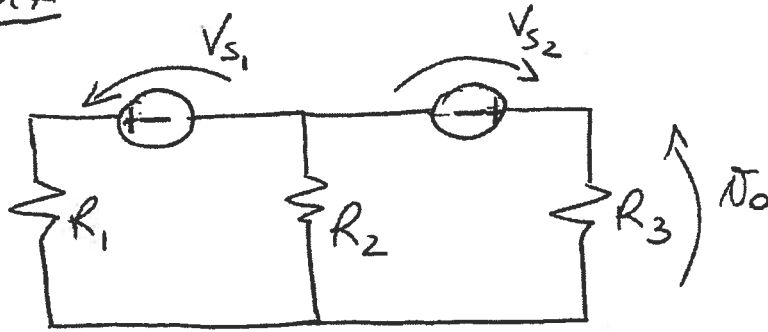
$$V_B'' = - V_{S2} \frac{R_1 // R_2}{R_1 // R_2 + R_3 // R_4} = -3V$$

$$V_C'' = V_{S2} \frac{R_3 // R_4}{R_1 // R_2 + R_3 // R_4} = 7V$$

$$V_B = V_B' + V_B'' = 9 - 3 = 6V$$

$$V_C = V_C' + V_C'' = 9 + 7 = 16V$$

ES 17



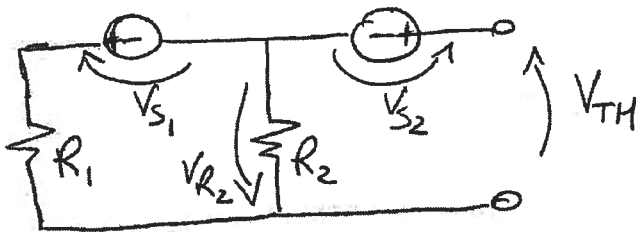
$$V_{S1} = 6V$$

$$V_{S2} = 12V$$

$$R_1 = R_3 = 2\Omega$$

$$R_2 = 4\Omega$$

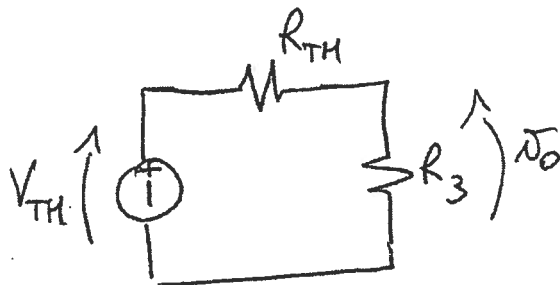
CALCOLIAMO I PARAMETRI DEL MODELLO EQUIVALENTE DI THÉVENIN



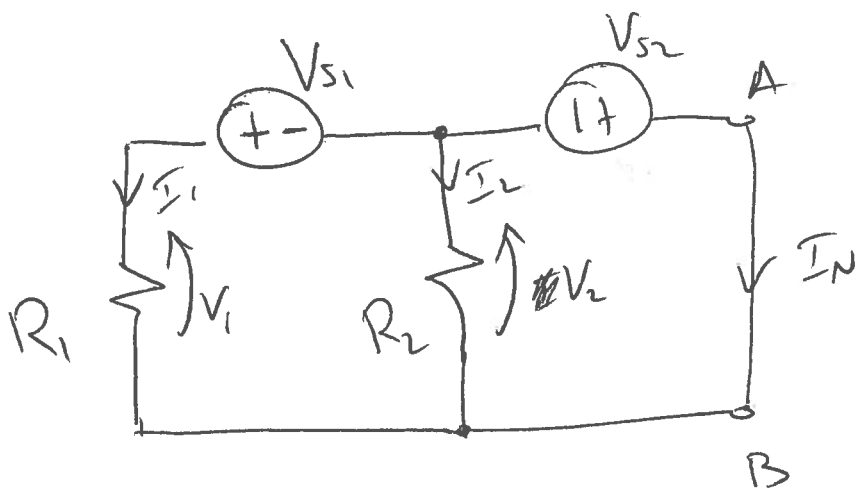
$$V_{R2} = \frac{R_2}{R_1 + R_2} V_{S1}$$

$$\begin{aligned} V_{TH} &= V_{S2} - V_{R2} \\ &= V_{S2} - \frac{R_2}{R_1 + R_2} V_{S1} = 8V \end{aligned}$$

