

Symmetric Positive Definite (SPD) Matrix

- An SPD matrix acts sort of like a positive number.
- A is *symmetric* if $a_{ij} = a_{ji}$, for all i and j .
- Several equivalent conditions for A to be *positive definite*:
 - All eigenvalues are > 0
 - LU factorization without pivoting succeeds, and all pivots are > 0
 - For every nonzero vector x , the number $x^T A x > 0$
- SPD matrices come up a lot in scientific computing & data analysis!
- The temperature matrix is SPD.

Orthogonal Matrix

- Matrix Q is *orthogonal* if the matrix $Q^T Q = I$ is the identity.
- An n -by- n orthogonal matrix represents a rotation or reflection of vectors in n -space.
- It acts sort of like a number whose absolute value is 1.
- Examples: I (identity matrix), any permutation matrix P .
- The inverse of Q is the transpose of Q .
- The columns of Q are mutually perpendicular (orthogonal).
- Every column of Q has length equal to 1.
- The same holds for the rows of Q .