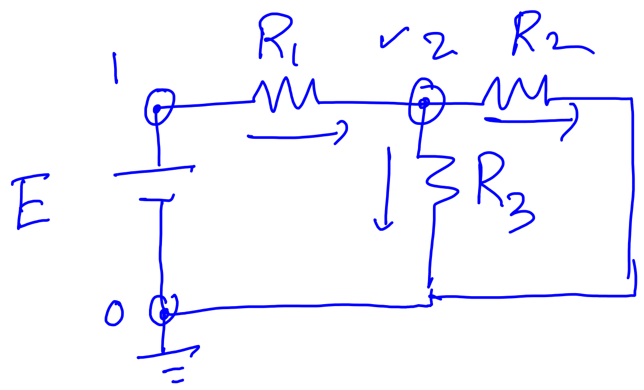
Node Variable Analysis



$b = 4$

$n = 3$

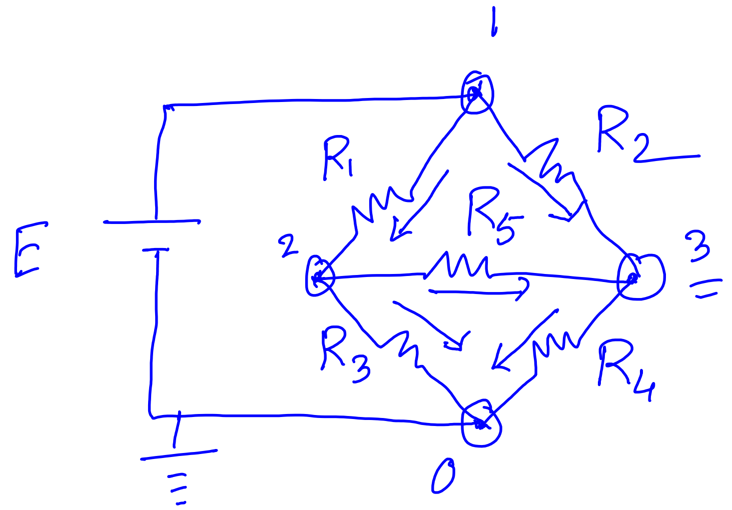
$(n-1)$

$V_1,\ V_2$

$$\frac{V_1 - V_2}{R_1} = \frac{V_2}{R_3} + \frac{V_2}{R_2}$$

$V_1 = E$

Solve for V_2



$b = 6$

$n =$

$V_1,\ V_2,\ V_3$

$V_1 = E$

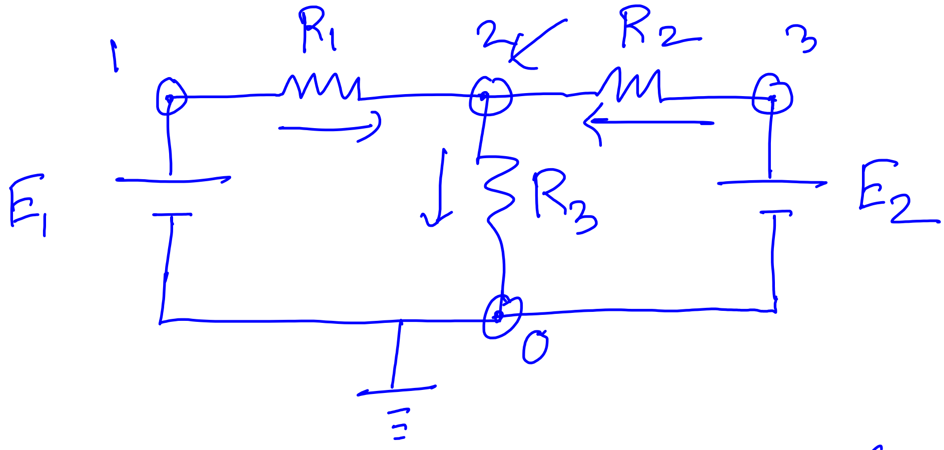
KCL at node 2,

$$\frac{V_1 - V_2}{R_1} = \frac{V_2 - V_3}{R_5} + \frac{V_2}{R_3}$$

KCL at node 3,

$$\frac{V_1 - V_3}{R_2} + \frac{V_2 - V_3}{R_5} = \frac{V_3}{R_4}$$

solve for V_2 and V_3



$n =$

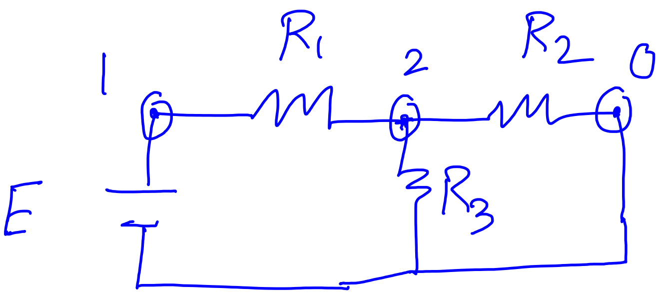
V_1, V_2, V_3

$V_1 = E_1, \quad V_3 = E_2$

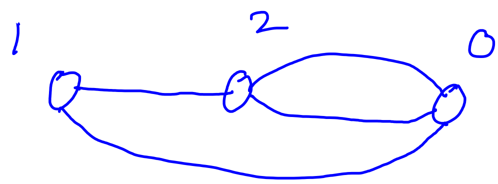
$$\frac{V_1 - V_2}{R_1} + \frac{V_3 - V_2}{R_2} = \frac{V_2}{R_3}$$

Loop Variable Analysis

Topological description of a circuit



circuit



(graph)

$G = \{V, E\}$

set of nodes (vertices)

set of Edges (links/branches)

