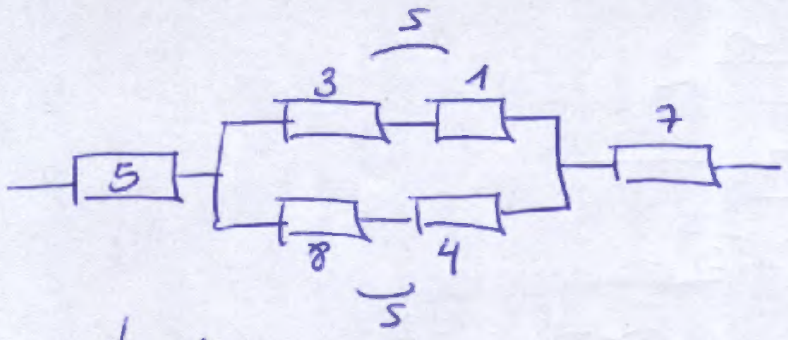
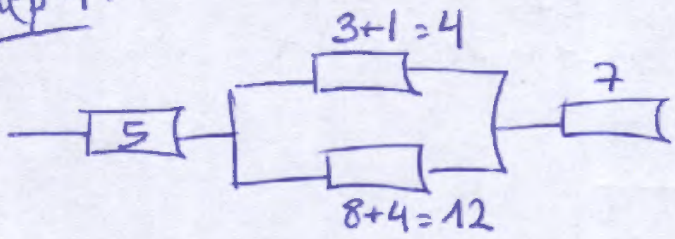
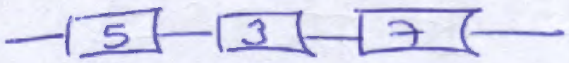
a)



step 1:

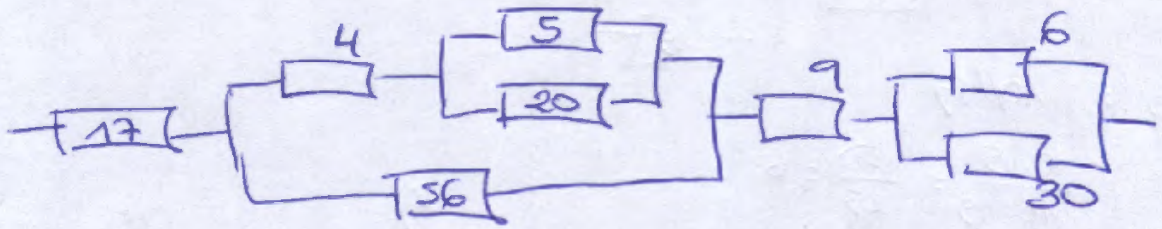


step 2: $4 // 12$ $\quad \frac{4 \cdot 12}{4+12} = \frac{48}{16} = 3$



step 3: $R_T = 5+3+7 = \boxed{15\,\Omega}$

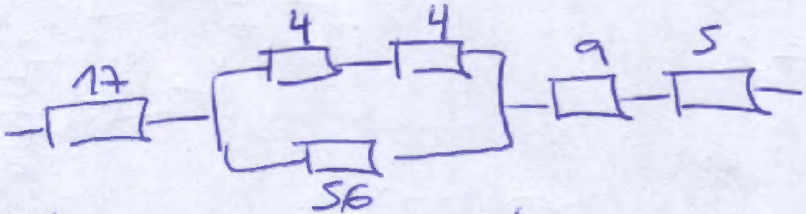
b)



step 1 $5 // 20$ & $6 // 30$

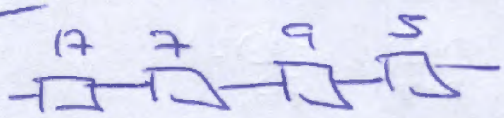
$\frac{5 \cdot 20}{5+20} = \frac{100}{25} = 4$