$$R_{TH} = \frac{R_1 R_2}{R_1 + R_2} = \frac{4}{3}\Omega$$



$$V_O = \frac{R_3}{R_3 + R_{TH}} V_{TH} = \frac{24}{5}V$$



$$I_N = -I_1 - I_2 = 6A$$

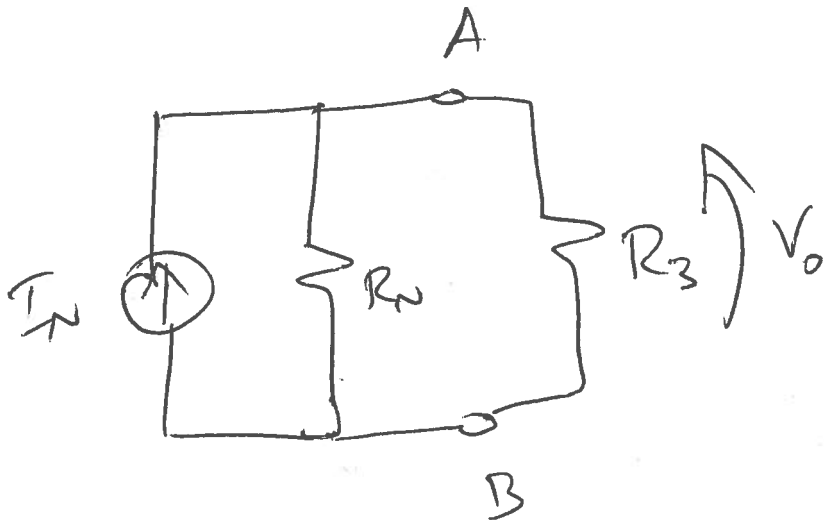
$$V_1 = V_{s1} - V_{s2}$$

$$I_1 = \frac{V_1}{R_1} = -3A$$

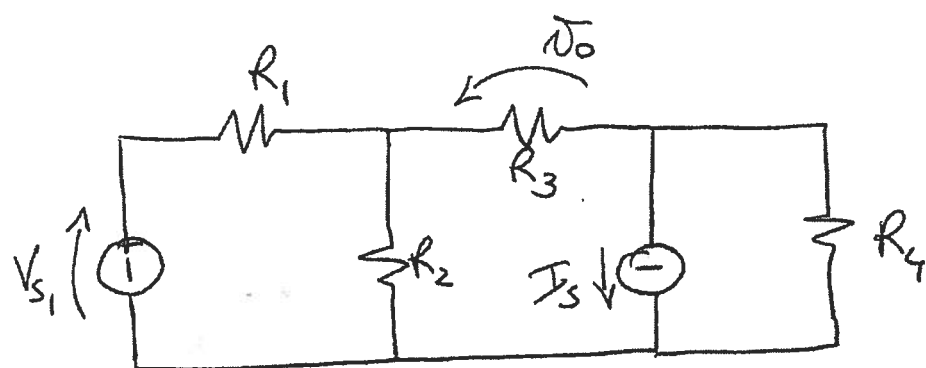
$$V_2 = -V_{s2}$$

$$I_2 = \frac{V_2}{R_2} = -3A$$

$$R_N = R_{Th}$$



ES 18



$$V_s = 12V$$

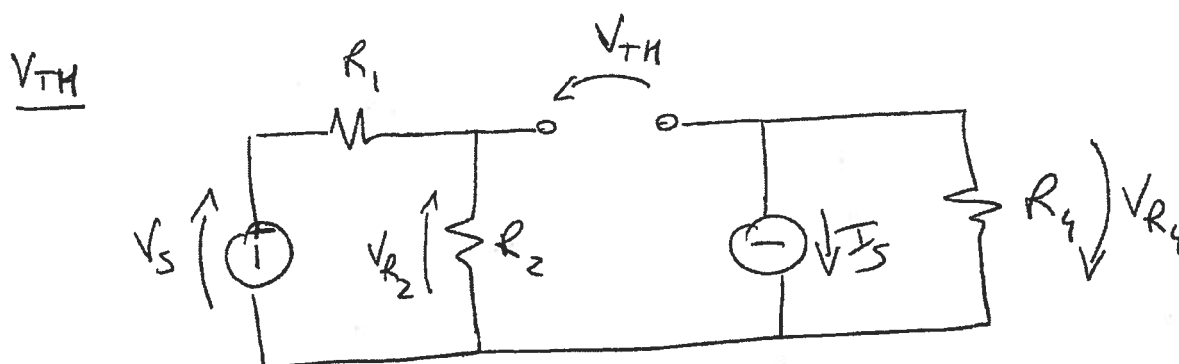