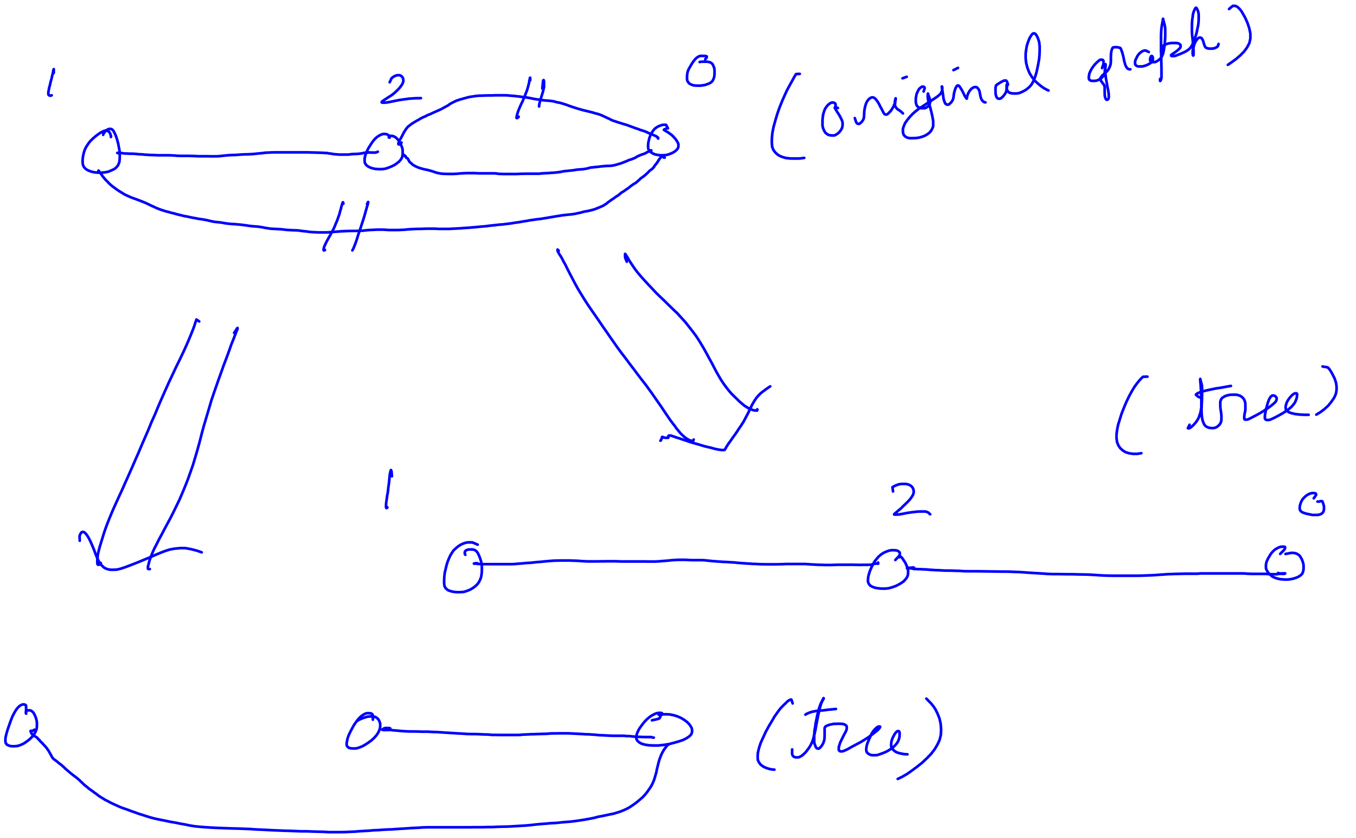
$V = \{0, 1, 2\}$

$E = \{\{1,2\}, \text{—}\}$

From a graph, if we remove few edges, we can create a sub-graph.

Tree is a special type of Graph, which has the following properties.

1> There are no closed-paths (loops)
2> It has exactly (n-1) links/edges
3> No node is kept isolated.