$\frac{6 \cdot 30}{6+30} = \frac{180}{36} = 5$



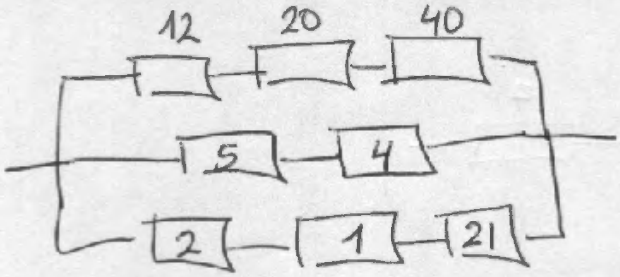
step 2 $4+4$ (serial) $// 56$

$\frac{8 \cdot 56}{8+56} = \frac{448}{64} = 7$

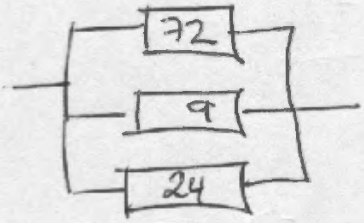


step 3: $R_T = 17+7+9+5 = 38\,\Omega$

c)

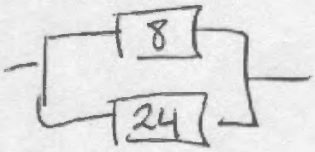


step 1: serial | $12+20+40 = 72$, $5+4 = 9$, $2+1+21 = 24$



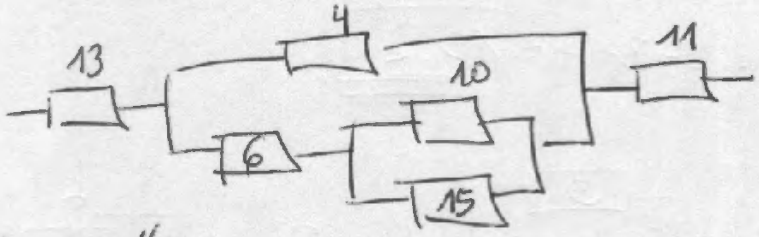
step 2: $72 // 9$ $\quad R_{eq} = \frac{72 \cdot 9}{72+9} = 8$

step 3



$R_T = \frac{8 \cdot 24}{8+24} = 6\,\Omega$

d)



step 1: $10 // 15$

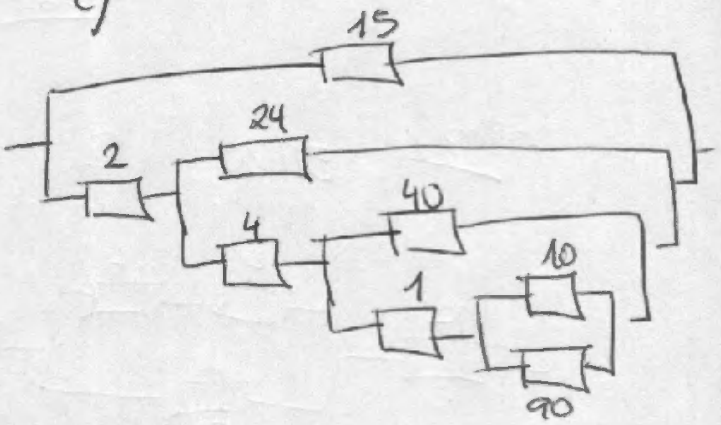
$\frac{10 \cdot 15}{10+15} = \frac{150}{25} = 6$

step 2: $4 // 6+6 = 4 // 12$

$\frac{4 \cdot 12}{4+12} = \frac{48}{16} = 3$

step 3: $13+3+11 = 27\,\Omega$

e)



step 1

$10 // 90$ $\quad \frac{10 \cdot 90}{10+90} = \frac{900}{100} = 9$

step 2

$9+1 // 40$ $\quad \frac{10 \cdot 40}{10+40} = \frac{400}{50} = 8$

step 3

$8+4 // 24$ $\quad \frac{12 \cdot 24}{12+24} = 8$

step 4

$8+2 // 15$ $\quad R = \frac{10 \cdot 15}{10+15} = \frac{150}{25} = 6\,\Omega$

① a) $R_{eq} = R_1 + R_2 + R_3 = 5 + 10 + 7 = 22\,\Omega$

b) $I = \frac{V}{R_{eq}} = \frac{110}{22} = 5\,A.$

c) $V_1 = I \cdot R_1 = 5 \cdot 5 = 25\,V.$
$V_2 = I \cdot R_2 = 5 \cdot 10 = 50\,V.$
$V_3 = I \cdot R_3 = 5 \cdot 7 = 35\,V.$
$110\,V.$

