Homework #1

- Solutions -

7) a) $R_T = 1k\Omega + 4,7k\Omega + 2,2k\Omega = 7,9k\Omega = 7900\Omega$

b) $R_T = 10\Omega + 10\Omega + 12\Omega + 1\Omega = 33\Omega$

c) $R_T = 1M\Omega + 560k\Omega + 1M\Omega + 680k\Omega + 10M\Omega$

$= 1 + 0,56 + 1 + 0,68 + 10 = 13,24M\Omega = 13240k\Omega$

10) $R_T = 20k\Omega = R_1 + R_2 + R_3 + R_4 + R_5$

$= 4,7k\Omega + 1k\Omega + 2,2k\Omega + 3,9k\Omega + R_5$

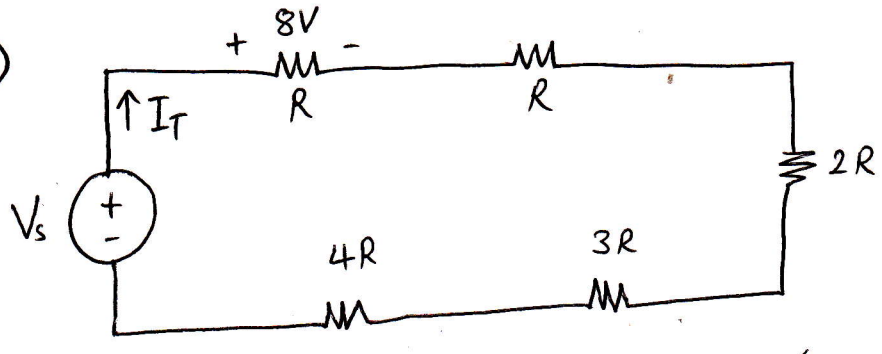
$= 11,8k\Omega + R_5$

$\Rightarrow R_5 = R_T - 11,8k\Omega = 20 - 11,8 = \underline{\underline{8,2k\Omega}}$

23) a) $15V = 2 + V_2 + 3,2 + 1 + 1,5 + 0,5$

$= 8,2 + V_2 \Rightarrow V_2 = 15 - 8,2 = \underline{\underline{6,8V}}$

b)



The same amount of I_T is passing through all resistors. Therefore

$V_R = I_T R = 8V$, $V_{2R} = 16V$, $V_{3R} = 24V$, $V_{4R} = 32V$

$V_S = V_R + V_R + V_{2R} + V_{3R} + V_{4R} = 8 + 8 + 16 + 24 + 32$

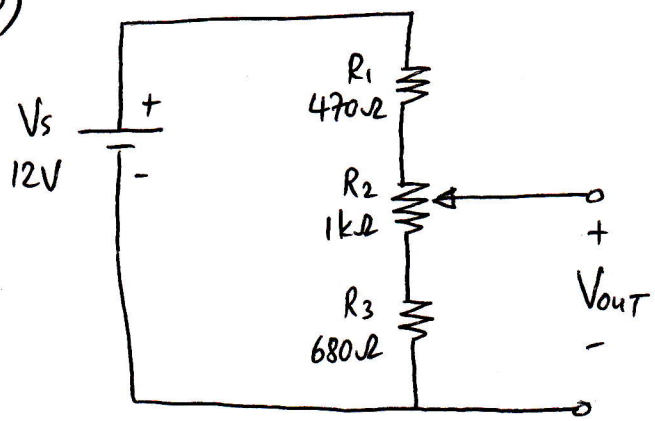
$= \underline{\underline{88V}}$

25) a) $V_{AB} = \frac{47}{100+47} \times 12 = 3.836\,V$

b) $V_{AB} = \frac{2.2+3.3}{1.0+2.2+3.3} \times 8 = 6.769\,V$

27) a) You are not supposed to solve this question!

