EXPERIMENT 3

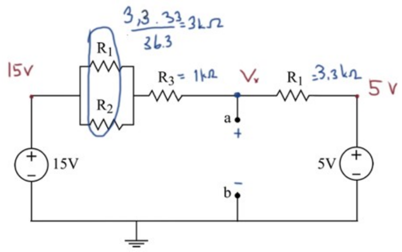
APPLICATION OF THEVENIN AND NORTON THEOREMS

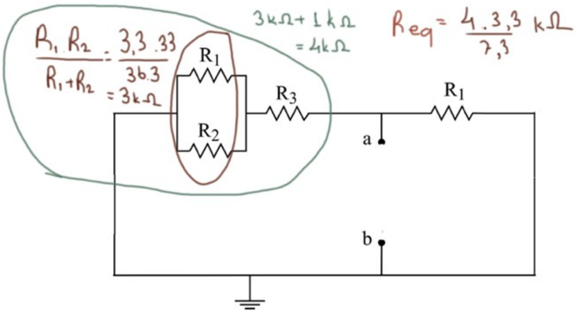
It took me about 3 hours to complete.

3.3 Preliminary Work

1.

i.



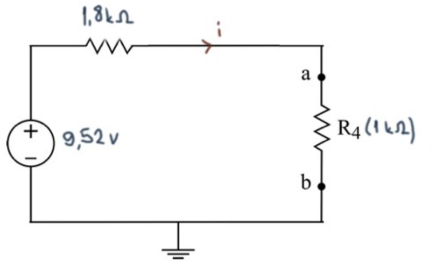


$$\frac{V_x - 15V}{4k\Omega} + \frac{V_x - 5V}{3{,}3k\Omega} = 0$$

$7{,}3 V_x = 69{,}5V \qquad V_x = E_{TH} = 9{,}52V$

$R_{TH} = 1{,}8\ k\Omega$

ii.



$9{,}52V = 2{,}8\ k\Omega . i$

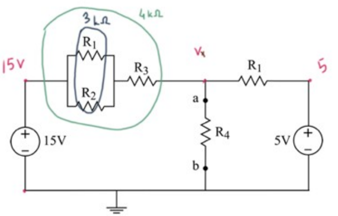
$i = 3{,}4mA$

$V_4 = R_4 . i$

$V_4 = 1k\Omega . 3{,}4\ mA$

$V_4 = 3{,}4V$

iii.



$$\frac{V_x - 15V}{4k\Omega} + \frac{V_x}{1k\Omega} + \frac{V_x - 5V}{3.3k\Omega} = 0$$

$3.3V_x - 49.5V + 13.2V_x + 4V_x - 20V = 0$

$20.5V_x = 69.5V$

$V_x = 3{,}39V \sim 3.4V$

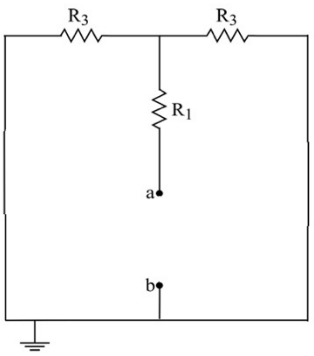
$V_4 = V_x - 0 = 3.39V$

$i = \frac{V_L}{R_4} = 3.39\ mA \sim 3.4mA$

My calculations are same

2.

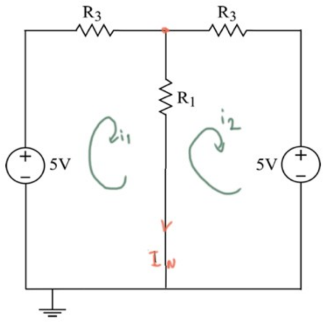
i.



