

## Oppgave a)

### Krets 1:

**8V:**

Setter 15 V som en kortslutning

$$\text{Finner } R_{R1||R2} = \frac{8,2 \cdot 8,2}{8,2 + 8,2} = 4,1 \text{ k}\Omega$$

Finner  $R_{\text{tot}}$  for 8V ved hjelp av  $R_1 + (R_2//R_3) = 10,9 \text{ k}\Omega$

$$\text{Finner vi } I_{\text{tot}} \text{ for } 8 \text{ V ved hjelp av } I_{\text{tot}-8V} = \frac{V}{R_{\text{tot}}} = \frac{8V}{10900 \Omega} = 734 \mu A$$

$$I = I_{\text{tot}-8V} * \frac{R_3}{R_3+R_2} \rightarrow 734 \mu A * \frac{8,2 \text{ k}}{8,2 \text{ k} + 8,2 \text{ k}} \approx 366,97 \mu A$$

**15V:**

Setter 8 V som en kortslutning

$$\text{Finner } R_{R2||R3} = \frac{6,8 \cdot 8,2}{6,8 + 8,2} = 3717,3 \Omega$$

Finner  $R_{\text{tot}}$  for 15 V ved hjelp av  $R_3 + (R_1//R_2) = 11917,3 \Omega$

$$\text{Finner vi } I_{\text{tot}} \text{ for } 15 \text{ V ved hjelp av } I_{\text{tot}-15V} = \frac{V}{R_{\text{tot}}} = \frac{15}{11917,3 \Omega} = 1,259 mA$$

$$I = I_{\text{tot}-15V} * \frac{R_1}{R_1+R_2} \rightarrow 1,259 mA * \frac{6,8 \text{ k}}{6,8 \text{ k} + 8,2 \text{ k}} \approx 570,599 \mu A$$