b)



$$V_{OUT,min} = \frac{R_3}{R_1+R_2+3} \times V_S$$

$$= \frac{0.68}{0.47+1+0.68} \times 12 = 3.795\,V$$

$$V_{OUT,max} = \frac{R_2+R_3}{R_1+R_2+R_3} V_S$$

$$= \frac{1.68}{0.47+1+0.68} \times 12 = 9.376\,V$$

32) $R_T = 5.6+5.6+1+1 = 13.2\,k\Omega$

$I_T = \frac{10V}{13.2k\Omega} = 0.757\,mA$

$V_A = 10\,V$

$V_B = \frac{5.6+1+1}{R_T} \times 10 = 5.757\,V$

$V_C = \frac{1+1}{R_T} \times 10 = 1.515\,V$

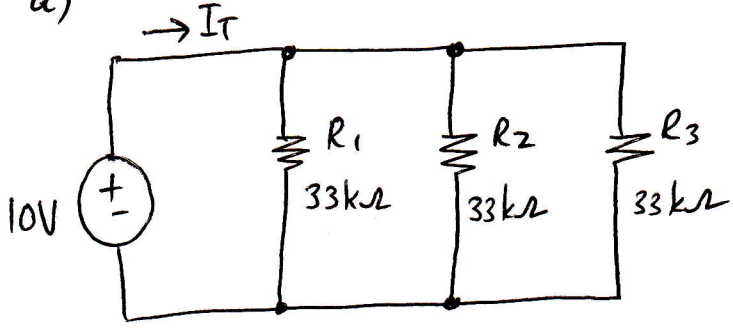
$V_D = \frac{1}{R_T} \times 10 = 0.757\,V$

6) a) $R_T = \frac{R_1 R_2}{R_1 + R_2} = \frac{4{,}7 \times 2{,}2}{4{,}7 + 2{,}2} = 1{,}498\ k\Omega$

b) $R_T = \frac{R_1 R_2}{R_1 + R_2} = \frac{27 \times 56}{27 + 56} = 18.216\ \Omega$

c) $R_T = \frac{R_1 R_2}{R_1 + R_2} = \frac{1{,}5 \times 2{,}2}{1{,}5 + 2{,}2} = 0{,}891\ k\Omega$

11) a)



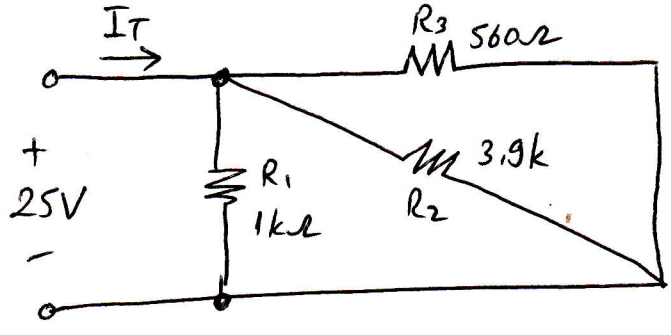
$Req_{2,3} = \frac{R_2 R_3}{R_2 + R_3} = 16{,}5\ k\Omega$

$R_T = \frac{R_1 Req_{2,3}}{R_1 + Req_{2,3}} = \frac{16{,}5 \times 33}{16{,}5 + 33}$

$R_T = 11\ k\Omega$

$I_T = \frac{10V}{R_T} = \frac{10V}{11\ k\Omega} = 0{,}909\ mA$

b)



$R_{2,3} = \frac{R_2 \times R_3}{R_2 + R_3} = 0{,}489\ k\Omega$

$R_T = \frac{R_1 R_{2,3}}{R_1 + R_{2,3}} = \frac{1 \times 0{,}489}{1 + 0{,}489} = 0{,}328\ k\Omega$