$$R_N = R_1 + \frac{R_3}{2}$$

$$R_N = 3.3k\Omega + 0.5k\Omega$$

$$R_N = 3.8k\Omega$$



$$5 - R_3 i_1 - R_1(i_1 - i_2) = 0$$

$$-R_3 i_2 - 5 - R_1(i_2 - i_1) = 0$$

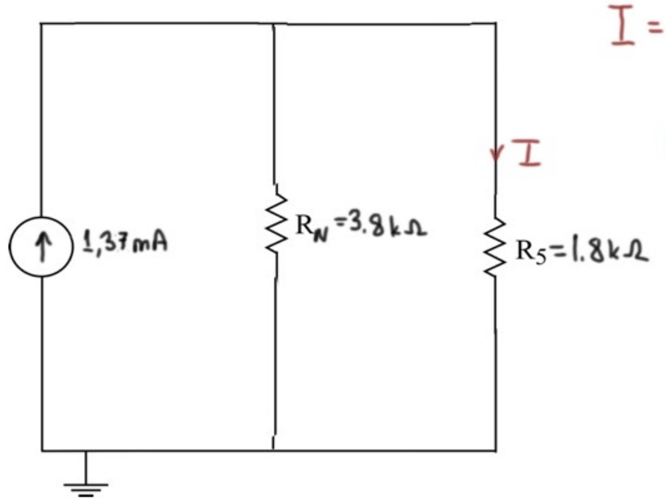
$$5 = 4{,}3 i_1 - 3{,}3 i_2$$

$$-5 = 4{,}3 i_2 - 3{,}3 i_1$$

$$i_1 = 0{,}68mA \quad i_2 = -0{,}68mA$$

$$I_N = i_1 - i_2 = 1{,}37mA$$

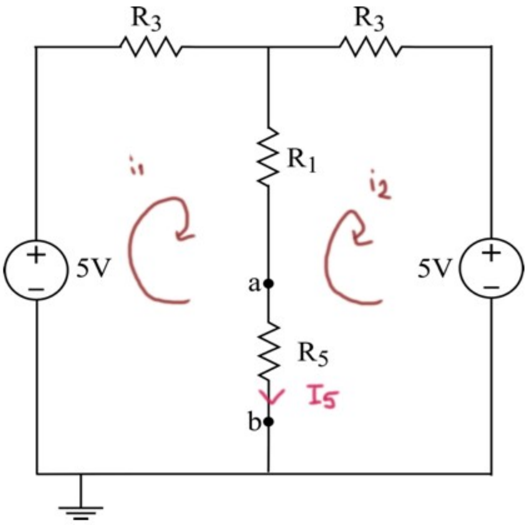
ii.



$$I = \frac{1{,}37mA \cdot 3{,}8k\Omega}{(3{,}8 + 1{,}8)k\Omega} = 0{,}93\ mA$$

$$V = 0.93mA \cdot 1{,}8k\Omega = 1{,}67V$$

iii.



$$5 - R_3 i_1 - R_1(i_1 - i_2) - R_5(i_1 - i_2) = 0$$

$$-R_3 i_2 - 5 - R_5(i_2 - i_1) - R_1(i_2 - i_1) = 0$$

$$5 = 6{,}1 i_1 - 5{,}1 i_2$$

$$-5 = 6{,}1 i_2 - 5{,}1 i_1$$

$$i_1 \simeq 0{,}45mA \qquad I_5 = i_1 - i_2 = 0{,}9mA$$

$$i_2 \simeq 0{,}45mA$$

$$V_5 = I_5 \cdot R_5 = (0.9mA) \cdot (1.8k\Omega) = 1{,}62V$$

My calculations are same (just significant figures differ).