$$I_s = 2A$$

$$R_1 = 3\Omega$$

$$R_2 = 6\Omega$$

$$R_3 = 8\Omega$$

$$R_4 = 2\Omega$$

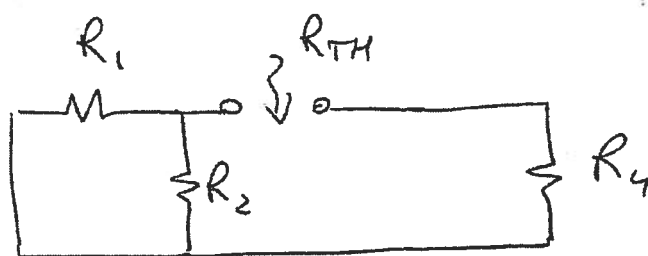


$$V_{R_2} = \frac{R_2}{R_1 + R_2} V_s$$

$$V_{R_4} = R_4 I_s$$

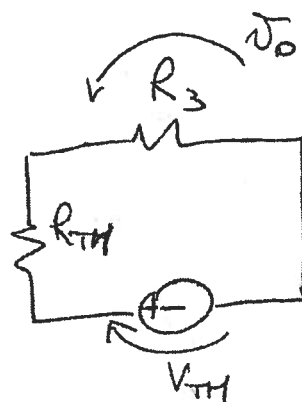
$$V_{TH} = V_{R_2} + V_{R_4} = \frac{R_2}{R_1 + R_2} V_s + R_4 I_s = 12V$$

R_{TH}

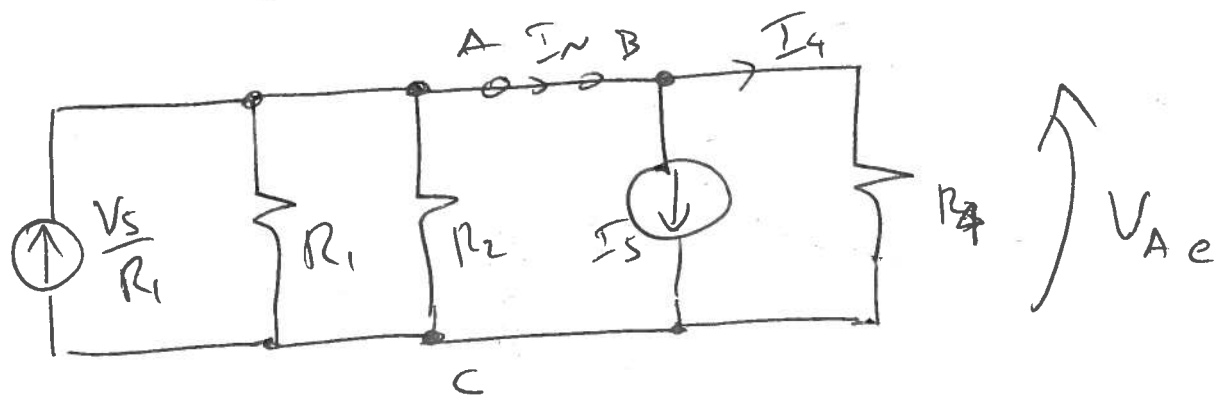
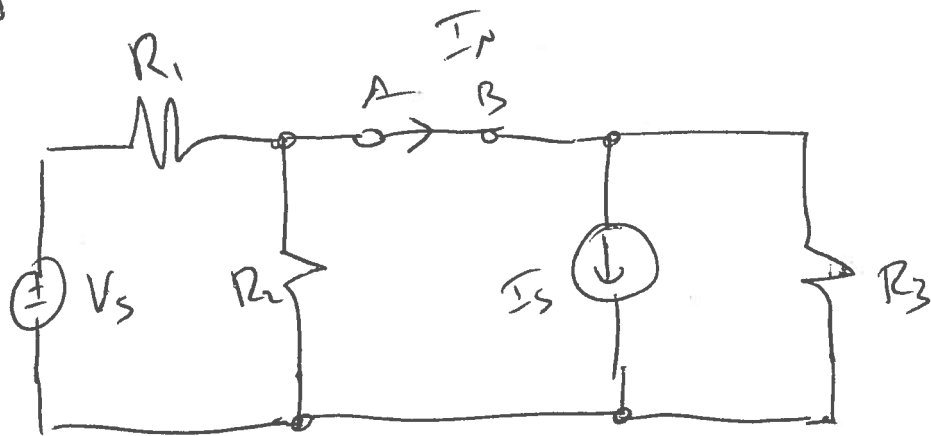


