

Experiment 4: Network Analysis II

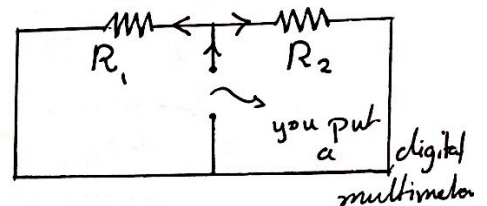
The Thevenin and Norton Techniques

Thevenin: "any network of resistors and supplies having two output terminals and supplies having two output terminals can be replaced by a series combination of E_{eq} & R_{eq} By three steps:- starting by R_3

Step 1:- you consider that E_1, E_2 does not exist:-

$$R_{eq} = R_1 + R_2$$

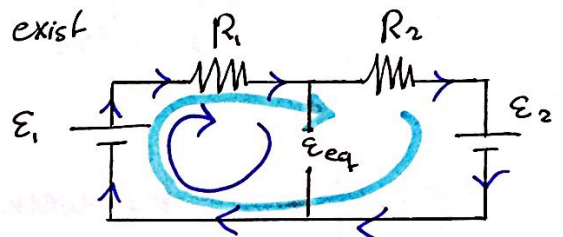
$$R_{eq3} = \frac{R_1 R_2}{R_1 + R_2}$$



Step 2:- you consider that E_1, E_2 exist

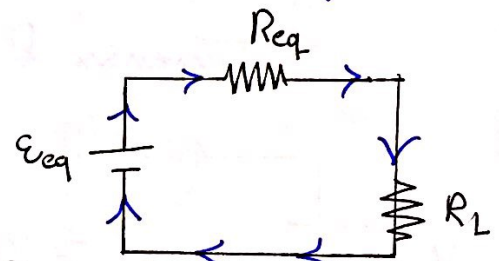
$$E_{eq} = E_1 - I R_1 \quad \text{--- ①}$$

$$\text{you find } I \quad \text{--- ②}$$



Step 3:- you find I_{eq3}

$$I_{eq3} = \frac{E_{eq}}{R_{eq} + R_L}$$



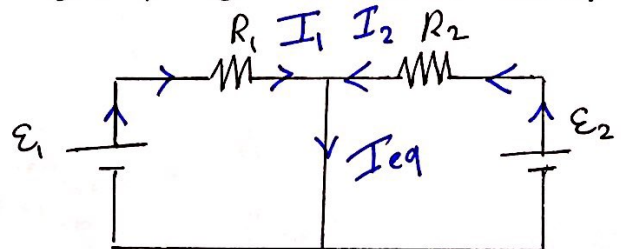
• You do the same for R_1 and R_2 and you find I_{eq1} and I_{eq2}

2- **Norton's** for R_3

Step 1:- The same

$$\text{Step 2:- } I_{eq3} = I_1 + I_2$$

$$= \frac{E_1}{R_1} + \frac{E_2}{R_2}$$



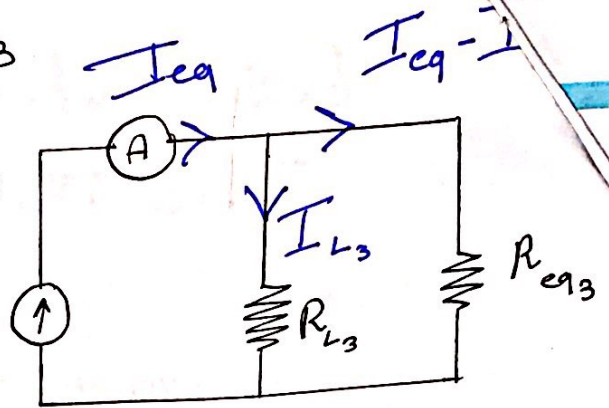
Step 3 get rid of E_1, E_2

Also Etan →

• you replace R_1, R_2 with R_{eq3}

• $I_{L3} R_3 = (I_{eq3} - I_{L3}) R_{eq3}$

على مصدر الجهد عند التوصل على التوازي



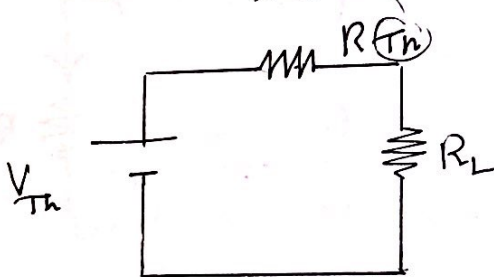
$$I_{L3} (R_3) = I_{eq3} R_{eq3} - I_{L3} R_{eq3}$$

$$I_{L3} (\underbrace{R_3 + R_{eq3}}_{\text{you have it}}) = \underbrace{I_{eq3} R_{eq3}}_{\text{you have it}}$$

