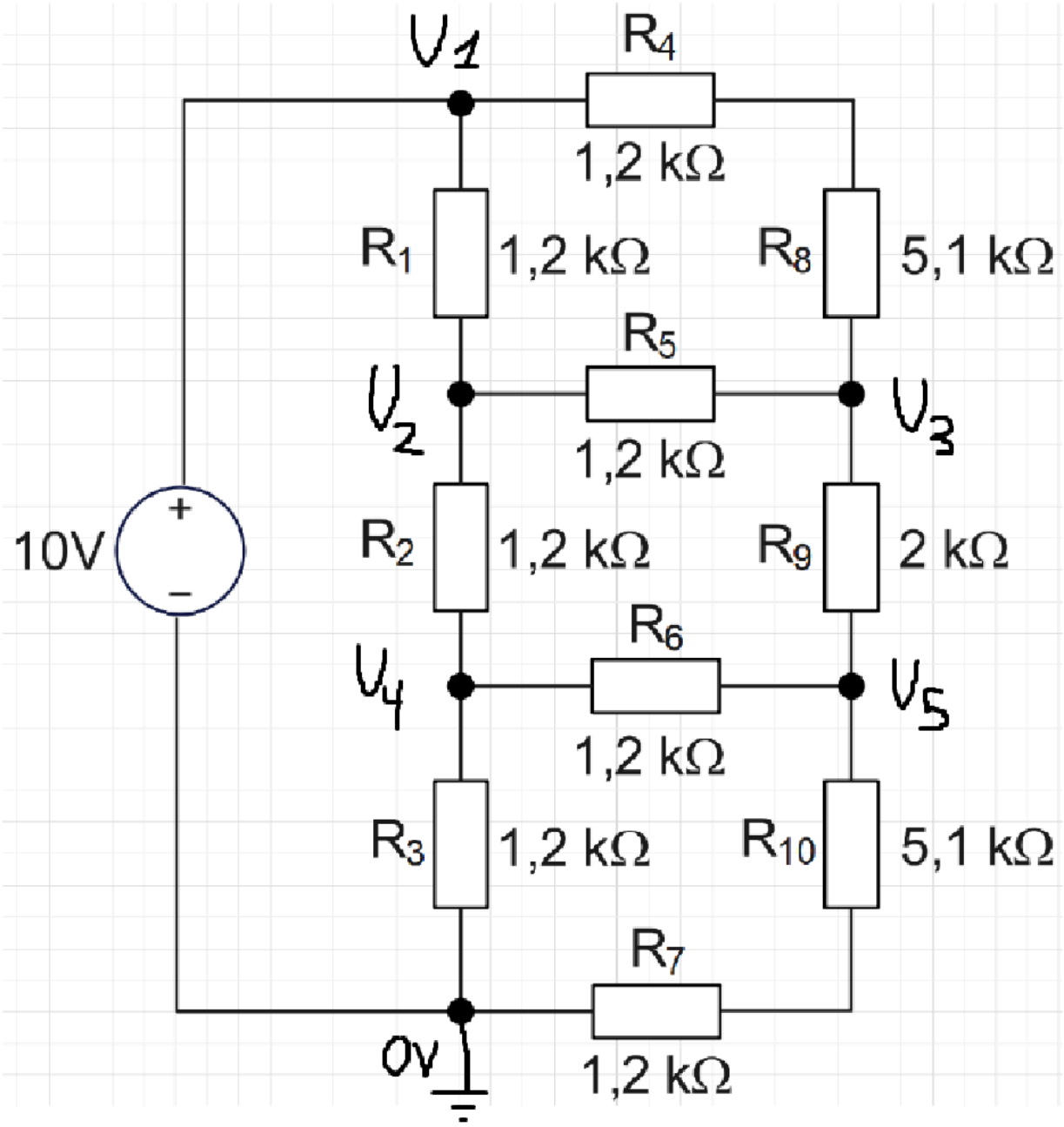
Oppgave a)