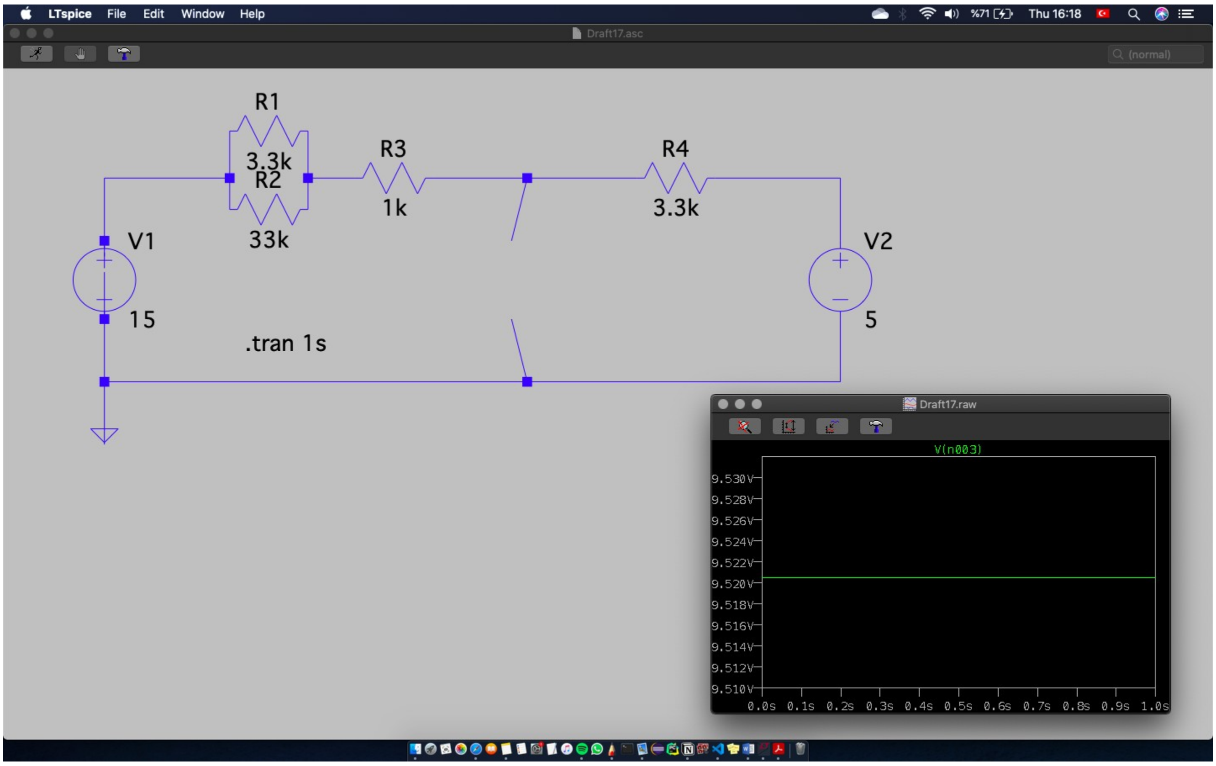
EXPERIMENT 3
REPORT SHEET

Name & Surname: Derya Tınmaz

Date: 26.11.2020

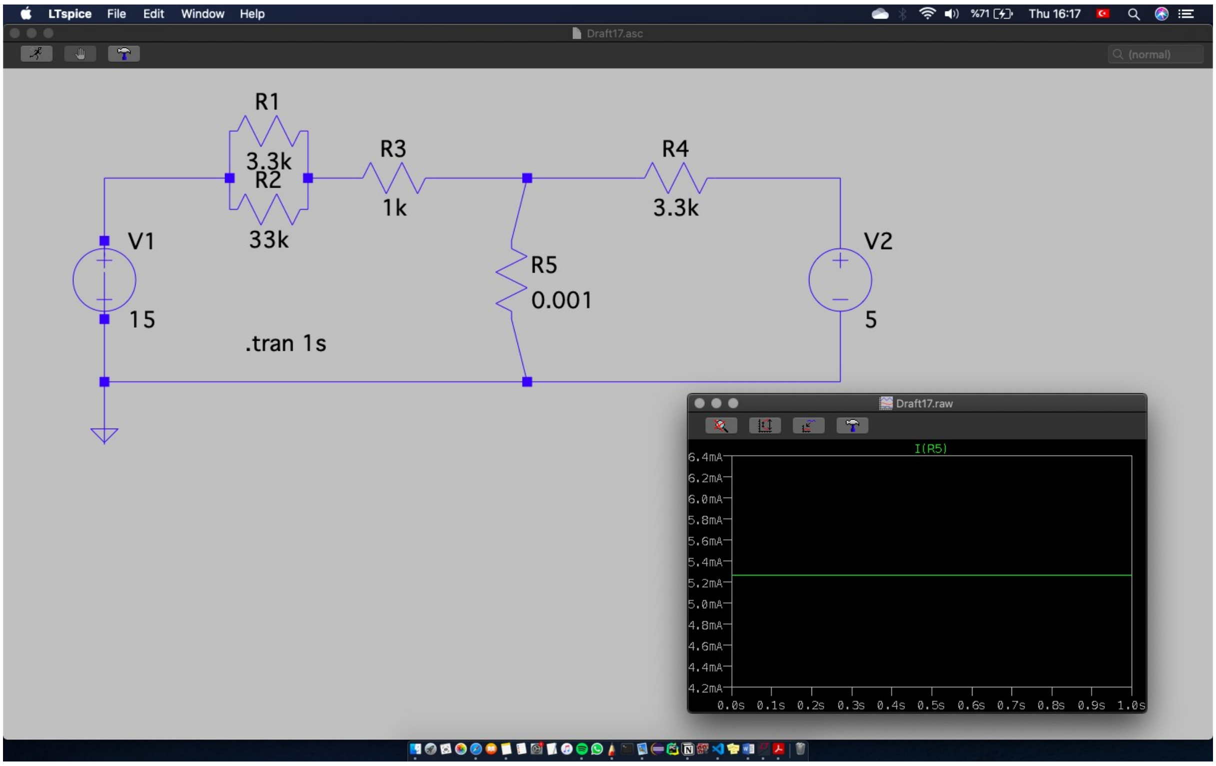
Experimental Work:

1. Take the screenshots of both circuit and DC operating point simulation results and fill the table given below with calculated and measured values.



