$$\begin{bmatrix} \quad A \quad \end{bmatrix}_{M \times N}$$

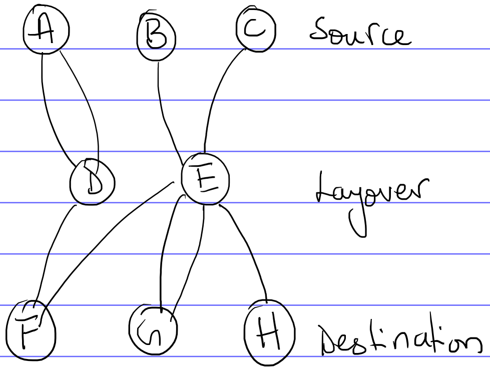
→ view matrix as a transformation (linear)

e.g. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \quad \mathbb{R}^3 \rightarrow \mathbb{R}^2$

$M \times N$

M ← output space

N ← input space



$$\begin{array}{c|cc} & D & E \\ \hline A & 2 & 0 \\ B & 0 & 1 \\ C & 0 & 1 \end{array} \quad \begin{array}{c|ccc} & F & G & H \\ \hline D & 1 & 0 & 0 \\ E & 1 & 2 & 1 \end{array}$$

$$=$$

$$\begin{array}{c|ccc} & F & G & H \\ \hline A & 2 & 0 & 0 \\ B & 1 & 2 & 1 \\ C & 1 & 2 & 1 \end{array}$$

$$\frac{d}{dx} Ax = A \qquad \frac{d}{dx} x^T A x = 2Ax$$

← assuming A is symmetric