Målte verdier			Beregnede verdier		
UR1: 3.491 V	IR1: 2,889 mA	PR1: 10.085 mW	3.49 V	2.908 mA	10,148 mW
UR2: 3.015 V	IR2: 2,492 mA	PR2: 7.513 mW	3.02 V	2.516 mA	7,598 mW
UR3: 3.494 V	IR3: 2,894 mA	PR3: 10.090 mW	3.49 V	2.908 mA	10,148 mW
UR4: 0,757 V	IR4: 629,25 µA	PR4: 476.342 µW	0.756 V	630 µA	476,28 µW
UR5: 0.481 V	IR5: 397,30 µA	PR5: 191.101 µW	0.48 V	400 µA	192 µW
UR6: -0,477 V	IR6: 397,15 µA	PR6: -189.440 µW	-0.48 V	- 400 µA	192 µW
UR7: -0,755 V	IR7: 629,71 µA	PR7: -475.431 µW	0.756 V	630 µA	472,5 µW
UR8: 3,214 V	IR8: 629,35 µA	PR8: 2.022 mW	3.213 V	630 µA	2,024 mW
UR9: 2,057 V	IR9: 1,025 mA	PR9: 2.108 mW	2.06 V	1,03 mA	2,121 mW
UR10: 3,216 V	IR10: 629,64 µA	PR10: 2.024 mW	3.213 V	630 µA	1,951 mW



Utregning for spenning: U = I * R

$$U_1 = 10\,V$$

$$U_2 = U_2 * \left(\frac{1}{1200\,\Omega} + \frac{1}{1200\,\Omega} + \frac{1}{1200\,\Omega}\right) - U_3 * \frac{1}{1200\,\Omega} - U_4 * \frac{1}{1200\,\Omega} = \frac{10\,V}{1200\,\Omega}$$

$$U_3 = U_3 * \left(\frac{1}{1200\,\Omega} + \frac{1}{1200\,\Omega} + \frac{1}{2000\,\Omega}\right) - U_5 * \frac{1}{2000\,\Omega} - U_2 * \frac{1}{1200\,\Omega} = \frac{10\,V}{6300\,\Omega}$$

$$U_4 = U_4 * \left(\frac{1}{1200\,\Omega} + \frac{1}{1200\,\Omega} + \frac{1}{1200\,\Omega}\right) - U_5 * \frac{1}{1200\,\Omega} - U_2 * \frac{1}{1200\,\Omega} = 0$$

$$U_5 = U_5 * \left(\frac{1}{6300\,\Omega} + \frac{1}{1200\,\Omega} + \frac{1}{2000\,\Omega}\right) - U_4 * \frac{1}{1200\,\Omega} - U_3 * \frac{1}{1200\,\Omega} = 0$$

$$\begin{pmatrix} \frac{1}{400} & -\frac{1}{1200} & -\frac{1}{1200} & 0 \\ -\frac{1}{1200} & \frac{47}{31500} & 0 & -\frac{1}{2000} \\ -\frac{1}{1200} & 0 & \frac{1}{400} & -\frac{1}{1200} \\ 0 & -\frac{1}{2000} & -\frac{1}{1200} & \frac{47}{31500} \end{pmatrix} * \begin{pmatrix} x \\ y \\ z \\ w \end{pmatrix} = \begin{pmatrix} \frac{10}{1200} \\ \frac{10}{6300} \\ 0 \\ 0 \end{pmatrix}$$

$$w = \frac{3570}{899}, \quad x = \frac{5850}{899}, \quad y = \frac{5420}{899}, \quad z = \frac{3140}{899}$$