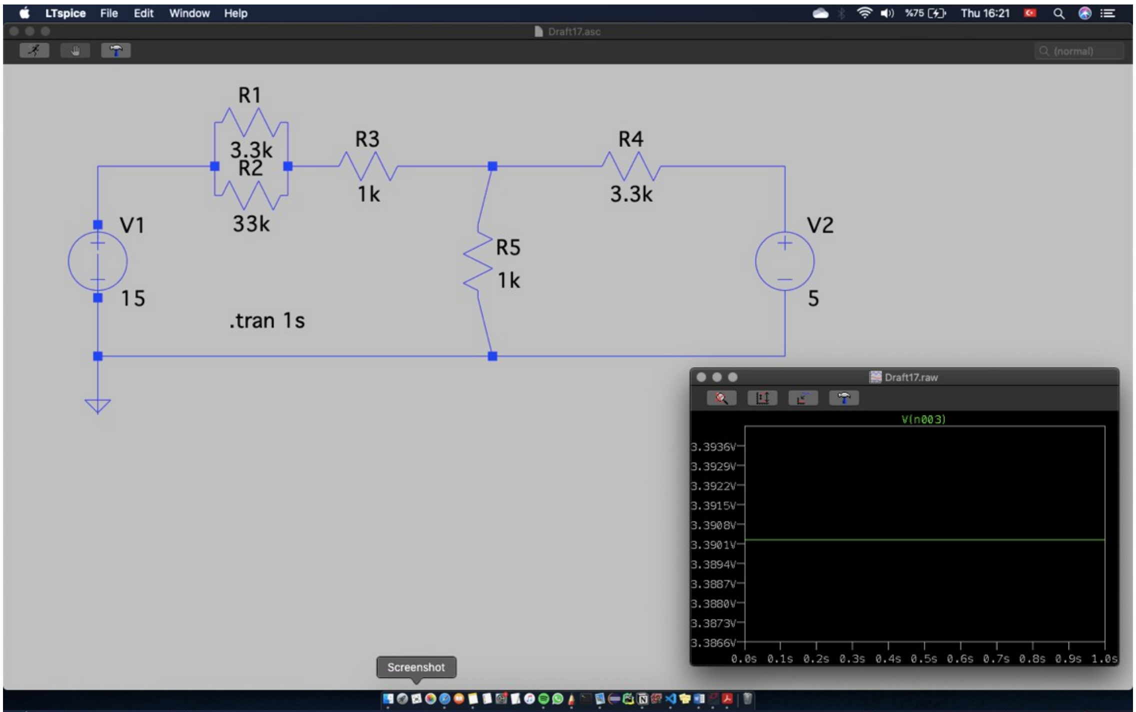
	Calculated	**Measured**
$\mathbf{E_{TH}}$	9.52 V	9.52V

