

Symmetric Matrices

Symmetric matrix: A matrix A is symmetric if it equals its transpose:

$$A = A^T$$

A symmetric matrix must be square (why?).

The entries in a symmetric matrix are the same on both sides of the diagonal:

$$\text{i.e. } \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 0 \\ 3 & 0 & 5 \end{bmatrix}$$

Example: For any matrix A , the matrices $A^T A$ and AA^T are symmetric matrices. If A is $m \times n$, then $A^T A$ is $n \times n$ and AA^T is $m \times m$

Proof: $(A^T A)^T = A^T A^{TT} = A^T A$ and $(AA^T)^T = A^{TT} A^T = AA^T$.