$$U_1 = 10\,V$$

$$U_2 = 6,51\,V$$

$$U_3 = 6,03\,V$$

$$U_4 = 3,49\,V$$

$$U_5 = 3,97\,V$$

$$U_{R1} = U_1 - U_2 = 10 - 6,51\,V = 3,49\,V$$

$$U_{R2} = U_2 - U_{R1} = 6,51 - 3,49\,V = 3,02\,V$$

$$U_{R3} = U_3 - U_5 = 6,03 - 3,97\,V = 2,06\,V$$

$$U_{R4} = U_{R7} = I_{R4} * R_4 = 630\,\mu A * 1200\,\Omega = 0,756\,V$$

$$U_{R5} = U_2 - U_3 = 6,51 - 6,03\,V = 0,48\,V$$

$$U_{R6} = U_4 - U_5 = 3,49 - 3,97\,V = -0,48\,V$$

$$U_{R8} = U_{R10} = I_{R8} * R_8 = 630\,\mu A * 5100\,\Omega = 3.213\,V$$

$$U_{R9} = U_3 - U_5 = 6,03 - 3,97\,V = 2,06\,V$$

Utregning for strøm: I = U/R

$$I_{R1} = \frac{U_{R1}}{R1} = \frac{3{,}49\ V}{1200\ \Omega} = 2.908\ mA$$

$$I_{R2} = \frac{U_{R2}}{R2} = \frac{3{,}02\ V}{1200\ \Omega} = 2.516\ mA$$

$$I_{R3} = \frac{U_{R3}}{R3} = \frac{3{,}49\ V}{1200\ \Omega} = 2.908\ mA$$

$$I_{R4} = I_{R8} = \frac{U1-U3}{R4+R8} = \frac{10-6{,}03\ V}{1{,}2k\ \Omega+5{,}1k\ \Omega} = 630\ \mu A$$

$$I_{R5} = \frac{U_{R5}}{R5} = \frac{0{,}48\ V}{1200\ \Omega} = 400\ \mu A$$

$$I_{R6} = \frac{U_{R6}}{R6} = \frac{-0{,}48\ V}{1200\ \Omega} = -\ 400\ \mu A$$

$$I_{R7} = I_{R10} = \frac{U5}{R7+R10} = \frac{3{,}97\ V}{1{,}2k\ \Omega+5{,}1k\ \Omega} = 630\ \mu A$$