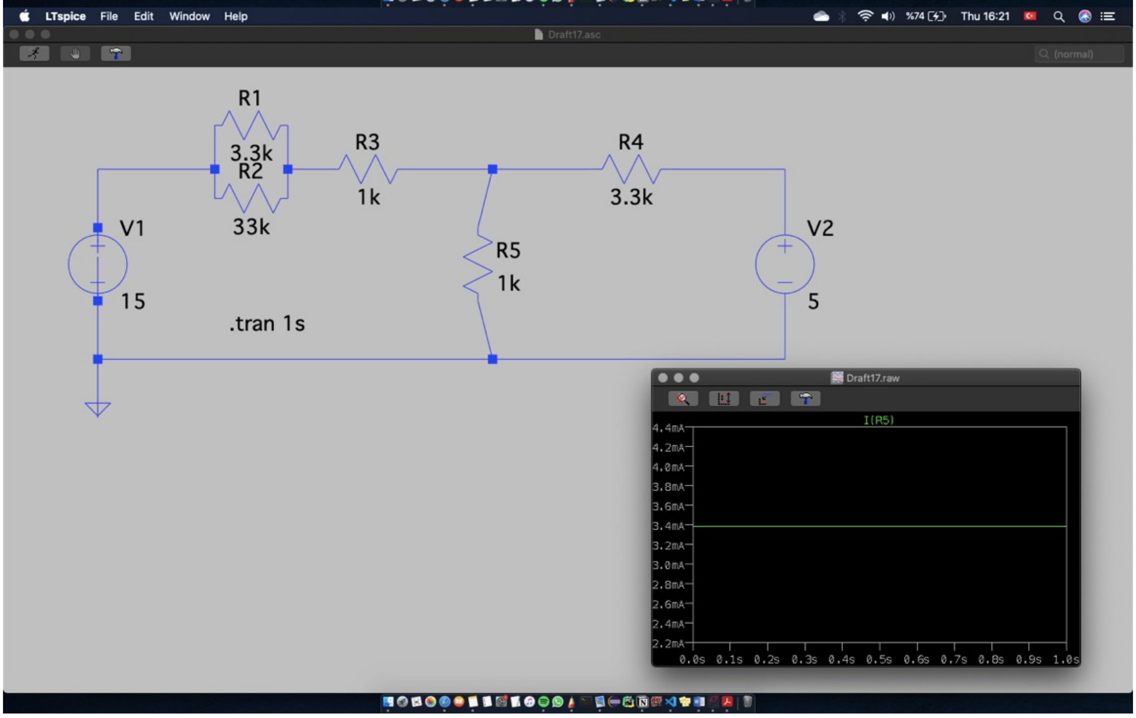
2. Take the screenshots of both circuit and DC operating point simulation results and fill the table given below with calculated and measured values.



	Calculated in Preliminary Work	**Measured/ Calculated in LTSpice**
I_{SC}	**X**	5.25mA
R_{TH}	1.8 kΩ	1.8 kΩ

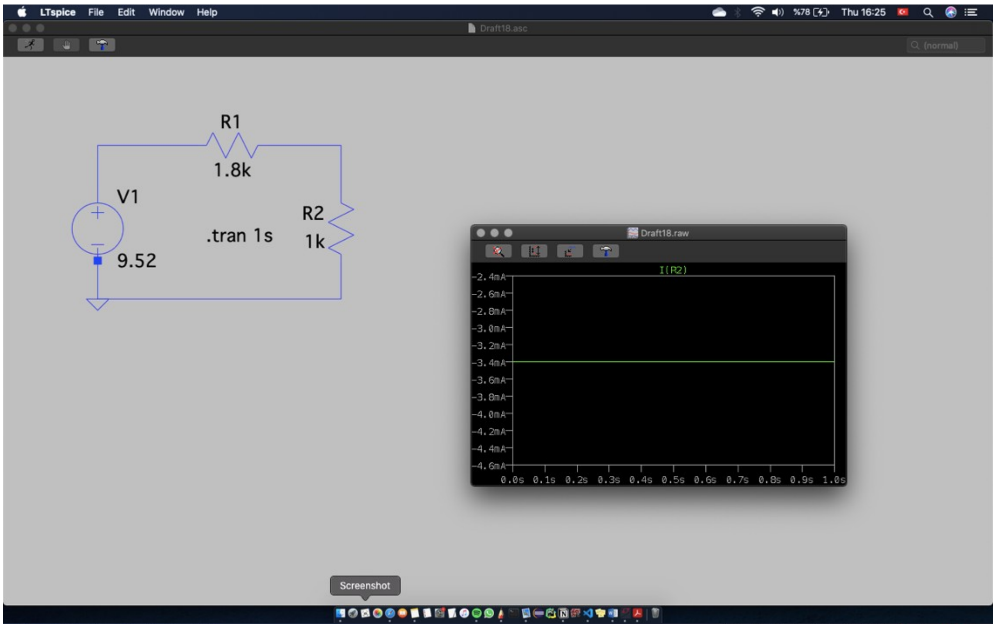
3. Take the screenshots of both circuit and transient simulation results.