$$I_{\text{tot}} = 366,97 \mu A + 570,599 \mu A = 937,569 \mu A$$

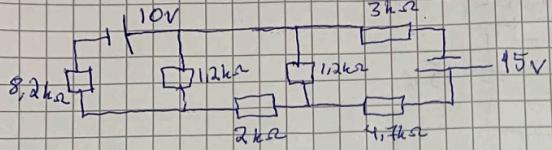
8V-kildens bidrag:  $I = 366,97 \mu A$

15V-kildens bidrag  $I = 570,599 \mu A$

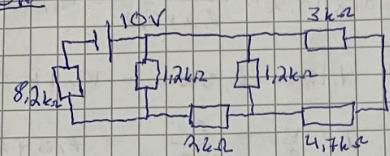
Sum I total = **937,569 μA**

### Krets 2:

## Krets 2%



10V

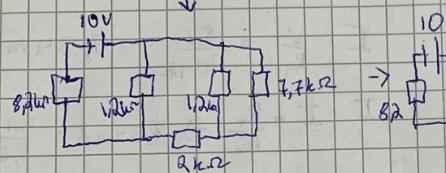


$$3k\Omega + 4.7k\Omega = 7.7k\Omega$$

$$7.7 \parallel 1.2 \approx 1.038k\Omega$$

$$1.038k\Omega + 2k\Omega = 3.038k\Omega$$

$$3.038k\Omega \parallel 1.2k\Omega = 0.860\Omega$$



$$R_T = 8.2k\Omega + 860\Omega = 9.06k\Omega$$

$$I'_T = \frac{10V}{9.06k\Omega} = 1.104mA$$

$$I = I'_T + \frac{R_X}{R_T} = 1.104 \cdot \frac{860}{3.038} = 0.313mA$$

$$0.313mA \cdot \frac{1038}{1200} = 0.271mA$$

$$I' = 10V : 0.271mA$$

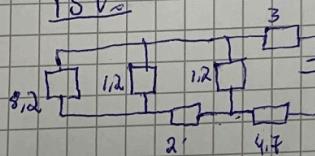
$$I'' = 15V : 1.257mA$$

$$I = I' + I'' = 1.486mA$$

$$-0.986mA$$

~~1.486mA~~

15V



$$8.2 \parallel 1.2 = 1.046,809\Omega$$

$$1.046,809 + 2k\Omega = 3.046,809\Omega$$

$$3.046,809 \parallel 1.2k\Omega = 860,922\Omega$$

$$R_T = 3k\Omega + 4k\Omega + 860,922\Omega = 8,561k\Omega$$

$$I_T = \frac{U}{R_T} = \frac{-15V}{8,561k\Omega} = -1.752mA$$

$$-1.752mA \cdot \frac{861}{1200} = -1.257mA$$

1200

10V-kildens bidrag:  $I = 0,271 \text{ mA}$

15V-kildens bidrag  $I = -1,257 \text{ mA}$

Sum I total = **-0,986 mA**

### Oppgave b)

Krets 1:

8V-kildens bidrag  $I = 365,89 \mu A$

15V-kildens bidrag  $I = 568,42 \mu A$

Sum I\_total = 934,31  $\mu A$

Direktemålt I\_total = 934,3  $\mu A$

Krets 2:

10V-kildens bidrag  $I = 268,74 \mu A$

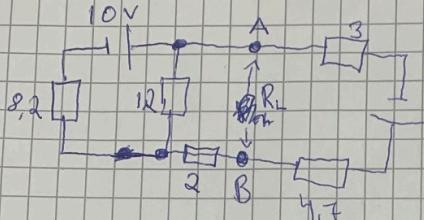
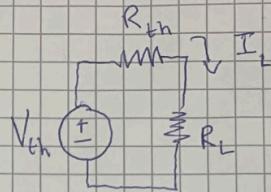
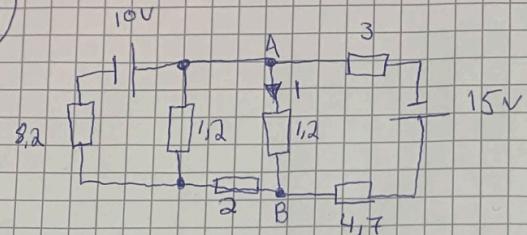
15V-kildens bidrag  $I = -1,2455 \text{ mA}$

Sum I\_total = -0,9767 mA

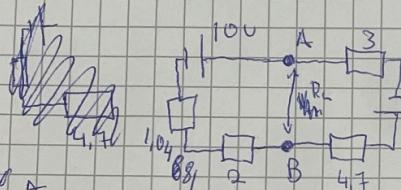
Direktemålt I\_total = -0,9763 mA

### Oppgave c)

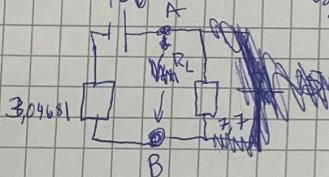
1)



$$\rightarrow 8,2 \parallel 1,2 = 1,04681$$



$$4,7+3=7,7$$



$$R_{th} = 3,04681 \parallel 7,7 = \underline{\underline{2183,012}}$$

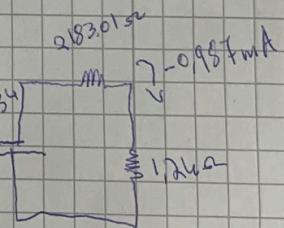
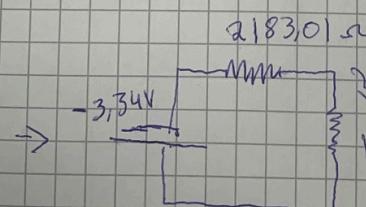
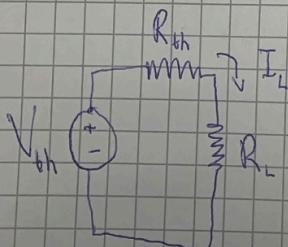
$$\text{V}_{\text{th}} = \frac{1}{2} (3.3 + 10) V_{\text{DD}} = 3.34 \text{ V}$$