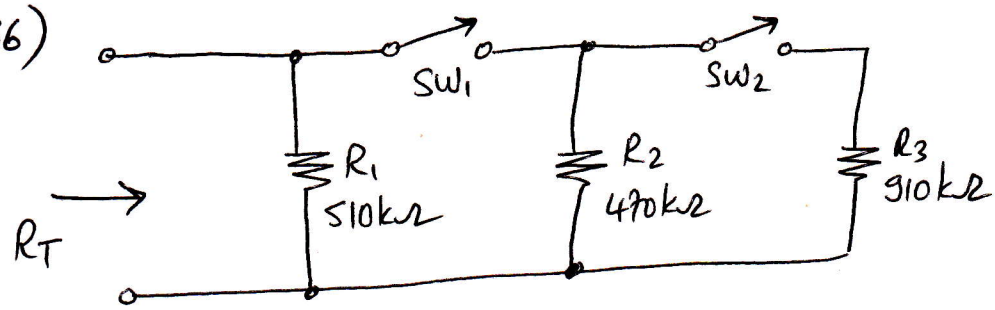
$I_T = \frac{25V}{R_T} = \frac{25V}{0{,}328\ k\Omega} = 76{,}219\ mA$

21)

$A1 = \frac{R_2}{R_1 + R_2} A3 = \frac{2{,}7}{1 + 2{,}7} \times 3 = 2{,}189\ A$

$A2 = \frac{R_1}{R_1 + R_2} A3 = \frac{1}{1 + 2{,}7} \times 3 = 0{,}81\ A$

36)



a) $R_T = R_1 = 510\,k\Omega$

b) $R_T = \dfrac{R_1 R_2}{R_1 + R_2} = 244.59\,k\Omega$

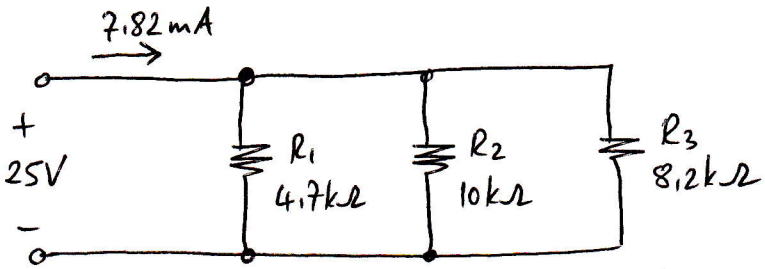
c) $R_T = R_1 = 510\,k\Omega$

d) $R_T = R_1 // R_2 // R_3$

$R_{2,3} = \dfrac{R_2 R_3}{R_2 + R_3} = 309.92\,k\Omega$

$R_T = \dfrac{R_1 R_{2,3}}{R_1 + R_{2,3}} = 192.77\,k\Omega$

28)



$R_{2,3} = \dfrac{R_2 R_3}{R_2 + R_3} = 4.5\,k\Omega$

$R_T = \dfrac{R_1 R_{2,3}}{R_1 + R_{2,3}} = 2.298\,k\Omega$

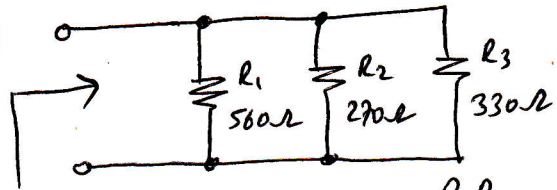
$I_T = \dfrac{25\,V}{2.298\,k\Omega} = 10.879\,mA$ (when all resistors are connected)

Clearly, the ampere meter measures 7.82mA which means that one of the resistor is burned out (open circuited)

$R_{1,2} = \dfrac{R_1 R_2}{R_1 + R_2} = 3.197\,k\Omega \Longrightarrow I_T = \dfrac{25\,V}{3.197\,k\Omega} = 7.82\,mA$

This means that R_3 is open!!

29)



$R_T = 207.6\,\Omega$

$R_{1,2} = \dfrac{R_1 R_2}{R_1 + R_2} = 182.16\,k\Omega$

$R_{2,3} = \dfrac{R_2 R_3}{R_2 + R_3} = 148.5\,k\Omega$

$R_{1,3} = \dfrac{R_1 R_3}{R_1 + R_3} = 207.6\,k\Omega \Longrightarrow$ Therefore, R_2 is open.