$$V_1 + V_2 - V = 0 \qquad\qquad V_R - V = 0$$

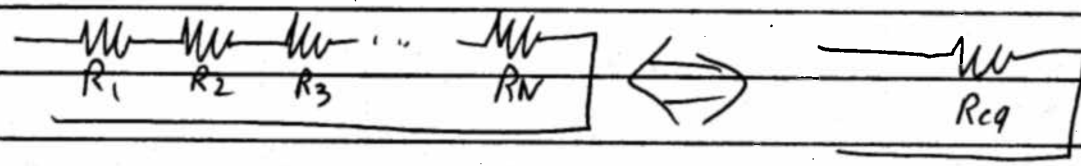
$$V = V_1 + V_2 \qquad\qquad V = V_R$$

$$V = R_1 I + R_2 I \qquad\qquad V = R_{eq} I$$

$$V = (R_1 + R_2) I \qquad\qquad V = R_{eq} I$$

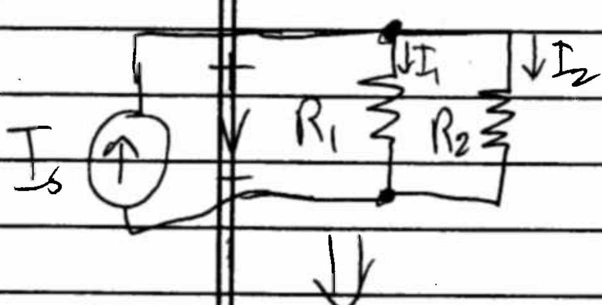
or $R_{eq} = R_1 + R_2$

True for N series resistors:



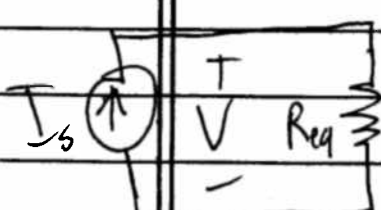
$$R_{eq} = \sum_{i=1}^{N} R_i$$

Parallel: Use Conductance $G = \frac{1}{R}$



$$I_1 = G_1 V \qquad I_2 = G_2 V$$

$$I_s = I_1 + I_2$$



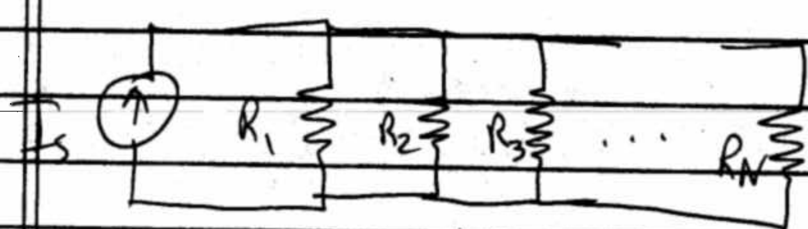
$$I_s = G_{eq} V$$

$$I = G_{eq}V = I_1 + I_2 = G_1V + G_2V$$
$$= (G_1 + G_2)V$$

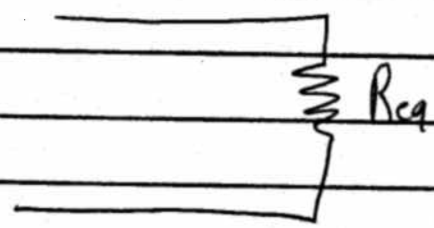
or $G_{eq} = G_1 + G_2$ or $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$

Same for N parallel:

$$R_{eq} = \frac{1}{1/R_1 + 1/R_2} = \frac{1}{\frac{R_2 + R_1}{R_1R_2}} = \frac{R_1R_2}{R_1+R_2}$$



$\Downarrow$



$$G_{eq} = \sum_{i=1}^{N} G_i$$

$$\frac{1}{R_{eq}} = \sum_{i=1}^{N} \frac{1}{R_i}$$

$$R_{eq} = \left(\sum_{i=1}^{N} R_i^{-1}\right)^{-1}$$

Results: Series: ① R_{eq} is larger than any single resistor.

② If one R is much larger than all others, it dominates.

③ $R_1 = R_2 = R$, $R_{eq} = 2R$

Parallel: ① R_{eq} is smaller than any single R.

② If one R is much smaller than all others, it dominates.

③ $R_1 = R_2 = R$, $R_{eq} = \frac{1}{2}R$