$$I_h \text{ fra krets } 2 = 1,51 \text{ mA}$$

$$V_{th} = 13,34V - 3,34V$$

$$10V - 13,34V = \underline{-3,34V}$$

$$10 - (1,515 \cdot 3) + 15 - (1,515 \cdot 4,7) = 1334 \text{ V}$$



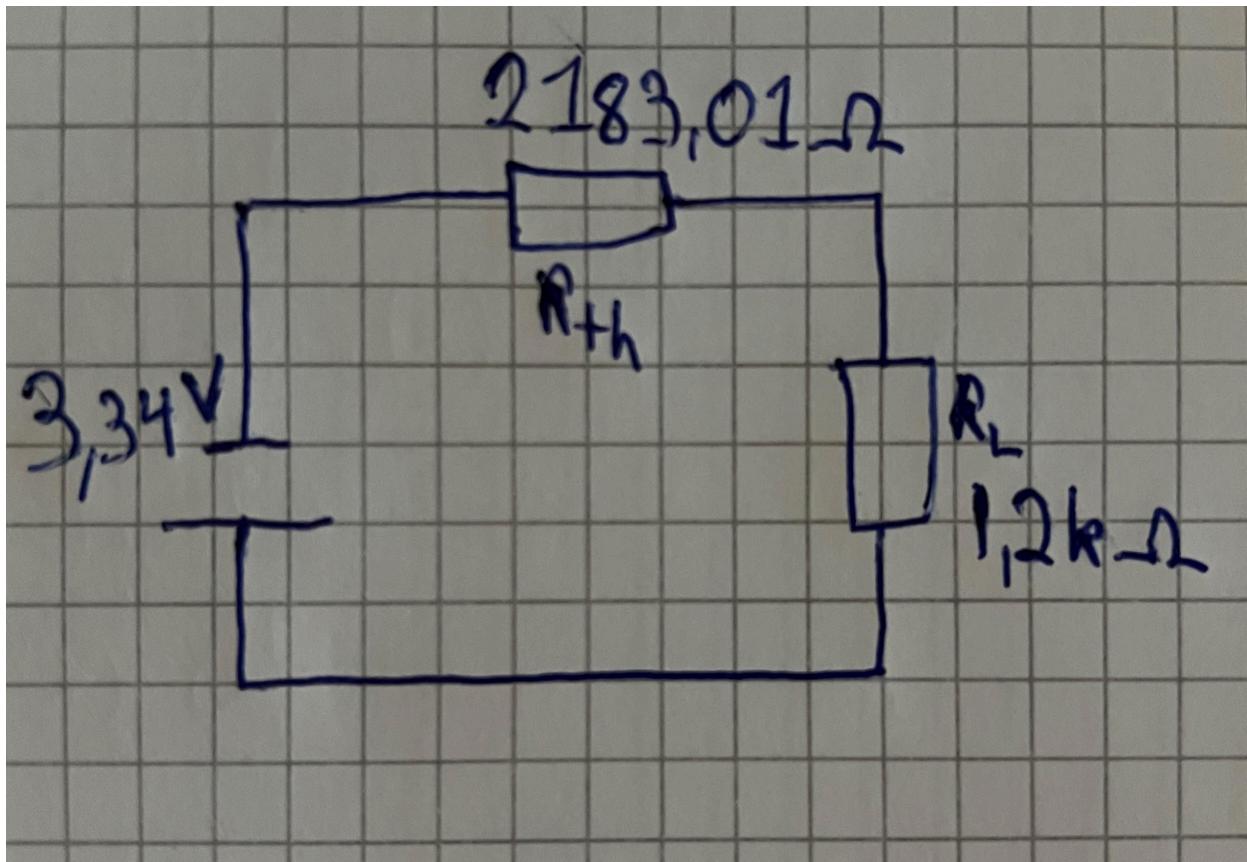
$$I_1 = \frac{-3,34}{2183,01+1,2} = -0,987 \text{ mA}$$