$$I_{R9} = \frac{U_{R9}}{R9} = \frac{2{,}06\,V}{2000\,\Omega} = 1{,}03\,mA$$

Utregning for effektforbruk: P = U * I

$$P_{R1} = U_{R1} * I_{R1} = 3{,}49\,V * 2{,}908 * 10^{-3}A = 10{,}148\,mW$$

$$P_{R2} = U_{R2} * I_{R2} = 3{,}02\,V * 2{,}516 * 10^{-3}A = 7{,}598\,mW$$

$$P_{R3} = U_{R3} * I_{R3} = 3{,}49\,V * 2{,}908 * 10^{-3}A = 10{,}148\,mW$$

$$P_{R4} = U_{R4} * I_{4} = 0{,}756\,V * 630 * 10^{-6}A = 476{,}28\,\mu W$$

$$P_{R5} = U_{R5} * I_{R5} = 0{,}48\,V * 400 * 10^{-6}A = 192\,\mu W$$

$$P_{R6} = U_{R6} * I_{R6} = -\,0{,}48\,V * -\,400 * 10^{-6}A = 192\,\mu W$$

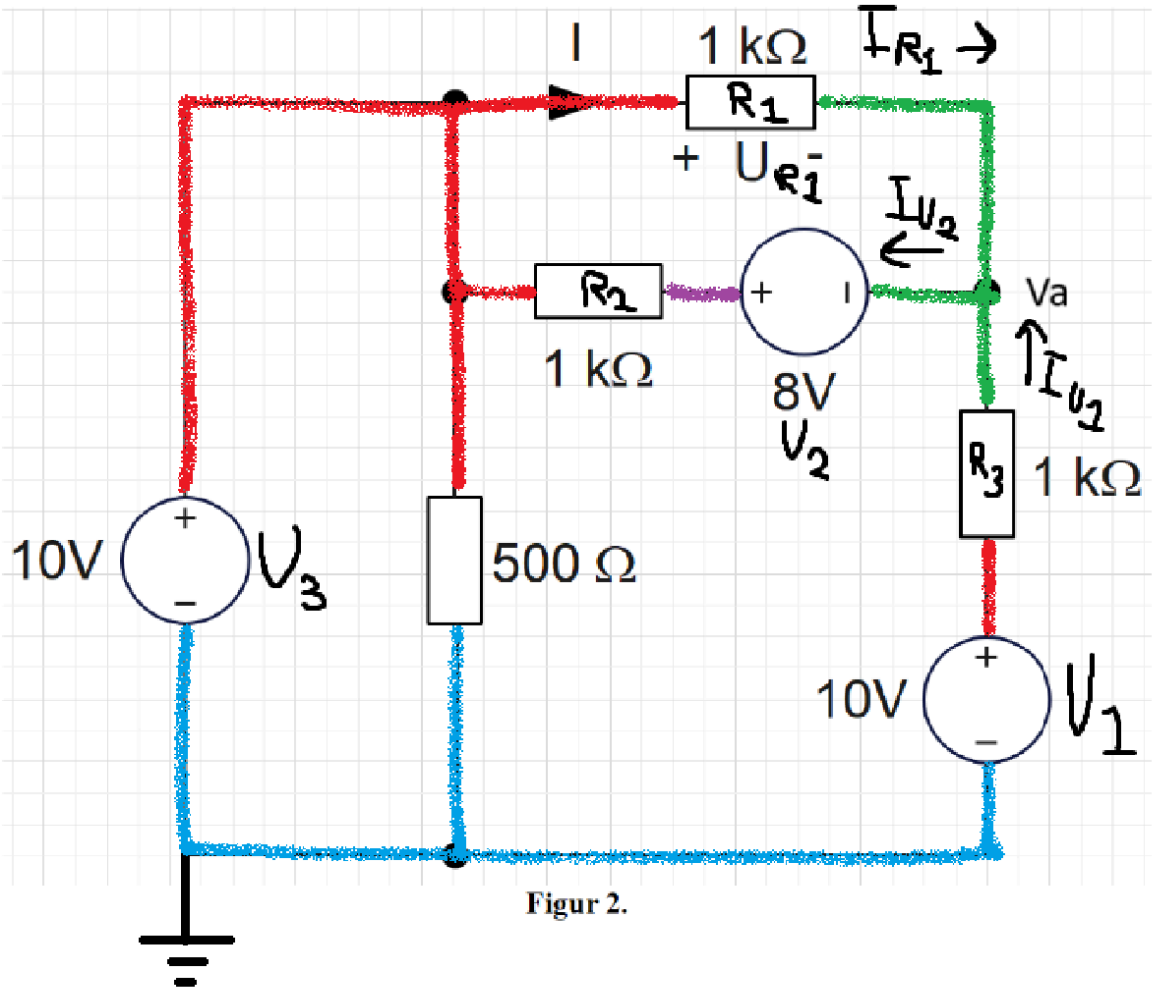
$$P_{R7} = U_{R7} * I_{R7} = 0{,}756 * 625 * 10^{-6}A = 472{,}5\,\mu W$$

