# CS6LXXXX – Linear Algebra, Analytic Geometry, and Matrix Decompositions

## Matrices and Linear Systems – Definitions, Properties, Rules & Constructs (Chapter 2)

- Matrix – Definition
- Matrix – Arithmetic Properties
  - Addition, Multiplication, Multiply by a scalar
- Matrix – Algebraic Properties
  - Commutative: Addition is Commutative, Multiplication is not Commutative
  - Associative: Both Addition and Multiplication is Associative
  - Distributive: Multiplication is Distributive over Addition (both left and right). Addition not Distributive over Multiplication
  - Transpose Matrix and Add/Multiply Property
    - $(A+B)^T = A^T + B^T = B^T + A^T$
    - $(AB)^T = B^T A^T$ and $(AB)^T \neq A^T B^T$
  - Square Matrix and its Properties
  - Identity Matrix and its Properties
  - Matrix Inversion and Add/Multiply Property
    - $(A+B)^{-1} \neq A^{-1} + B^{-1} \neq B^{-1} + A^{-1}$
    - $(AB)^{-1} = B^{-1}A^{-1}$ and $(AB)^{-1} \neq A^{-1}B^{-1}$

- Matrix – Algebraic Properties (continues)
  - Regular/Invertible/Non-singular Matrix
  - ~~Determinant, Trace, and Minor~~
  - Symmetric Matrix
  - Row-Echelon form of a matrix and pivots
  - Reduced Row-Echelon form of a matrix
  - Gaussian Elimination of a Matrix
  - Lower (L) and Upper (U) Triangular Matrices
  - LU factorization of a Matrix
- Linear System – Definition, Representation, Solution Set, and Elementary Transformation and its effect on Solution Set (exchange of rows, addition of rows, scalar multiplication of a row, any combination)
- Group and Vector Space
  - Definition, Properties, Abelian (Commutative) Group, General Linear Group
  - Linear Combination and Linearly Independent
  - Generating Set, Span & Minimal Generating Set
  - Basis and Rank