$$R_{TH} = \frac{R_1 R_2}{R_1 + R_2} + R_4 = 4\Omega$$

$$V_o = \frac{R_3}{R_3 + R_{TH}} V_{TH} = 8V$$



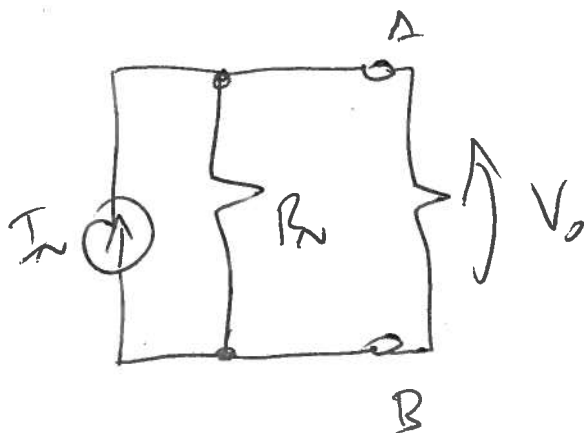
N



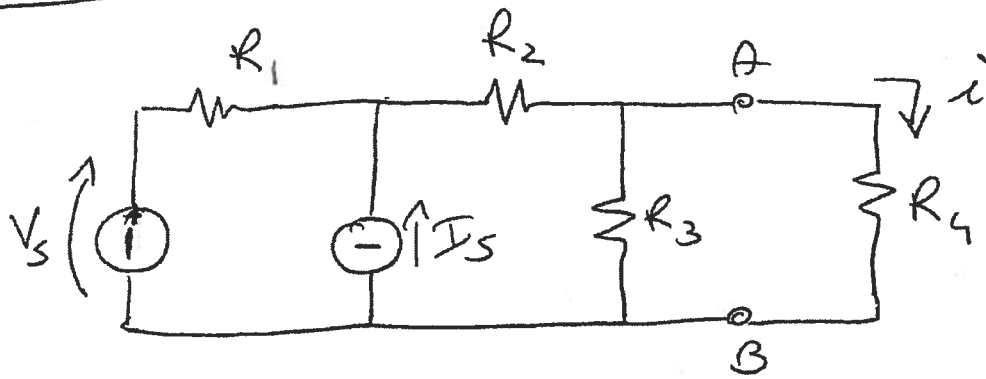
$$V_{Ac} = \frac{\frac{V_s}{R_1} - I_s}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_4}} = 2V$$

