Lab3 Prelab Report

Name	杨润康	Score	
Stu NO.	2022533080		of 42

Part One: Superposition Theorem

Consider the circuit given in Figure. 1, in which R_L is 10kΩ

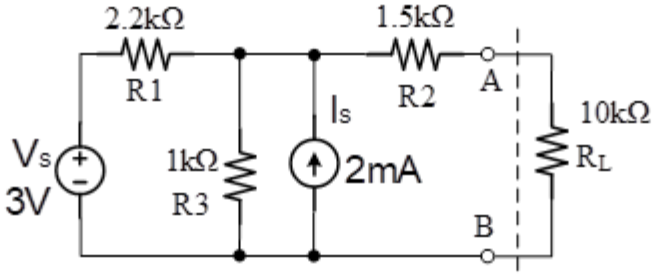
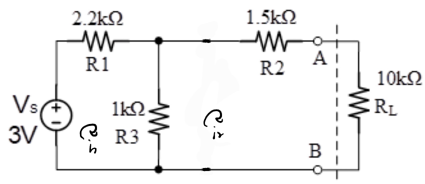
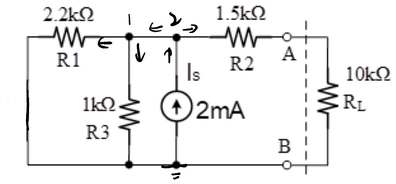


Figure 1.

Determine the U_L (voltage across R_L) and I_L (current through R_L) using superposition. __/12pt

<table>
<tr><td>i. U_S only</td><td>ii. I_S only</td></tr>
<tr><td>Equivalent Circuit


KVL $-3+2.2k\,i_1+(i_1-i_2)\times 1k=0$
$1k\times(i_2-i_1)+(1.5k+10k)\,i_2=0$
$i_2=I_L'$
$U_L'=i_2R_L$</td><td>Equivalent Circuit


KCL: node $2\times10^{-3}=\frac{V_1-0}{2.2k}+\frac{V_1-0}{1k}+\frac{V_1}{(1.5+10)k}$
$I_L''=\frac{V_1}{(1.5+10)k}$
$U_L''=I_L''R_L$</td></tr>
<tr><td>$U_L'=$ 769 mV

$I_L'=$ 76.9 μA</td><td>$U_L''=$ 1.13V

$I_L''=$ 113 μA</td></tr>
<tr><td colspan="2">$U_L=$ 1.90V
$I_L=$ 190 μA</td></tr>
</table>

Part Two: Thevenin's Theorem and Norton's Theorem

For the circuit given in Fig.2, remove R_L from the original circuit.

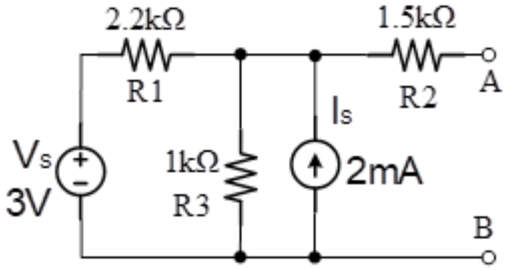


Fig. 2

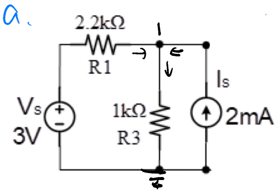
1. Calculate the Thevenin's equivalent parameters following from the perspective of terminals A and B. Show all work. __/9pt

   a. open-circuit voltage U_{OC}

   b. short circuit current I_{sc}

   c. equivalent resistance R_0

a.

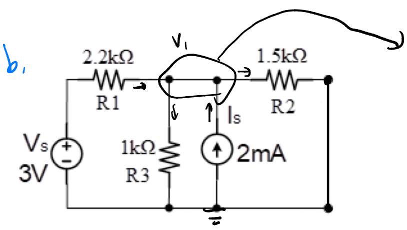


Node 1. KCL: $\frac{V_s - V_1}{2.2k} + 2\times10^{-3} = \frac{V_1 - 0}{1k}$

$U_{oc} = U_{Th} = V_1 - 0$

$\Rightarrow U_{oc} = 2.31V$

b.



KCL: $2\times10^{-3} + \frac{V_s - V_1}{2.2k} = \frac{V_1 - 0}{1k} + \frac{V_1 - 0}{1.5k}$

$I_{sc} = \frac{V_1 - 0}{1.5k}$

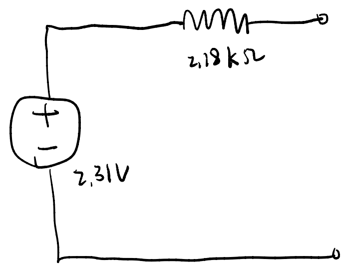
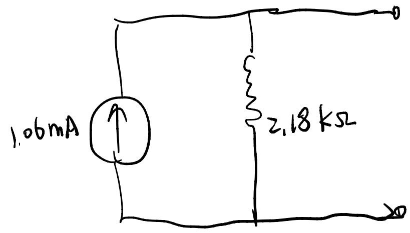
$\Rightarrow I_{sc} = 1.06mA$

c.

$R_0 = \frac{U_{oc}}{I_{sc}}$

$R_0 = 2.18\,k\Omega$

2. Use your results to construt Thévenin and Norton Equivalent Circuit. __/7pt

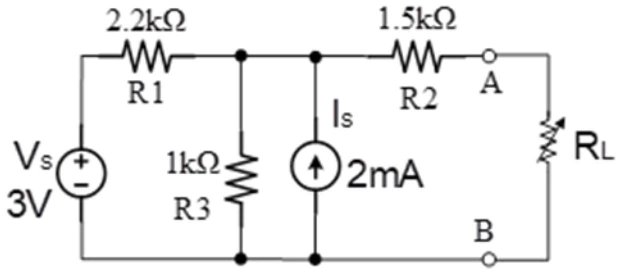
Thévenin Equivalent Circuit	Norton Equivalent Circuit
	

3. Validate Thevenin theorem.

1) Calculate the external characteristics of the linear two-terminal active network

As shown in Fig.3, the variable resistor R_L is connected between terminals A and B of the two-terminal active network. Change the resistance of R_L, as shown in Table1, and measure the external characteristics of the network. Record the corresponding voltages and currents into Table1. __/6pt

Fig.3



2) Calculate the external characteristics of the Thévenin Equivalent Circuit

According to your Thévenin Equivalent Circuit in step2, a variable resistor R_L is used as load.

Calcultae the external characteristics of the Thévenin Equivalent Circuit. Record the corresponding voltages and currents into the Table 1. __/14pt

Table 1.

R_L/Ω	0	1k	2k	R_0	6k	12k	∞
U_L/V Fig.8 original two-terminal network	0	725×10^{-3}	1.10	1.15	1.69	1.96	2.31
U_L/V Thevening equivalent circuit	0	726×10^{-3}	1.11	1.15	1.69	1.95	2.31
I_L/mA Fig.8 original two-terminal network	-1.06	-725×10^{-3}	-552×10^{-3}	-529×10^{-3}	-282×10^{-3}	-163×10^{-3}	-2.31×10^{-6}
I_L/mA Thevening equivalent circuit	-1.06	-726×10^{-3}	-553×10^{-3}	-530×10^{-3}	-282×10^{-3}	-163×10^{-3}	0