$$P_{R8} = U_{R8} * I_{R8} = 3{,}213\,V * 630 * 10^{-6}A = 2{,}024\,mW$$

$$P_{R9} = U_{R9} * I_{R9} = 2{,}06\,V * 1{,}03 * 10^{-3}A = 2{,}121\,mW$$

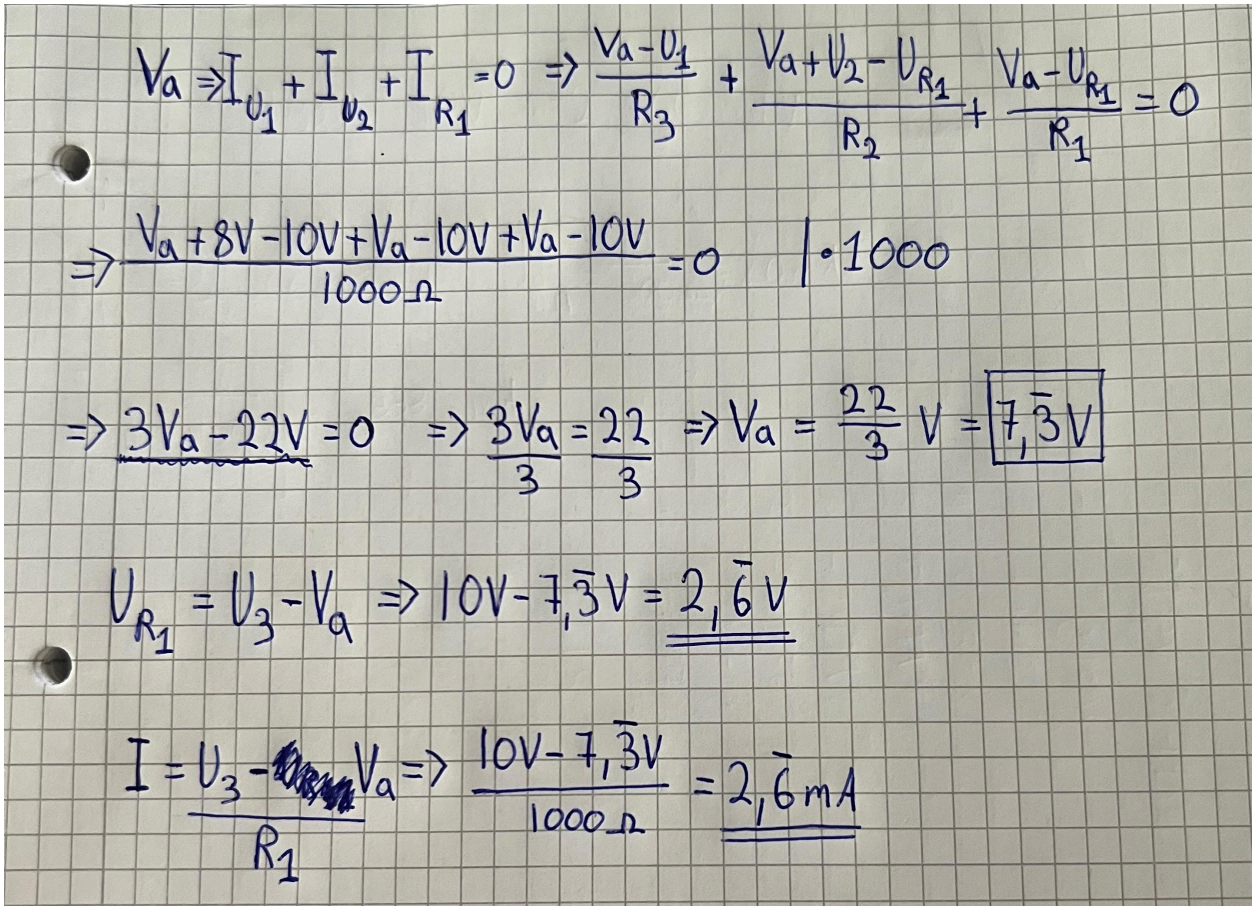
$$P_{R10} = U_{R10} * I_{R10} = 3{,}213\,V * 625 * 10^{-6}A = 1{,}951\,mW$$

Oppgave b)



Figur 2.

Setter nederste knutepunkt til referanse av 0 V og så tegner jeg opp alle kjente spenninger. Det markert i blå er 0 V, rød er 10 V, lilla er 8 V og grønn er en ukjent spenning som må regnes ut. Setter knutepunktet til grønn som Va og setter opp likningen ut fra det.



Underskrift:

Universitetet i Sørøst-Norge

Resultatskjema for laboratorieøvelse

Øvelse nr. 3	Øvelsen er utført av:	Navn: Salim og Adam
Øvelsens navn: Lab 3: Knutepunktsanalyse		Klasse: Data Gruppenr.: 11 Dato: 27/09/2024

Måleresultater:

Fortsett på baksiden, hvis behov

Dato og sign. lab.ing / faglærer: 27.09.24 Vetle M. Nilsen