$$I_4 = \frac{V_{Ac}}{R_4} = 1A$$

$$I_N = I_4 + I_s = 3A \quad ; \quad R_N = R_{Th}$$



ES 19



$$V_s = 12V$$

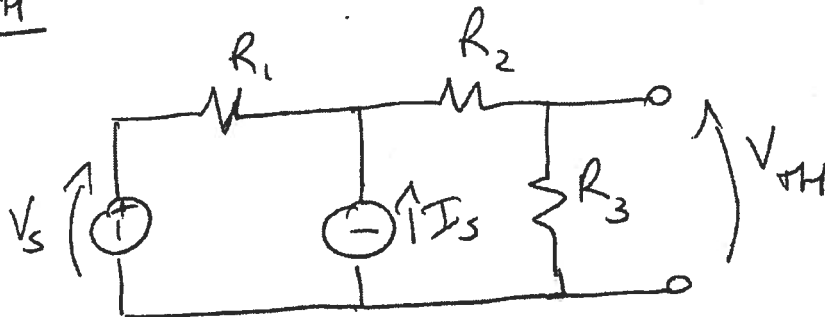
$$I_s = 2A$$

$$R_1 = R_2 = 6\Omega$$

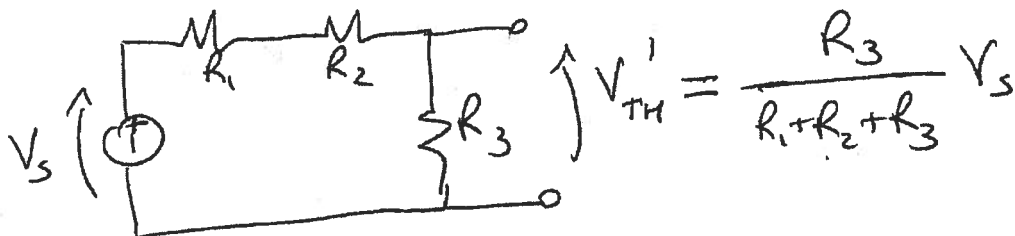
$$R_3 = 4\Omega$$

$$R_4 = 1\Omega$$

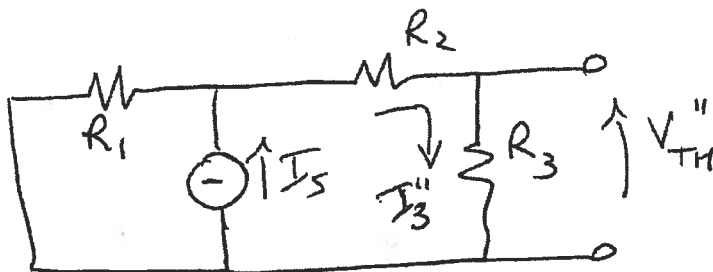
V_{TH}



Γ \times SOVRAPPOSIZIONE



$$V_{TH}' = \frac{R_3}{R_1 + R_2 + R_3} V_s$$

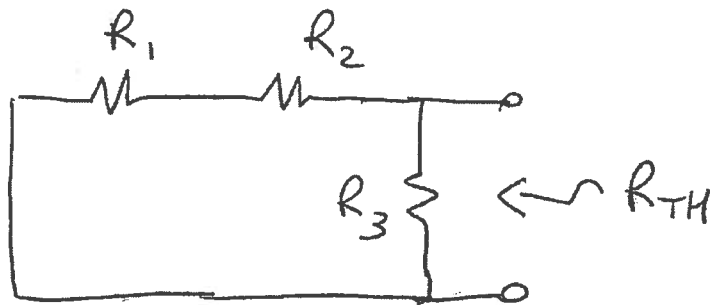


$$I_3'' = \frac{R_1}{R_1 + R_2 + R_3} I_s \quad V_{TH}'' = \frac{R_1 R_3}{R_1 + R_2 + R_3} I_s$$

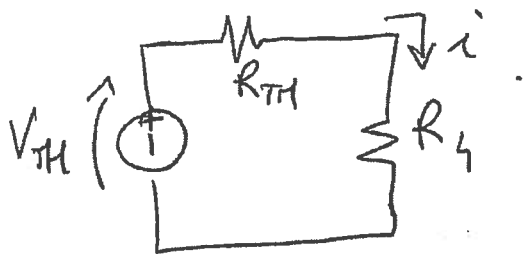
$$V_{TH} = V_{TH}' + V_{TH}'' = \frac{R_3}{R_1 + R_2 + R_3} V_s + \frac{R_1 R_3}{R_1 + R_2 + R_3} I_s = 6V$$

