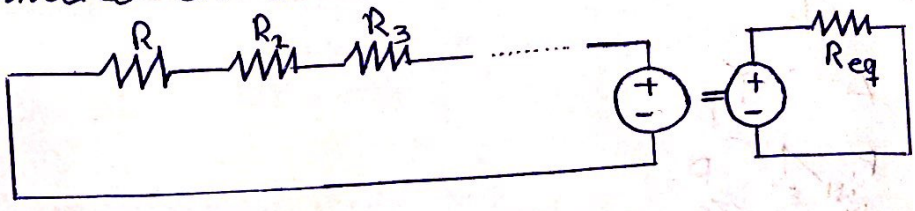
Chapter 3: Simple Resistor Circuits

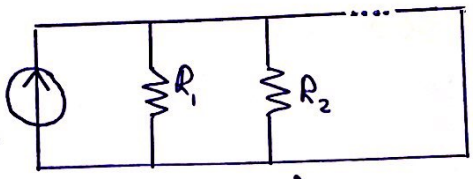
- Resistors Can be Connected on Series or on Parallel

Series Connection :



- $R_{eq} = R_1 + R_2 + \cdots + R_N$

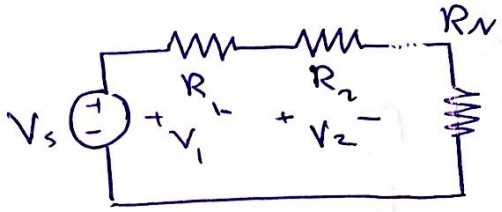
Parallel Connection :-



- $R_{eq} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots \frac{1}{R_N}$
- $R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$ (Special Case)

Divider Rule

↳ Voltage Divider Rule

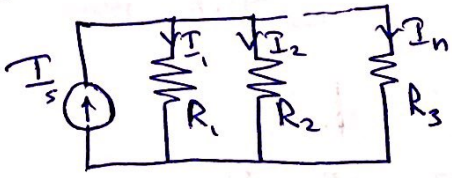


$$V_2 = \frac{V_s R_2}{R_1 + R_2 + \cdots + R_N}$$

$$V_1 = \frac{V_s R_1}{R_1 + R_2 + \cdots R_N}$$

- Used in Series only

↳ Current Divider Rule



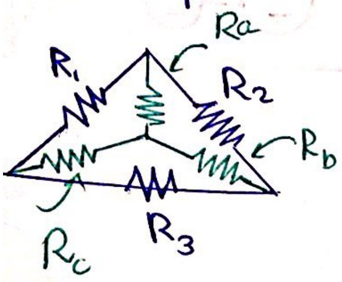
$$I_N = \frac{R_{eq}}{R_N} \cdot I_s$$

Where $R_{eq} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N}$

- Used in Parallel ::

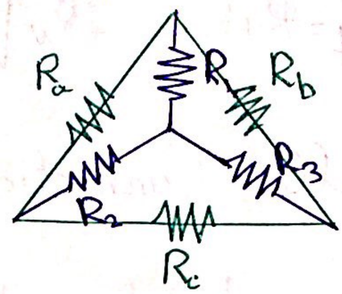
$\Delta \rightleftharpoons Y$ transformation

$\Delta \to Y$



- $R_a = \dfrac{R_1 R_2}{R_1 + R_2}$
- $R_b = \dfrac{R_2 R_3}{R_2 + R_3}$
- $R_c = \dfrac{R_1 R_3}{R_1 + R_3}$

$Y \to \Delta$



- $R_a = \dfrac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_3}$
- $R_b = \dfrac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_2}$
- $R_c = \dfrac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_1}$

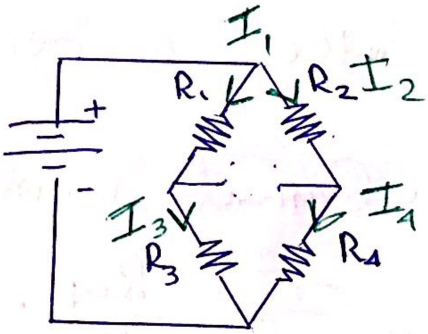
Special Case :-

If $R_1 = R_2 = R_3 = R_\Delta$

Then $R_Y = \dfrac{R_\Delta}{3}$

Steel Store Bridge

لو كانت $I_m = 0$ يصبح فرق الجهد متساوي
جهد بالتالي :



$$R_1 I_1 = R_2 I_2$$

and $R_3 I_3 = R_4 I_4$

and since (R_1 and R_3) and (R_2 and R_4) are each on series $R_4 = \dfrac{R_2 R_3}{R_1}$