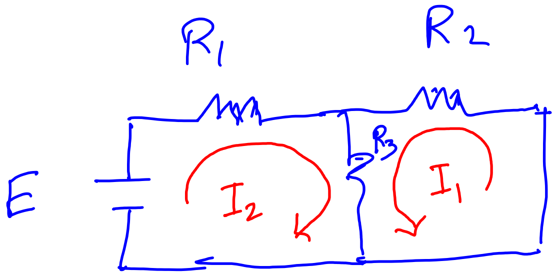


Chords = branches that you remove from the graph to construct a tree.

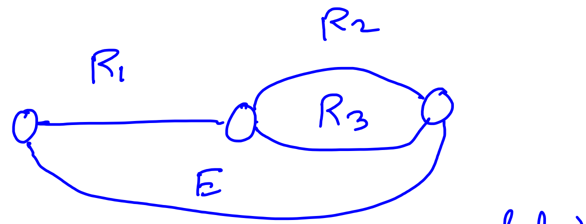
no. of chords = no. of branches in the original graph − no. of branches in the tree

$$= b - (n-1)$$

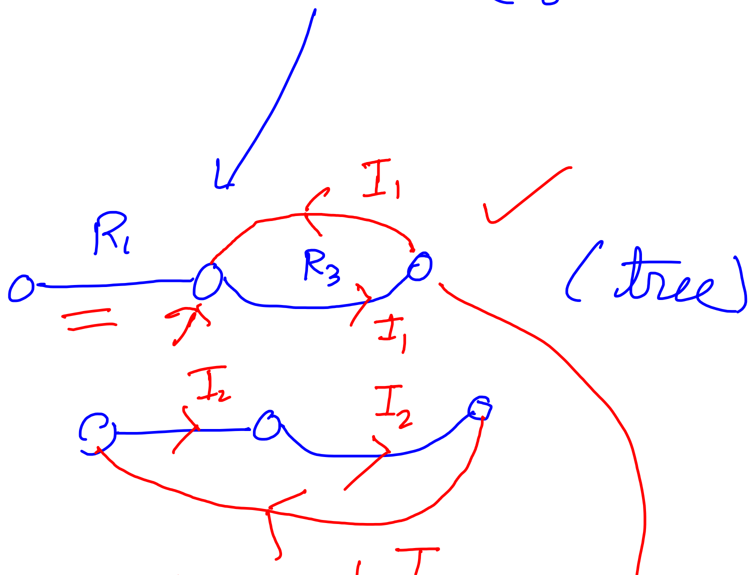
$$= b - n + 1 \quad ✓$$



(circuit)

