1 9/5 Matrices, vectors, and their applications

Linear Algebra: the study of matrices, vectors and their operations.

- *Matrix*: A rectangular grid of numbers. A $m \times n$ matrix is a matrix with m *rows* and n *colomns*. If A is a matrix, the (i, j)-entry of A, denoted as $a_{i,j}$, is the number on the i-th row and j-th column. Applications: data tables, greyscale pictures
- *Vector*: A matrix with one row or column (usually one column). *Standard vectors*. Applications: points in Euclidean space, velocity
- Zero matrix and identity matrix. Transpose of a matrix
- Submatrix, row, column (which are also vectors)
- Addition and scalar multiplication.
- Rules: commutative, associative for both, distributive rule, zero. negation (follows from the previous rules), both commutes with transposes
- Example 1: Parallelogram law for velocity/force)
- Linear combination. Relation with system of linear equations.
- Matrix-vector multiplication: definition and computation
- Rules: usual ones, multiply with standard vector, 0, identity, and that matrices are determined by their multiplication with all the vectors.
- Example 2: moving averages
- Example 3: Rotation matrix in 2 dimension, translation, affine transformation
- Example 4: Population migration, stochastic matrices
- Example 5: Random walks on graphs
- Example 6: Fibonacci sequence