This note is a summary note for UCSD CSE 190: Discrete and Continuous Optimization - Course Link Here

Gaussian Elimination

LU Factorization

Cholesky Factorization

QR Factorization

QR Factorization is a factorization to decompose matrix A into an orthonormal matrix Q and an upper-triangular matrix R

$$A = QR$$

where A is a $m \times n$ matrix, Q is a $m \times m$ matrix, and R is a $m \times n$ matrix. $(m \geq n)$

Orthonormal Matrix

Q is an orthonormal matrix if the matrix follows two properties:

- $Q^T Q = I_n$ (column vectors of Q are unit vector)
- Orthonormal **does not** necessarily imply $QQ = I_n$ (for this to be **true**, we need Q to be **symmetric**, which is not a property of orthonormal matrix)
- Q performs **rigid transformation** to the matrix R
- $Q = [\vec{q_1}, \vec{q_2}, \cdots, \vec{q_n}]$ where $\vec{q_i}$ is orthogonal to $\vec{q_j}$ if $i \neq j$. This also means that $\vec{q_i}^T \vec{q_j} = 0$

Gram-Schmit Algorithm

Householder Algorithm