✓

R_{TH}

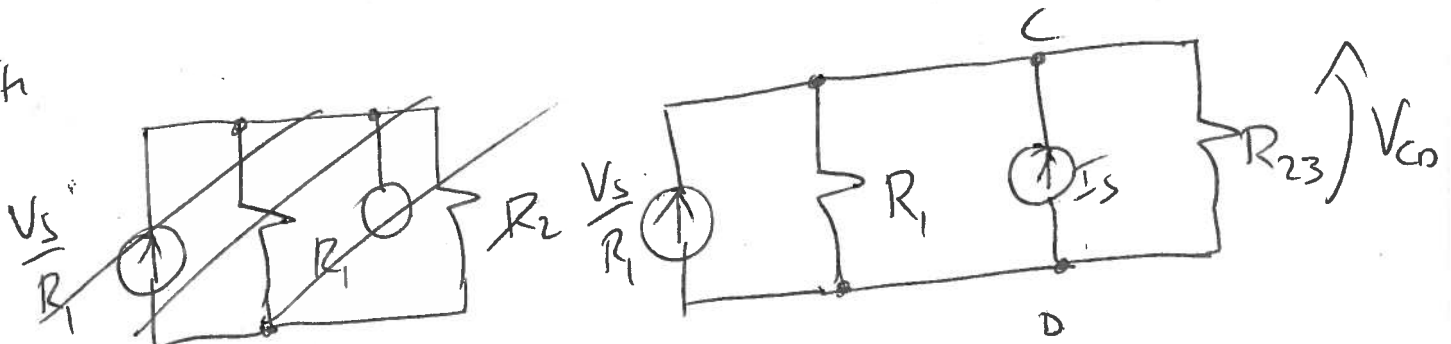


$$R_{TH} = \frac{R_3(R_1 + R_2)}{R_1 + R_2 + R_3} = 3 \Omega$$



$$i = \frac{V_{TH}}{R_4 + R_{TH}} = \frac{3}{2} A$$

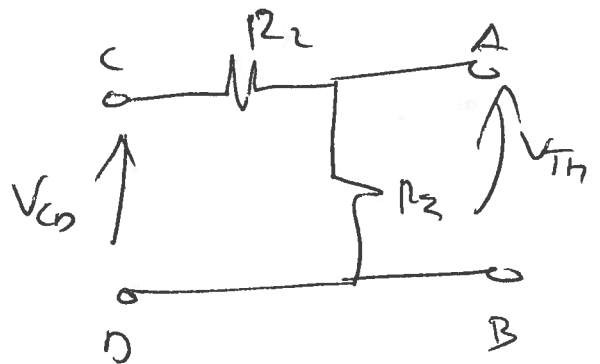
* V_{TH}



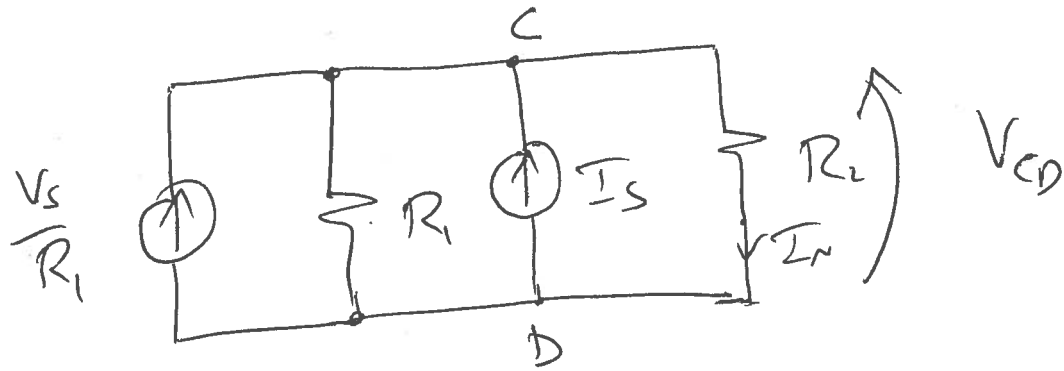
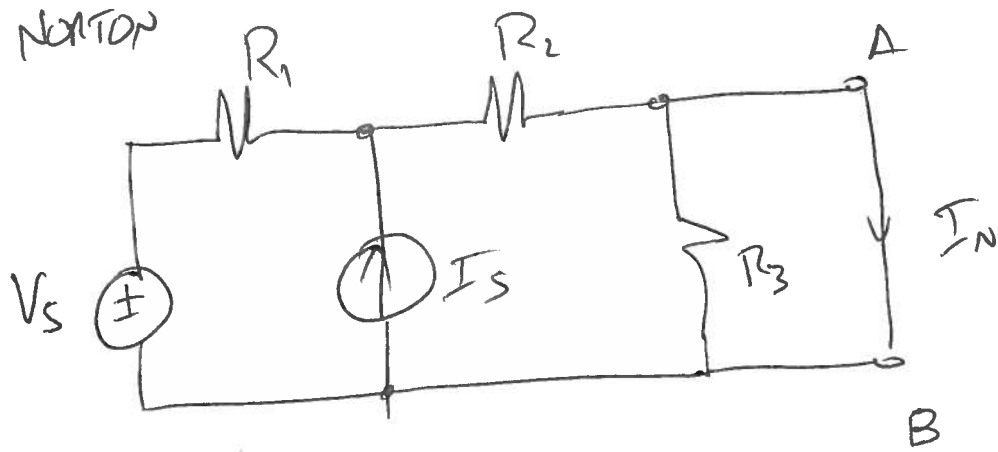
$$R_{23} = R_2 + R_3 = 10 \Omega$$