2) Norton ekvivalenten kan bli funnet ved å bruke ohms lov

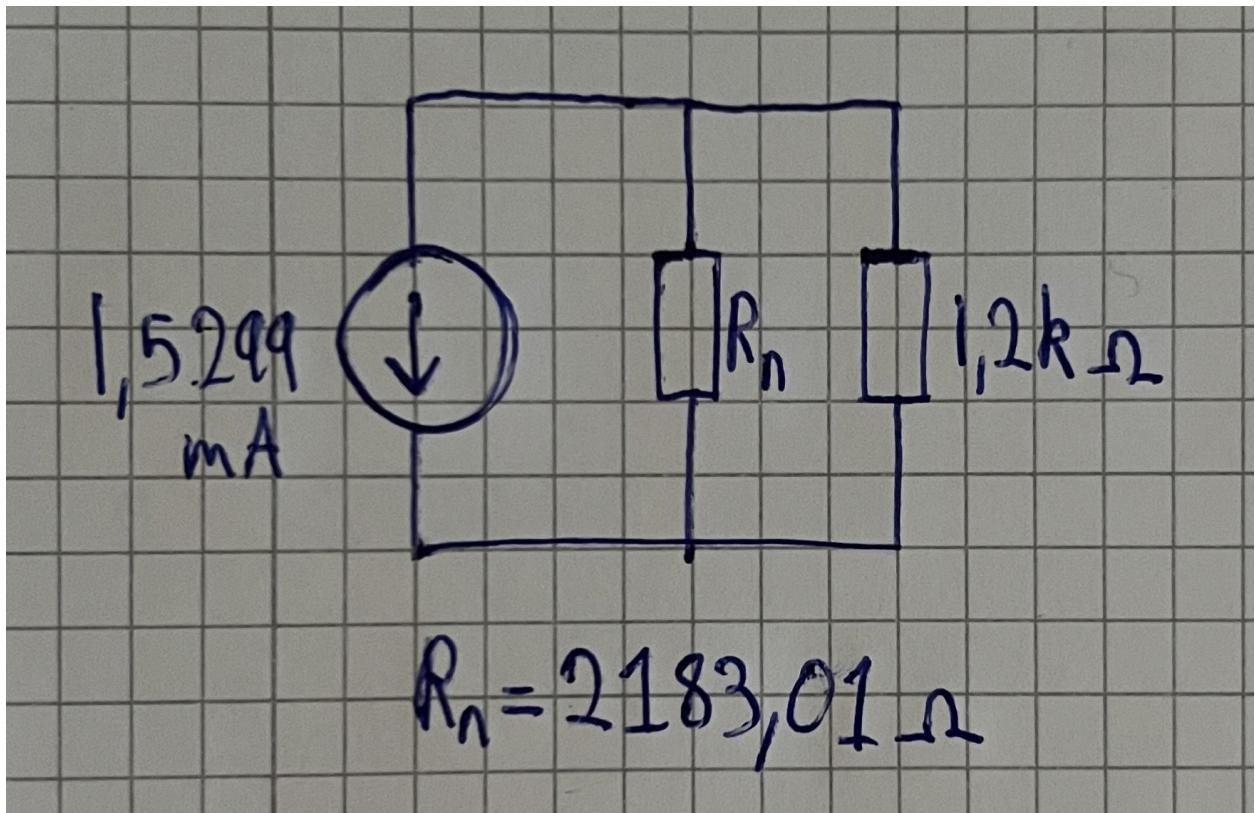
$$R_{th} = R_n = 2183,01 \Omega$$

$$I_n = \frac{V_{th}}{R_{th}} = \frac{-3,34 V}{2183,01 \Omega} = -1,5299 mA$$

3) Thevenin:



Norton:



4)  $R_{th}=2,1821 \text{ k ohm}$   $V_{th} = -3,318 \text{ V}$

5)  $I_n=-1,5077 \text{ mA}$

**Underskrift:**

Resultatskjema for laboratorieøvelse

Øvelse nr. **5** Øvelsen er utført av: Navn: **Salim og Adam**

Øvelsens navn:  
**Superposisjon, Thvenin, Norton**

Klasse: **Data**

Gruppenr.: **11**

Dato: **01/11/2024**

Måleresultater:

Fortsett på baksiden, hvis behov

Dato og sign. lab.ing / faglærer: **André Toft**