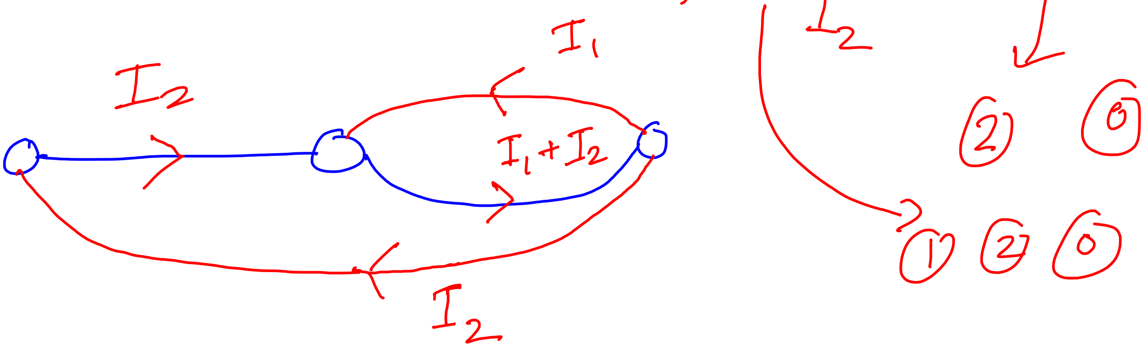


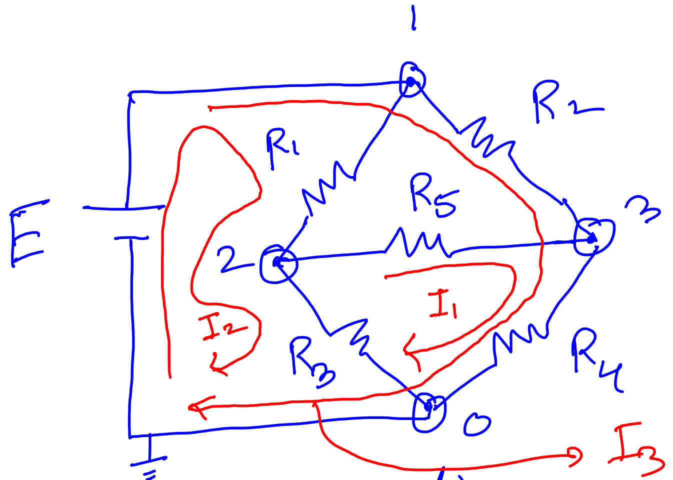
(graph)



(tree)

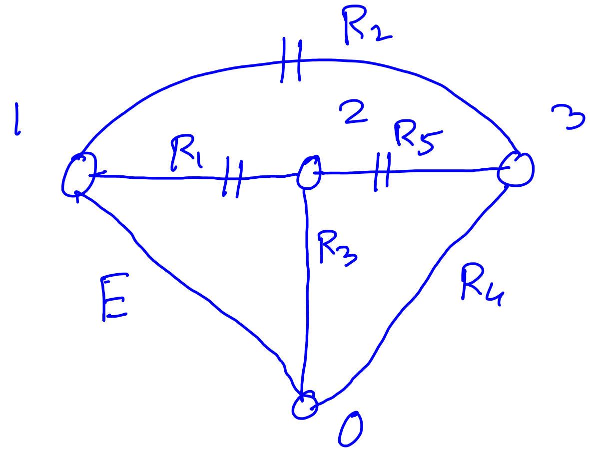
$(E, R_2) \rightarrow$ chords



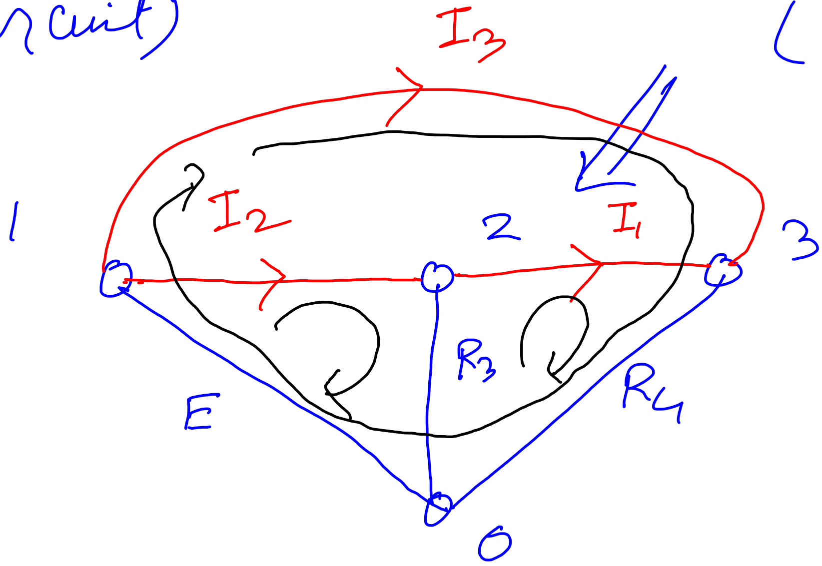


(circuit)

$\Rightarrow$



(graph)



$$I_1 R_5 + (I_1 + I_3) R_4 + (I_1 - I_2) R_3 = 0$$

$$I_2 R_1 + (I_2 - I_1) R_3 = E$$

$$I_3 R_2 + (I_1 + I_3) R_4 = E$$