$$V_{CD} = \frac{\frac{V_S}{R_1} + I_S}{\frac{1}{R_1} + \frac{1}{R_{23}}} = 15 V$$

$$V_{TH} = \frac{V_{CD} \cdot R_3}{R_2 + R_3} = 6 V$$

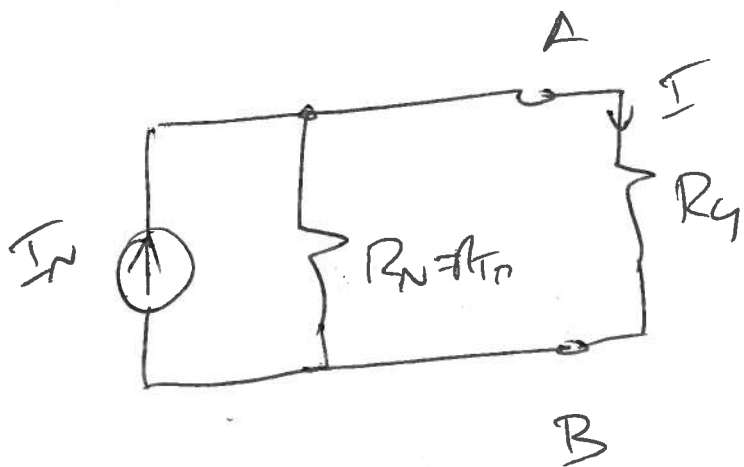


NORTON



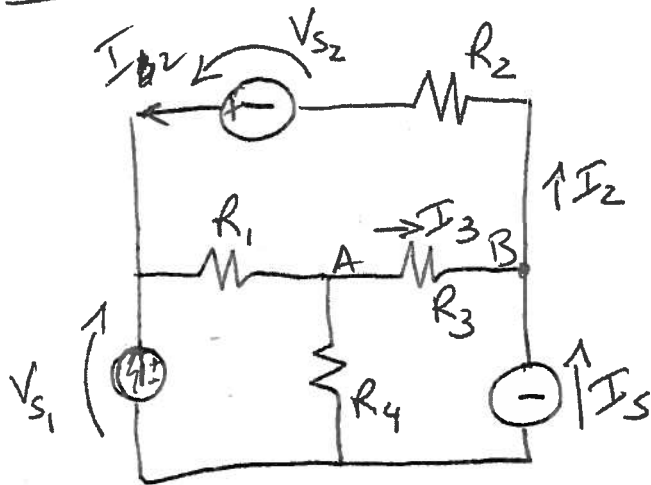
$$V_{CD} = \frac{\frac{V_s}{R_1} + I_s}{\frac{1}{R_1} + \frac{1}{R_2}} = 12V$$