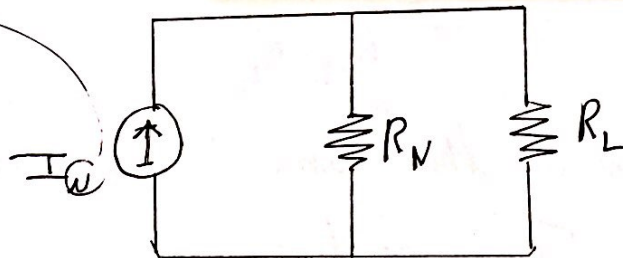
you have it

$$I_{L3} = \frac{I_{eq3} R_{eq3}}{R_3 + R_{eq3}}$$

Difference between
Theremin & Norton



$$R_{Th} = R_L$$



• in Theremin's

$$I_{L3} = \frac{E_{eq}}{R_{eq} + R_L}$$

if you dont calculate

Then I_{L3}

Alaa Itaiwi

• what we use

- 2 voltage sources
- 3 carbon Resistances
- Circuit board
- digital Multimeter

• DMM: digital Multimeter

• Procedure

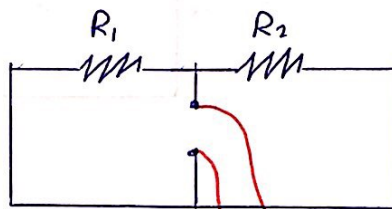
Theremin :-

There are 3 currents to measure each one we have 3 steps:- let's say we want to measure I_3

Step 1:- Calculate R_{eq} :-

• first circuit :-

- Take E_1 and E_2 off
- Put a DMM in the place of R_3

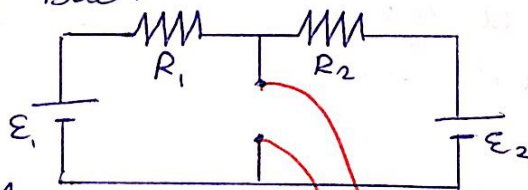


$$I_L = I_3$$

$$R_L = R_3$$

Step 2:- Calculate E_{eq} :-

- second circuit:-
- Take R_3 off and put E_1 and E_2 back

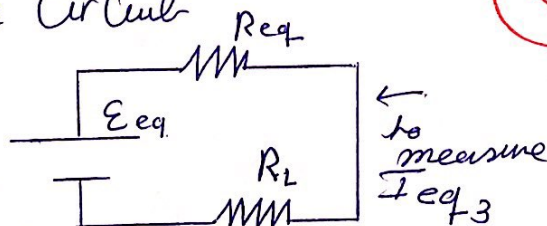


Step 3:-

- Connect the Circuit

$$R_L = R_3$$

R_{eq} = you get it from the box



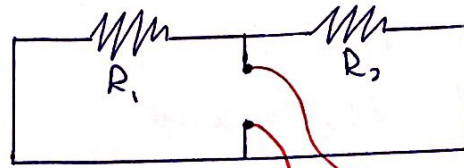
to a DMM
to measure
 E_{eq3}

E_{eq} = Power supply
Alaa Ffaini

• هذه الخطوات الثلاث هي الخطوات التي نحتاجها لقياس التيار I_3 في الدارة.
 1- ازالة R_3 وقياس R_{eq} باستخدام DMM.
 2- ازالة E_1 و E_2 وقياس E_{eq} باستخدام DMM.
 3- توصيل الدارة وقياس I_3 باستخدام DMM.

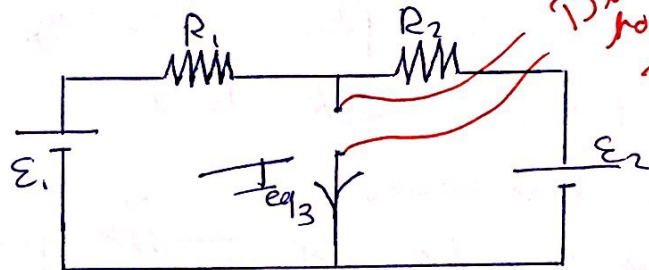
Norton :-

Step 1 :- The same as Thevenin's first step



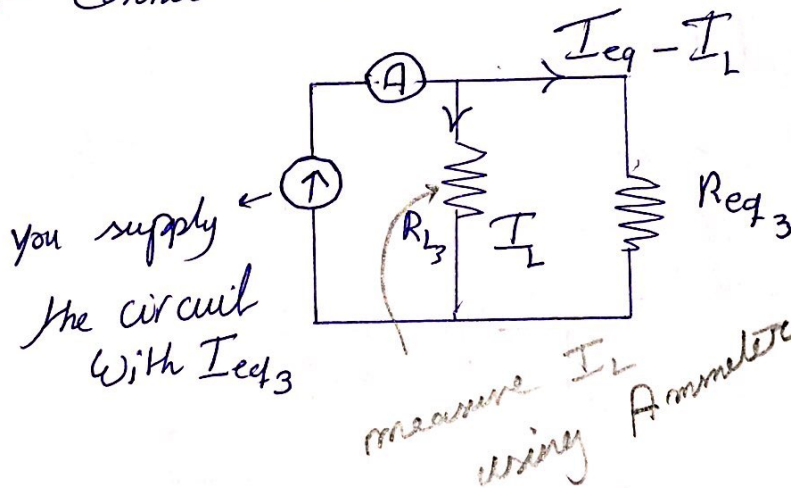
نفس الخطوة
Thevenin's

Step 2 :- measure I_{eq3} :-



I_{eq3} is.

Step 3 :- Connect this circuit



In Norton's

$$R_{eq} = R_2 + R_3$$

R_1 is the internal Resistance

Alaa Etaiwi