② a) $V_3 = V_{battery} - V_1 - V_2 = 40 - 10 - 20 = 10\,V.$

b) $I = \frac{V_3}{R_3} = \frac{10}{2} = 5\,A.$

c) $R_2 = \frac{V_2}{I} = \frac{20}{5} = 4\,\Omega$

$R_1 = \frac{V_1}{I} = \frac{10}{5} = 2\,\Omega$

③ a) R_{eq}. step 1: $R_1 // R_2 = R_{12} = \frac{4 \cdot 12}{4+12} = \frac{48}{16} = 3\,\Omega$

step 2: $R_{12} // R_3$; $R_T = \frac{3 \cdot 6}{3+6} = \frac{18}{9} = 2\,\Omega.$

b) $I = \frac{V}{R_T} = \frac{12}{2} = 6\,A.$

c) $I_1 = \frac{V}{R_1} = \frac{12}{4} = 3\,A.$
$I_2 = \frac{V}{R_2} = \frac{12}{12} = 1\,A$
$I_3 = \frac{V}{R_3} = \frac{12}{6} = 2\,A$

$I_1 + I_2 + I_3 = I_T$

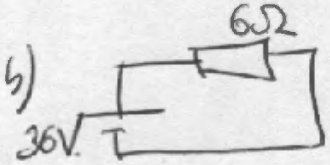
(4) a) R_{eq}.

$R_a = R_1 + R_2 = 6 + 2 = 8\,\Omega$

$R_b = R_3 + R_4 = 20 + 4 = 24\,\Omega$

$R_{eq} = R_a // R_b = \frac{24 \cdot 8}{24+8} = \frac{192}{32} = 6\,\Omega$

b)



$I = \frac{36}{6} = 6\,A.$

c) $I_a = \frac{V}{R_a} = \frac{36}{8} = 4'5\,A.$

$I_b = \frac{V}{R_b} = \frac{36}{24} = 1,5\,A$

$I_a + I_b = I_T$

d) $V_1 = I_a \cdot R_1 = 4,5 \cdot 6 = 27V$

$V_2 = I_a \cdot R_2 = 4,5 \cdot 2 = 9V.$

$V_1 + V_2 = V_{battery}$

$V_3 = I_b \cdot R_3 = 1'5 \cdot 20 = 30V.$

$V_4 = I_b \cdot R_4 = 1,5 \cdot 4 = 6V$

$V_3 + V_4 = V_{battery}$

(5) a) ~~I_3 V_{R3}~~ $I_3 = I_T - I_1 - I_2$

$I_3 = 12 - 4 - 6 = 10\,A.$

b) $V_{battery} = V_{R1} = V_{R2} = V_{R3}$

$R_3 = \frac{V_{R3}}{I_3} = \frac{2}{10} = 0'2\,\Omega.$

c) $R_1 = \frac{V_{R1}}{I_1} = \frac{2}{4} = 0'5\,\Omega$

$R_2 = \frac{V_{R2}}{I_2} = \frac{2}{6} = 0'3\,\Omega$

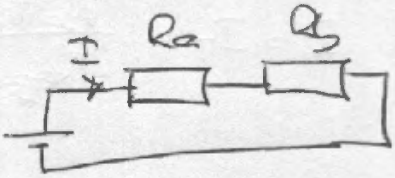
(6) a) R_{eq}

$$R_a = R_1 // R_2 = \frac{36}{3+6} = \frac{18}{9} = 2\Omega$$

$$R_b = R_3 // R_4 = \frac{6 \cdot 12}{6+12} = \frac{72}{18} = 4\Omega$$

$$R_{eq} = R_a + R_b = 2+4 = 6\Omega$$

b) $I = \frac{V}{R_T} = \frac{18}{6} = 3\,A.$



c) $V_1 = V_2 = R_a \cdot I = 2 \cdot 3 = 6\,V.$

$V_3 = V_4 = R_b \cdot I = 4 \cdot 3 = 12\,V.$

$\overline{18V}$

d) $I_1 = \frac{V_a}{R_1} = \frac{6}{3} = 2A$

$I_2 = \frac{V_a}{R_2} = \frac{6}{12} = 1A$

$I_1 + I_2 = I$

$I_3 = \frac{V_b}{R_3} = \frac{12}{6} = 2A$

$I_4 = \frac{V_b}{R_4} = \frac{12}{12} = 1A.$

$I_3 + I_4 = I$