$$I_N = \frac{V_{CD}}{R_2} = 2A \quad ; \quad R_N = R_{TH}$$



$$I = \frac{I_N \cdot R_N}{R_N + R_L} = \frac{3}{2}A$$

ES 20



$$V_{s1} = 6V$$

$$V_{s2} = 10V$$

$$I_s = 2A$$

$$R_1 = 6\Omega$$

$$R_2 = 7\Omega$$

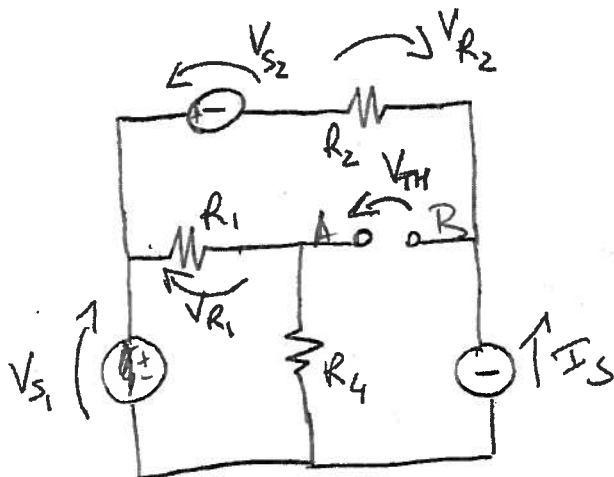
$$R_3 = 5\Omega$$

$$R_4 = 3\Omega$$

$$I_3 = ?$$

potenza erogata V_{s2}

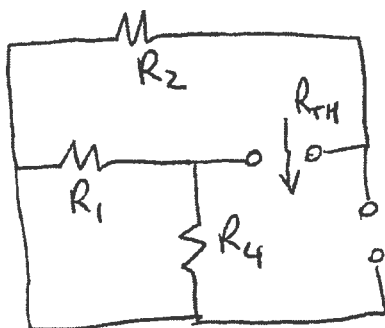
potenza assorbita da R_3



$$V_{R2} = R_2 I_s = 14V$$

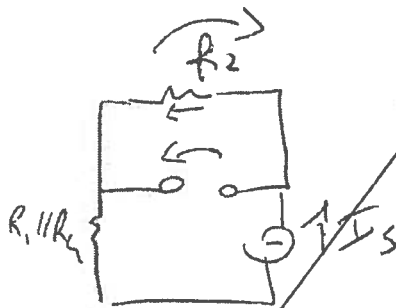
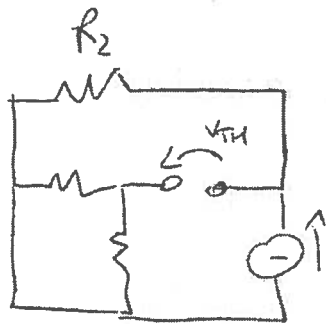
$$V_{R1} = \frac{R_1}{R_1 + R_4} V_{s1} = 4V$$

$$V_{TH} = V_{s2} - V_{R1} - V_{R2} = V_{s2} - \frac{R_1}{R_1 + R_4} V_{s1} - R_2 I_s = -8V$$

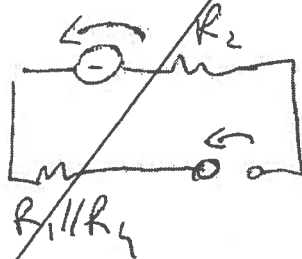
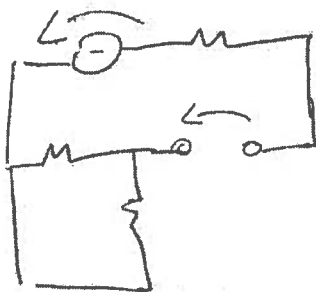


$$R_{TH} = R_1 \parallel R_4 + R_2$$

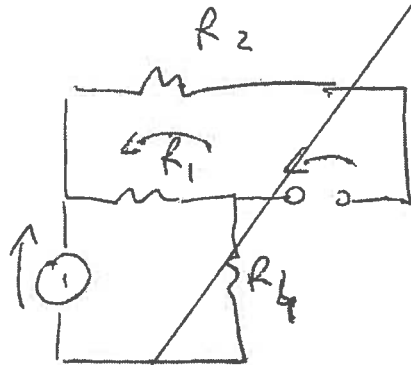
$$= \frac{R_1 R_4}{R_1 + R_4} + R_2 = 9\Omega$$



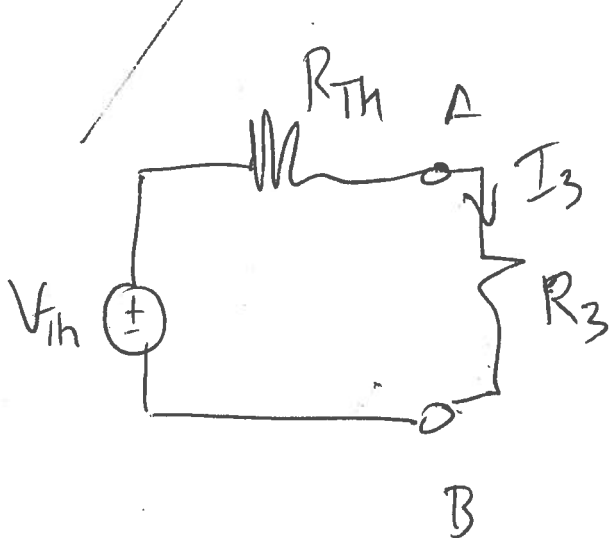
$$-I_2 I_5$$



$$V_{S2}$$



$$-V_{R1} = -V_{S1} \frac{R_1}{R_1 + R_4}$$



$$I_3 = \frac{V_{th}}{R_{th} + R_3} = -\frac{4}{7} A$$

$$I_2 = I_3 + I_5 = -\frac{18}{7} A$$

$$P_{g_{S2}} = V_{S2} I_{S2} = 25,71 W$$