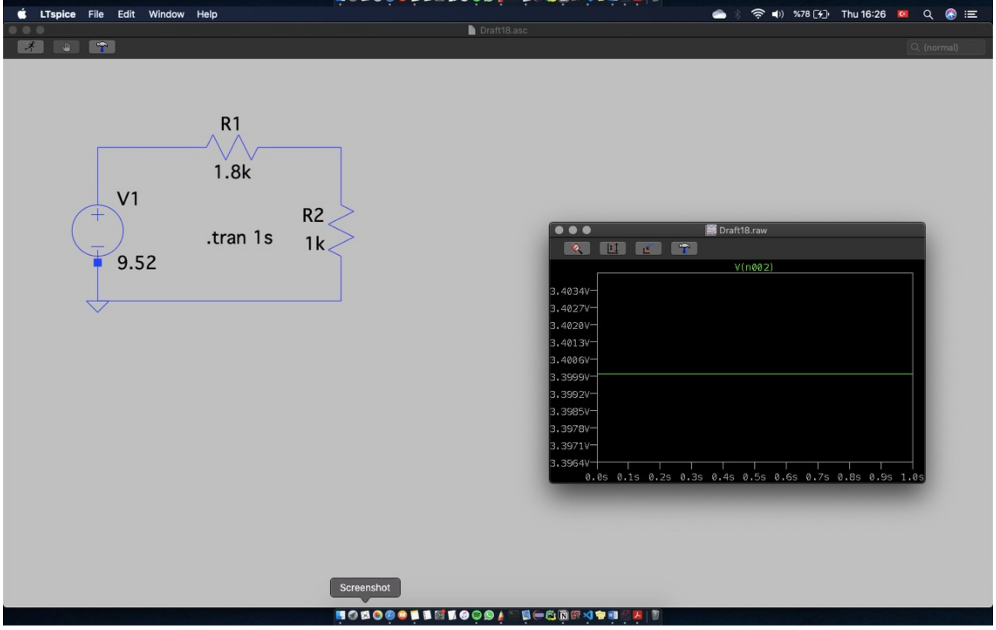




Voltage: 3.39 V Current:3.4mA

4. Take the screenshots of both circuit and transient simulation results.

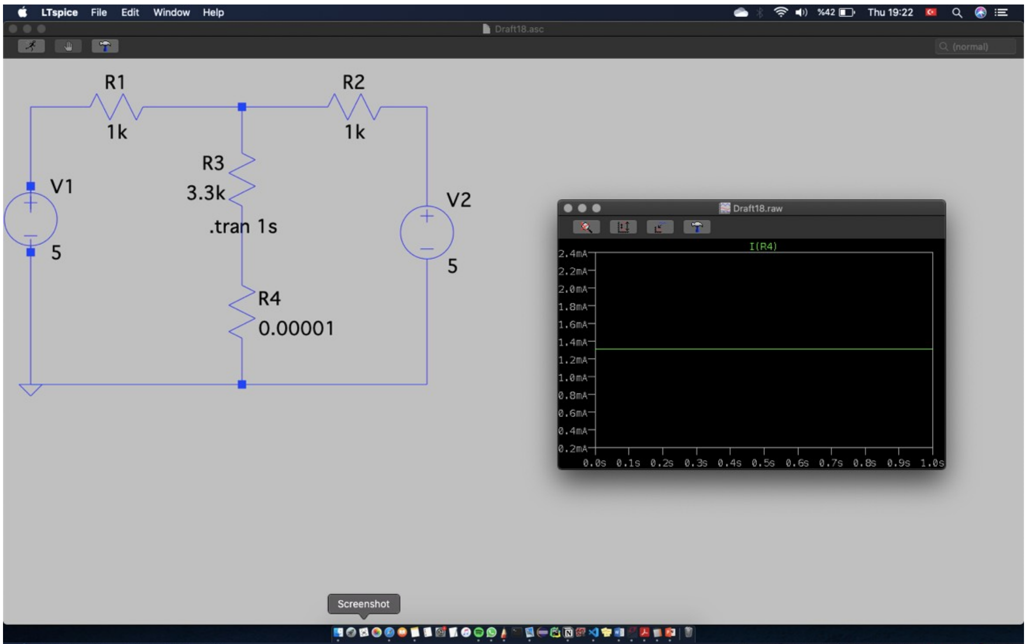


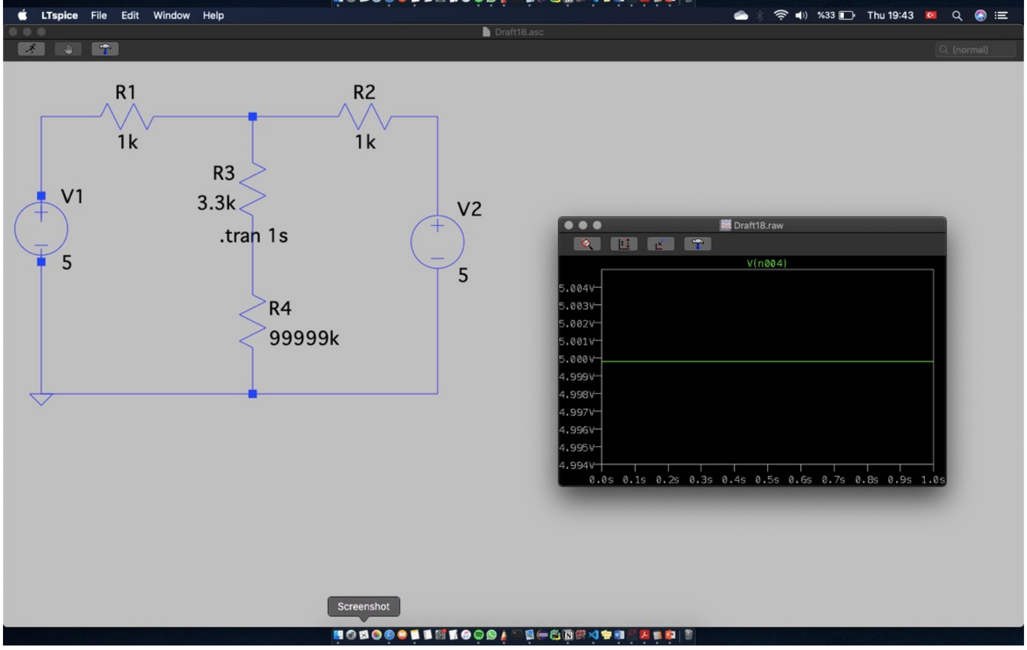


Voltage:3.4 V

