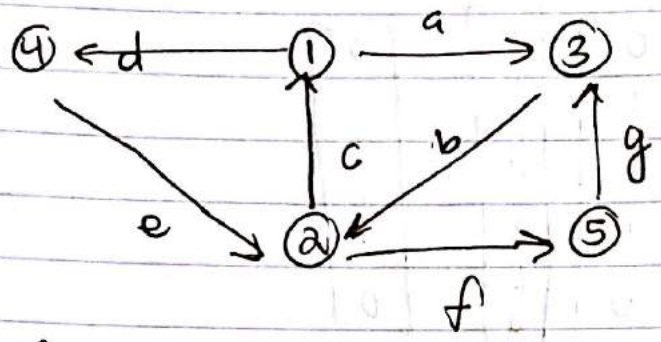
$\vec{w}_1$ $\vec{w}_2$ $\vec{w}_3$

02/16

- Packets don't accumulate at routers
  - Node-Edge Incidence matrix shows topology of graph
    - valid flow rates in nullspace of incidence matrix

$G\vec{w}_1 = \vec{0}$
$G\vec{w}_2 = \vec{0}$
$G\vec{w}_3 = \vec{0}$

- However, $\vec{w}_1$, $\vec{w}_2$, and, $\vec{w}_3$ are closed loops that go through node 2.
- These are independent loops!



loops:

$$\begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \quad \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}, \quad \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 1 \\ 1 \end{bmatrix}$$

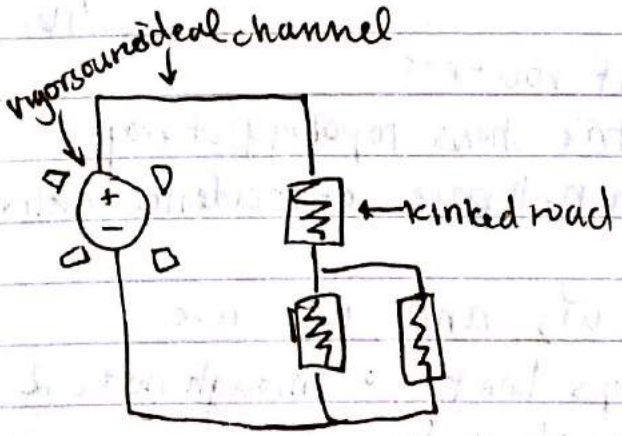
↑

adding columns of incidence matrix ⇒ sums to 0.

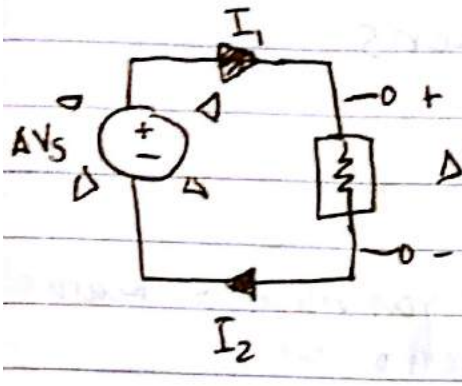
Euler's formula:

#nodes - #edges + #ind. loops = 1.

If remove c, e, g, we're left w/ a graph with no cycles ⇒ the graph is a <u>tree</u>.



$AV = I \cdot R$

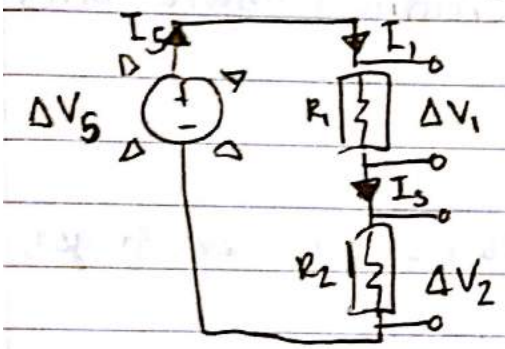


(1) $I_1 = I_2$

(2) $\Delta V_0 = \Delta V_R$

(3) $\Delta V = I \cdot R$

When you go through kinked road, nothing is lost.



Assume $I_S = N_I$ ← also eqn.

↳ 100 imps/sec.

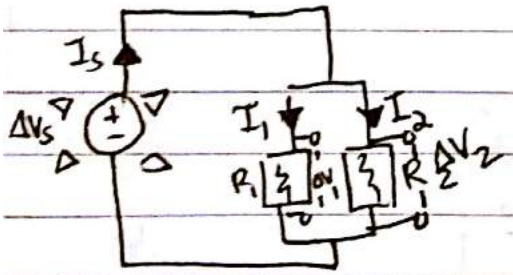
$\Delta V_S = \Delta V_1 + \Delta V_2$

$I_S = I_1$, $I_S = I_2$

$\Delta V_1 = I_1 R_1$

$\Delta V_2 = I_2 R_2$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & -1 & -1 \\ 1 & 0 & -1 & 0 & 0 & 0 \\ 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & -R_1 & 0 & 0 & 1 & 0 \\ 0 & 0 & -R_2 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} I_S \\ I_1 \\ I_2 \\ \Delta V_S \\ \Delta V_1 \\ \Delta V_2 \end{bmatrix} = \begin{bmatrix} N_I \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$



$I_S = N_I$

$I_1 + I_2 = I_S$

$\Delta V_1 = I_1 R_1$

$\Delta V_2 = I_2 R_2$

$\Delta V_1 = \Delta V_S$

$\Delta V_2 = \Delta V_S$