Current:3.4 mA

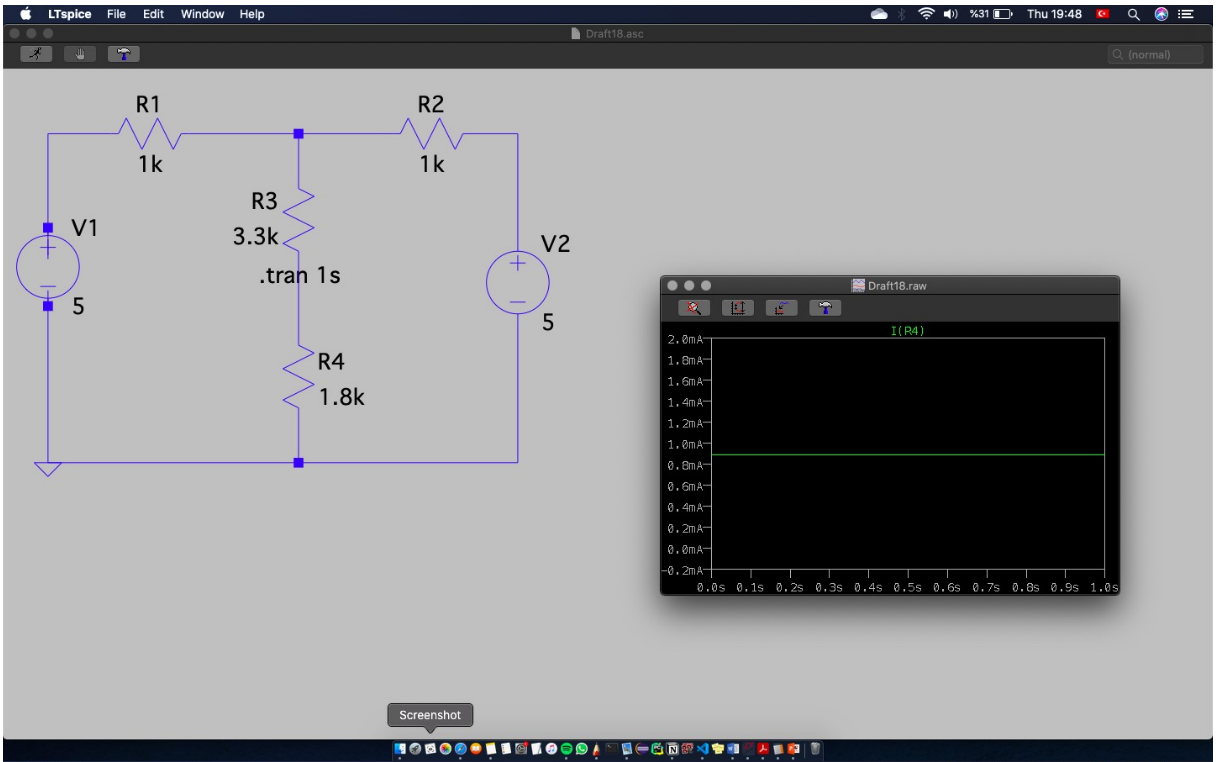
5. Take the screenshots of both circuits and DC operating point simulation results and fill the table given below with calculated and measured values. Compare your results with previous step.

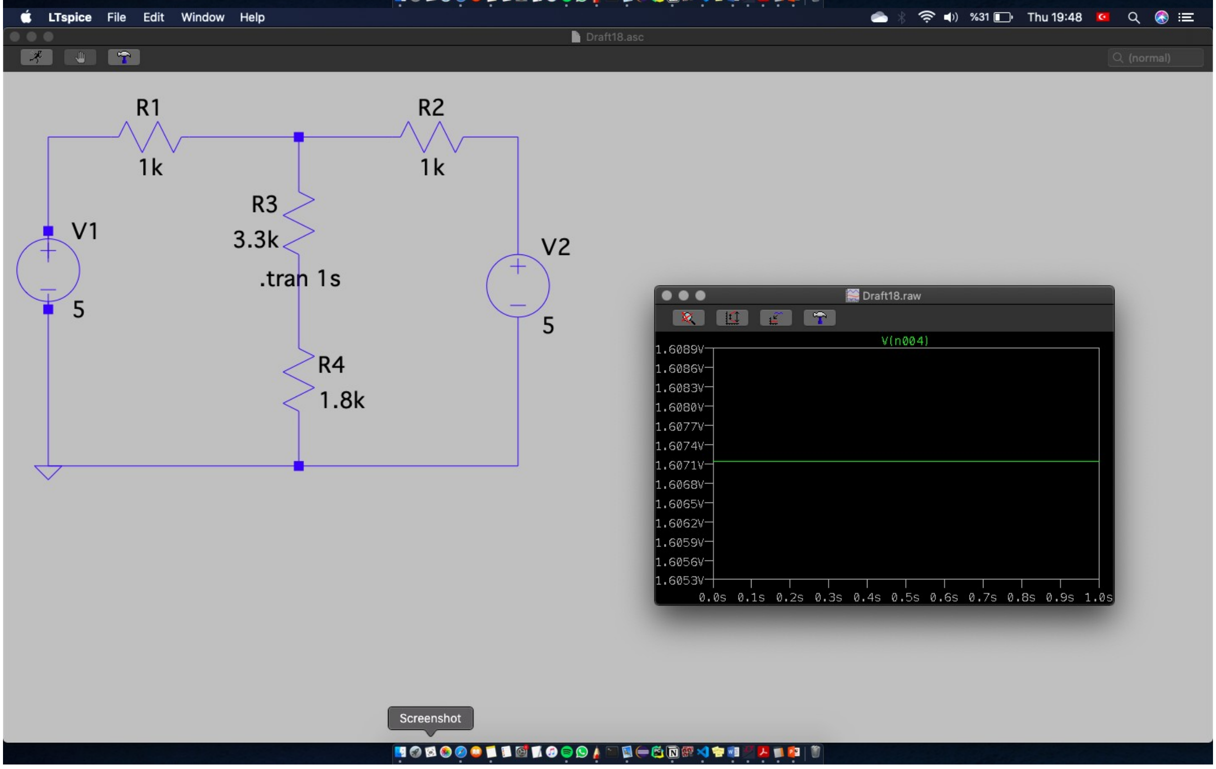




	Calculated in Preliminary Work	**Measured/ Calculated in LTSpice**
$\mathbf{I_N}$	1.37 mA	1.32 mA
$\mathbf{R_N}$	3.8 kΩ	3.78 kΩ

6. Take the screenshots of both circuit and transient simulation results. Compare your results with your calculations.





Voltage: 1.6V Current:0.9mA

My calculations and my results are same (just significant figures differ).

Conclusion
1.Discuss experimental results from Norton and Thevenin equivalent circuits.
Norton and Thevenin equivalent circuits make complicated circuits simple without changing the actual voltage and current values on the resistor.

2. Compare Thevenin and Norton equivalent circuit results with your calculation and simulation results.
My calculations and my results are same (just significant figures differ).