

# LINEAR ALGEBRA & ITS APPLICATIONS

## Ch.0 Preliminaries

1. Set, relations, functions & sequences
2. Inductive definitions & proofs by induction
3. Finite sums & products and infinite sets

## Ch.1 Vectors & Systems of Linear Equations (20 pages)

1. Column vectors and row vectors over  $\mathbb{R}$
2. Visualizing linear equations in 2 & 3 dimensions.
3. Gaussian & Gauss-Jordan Elimination
4. The coefficient matrix & augmented matrix

## Ch.2 Matrix Algebra & Special matrices (13 pages)

1. Matrix multiplication & invertible matrices
2. Elementary matrices & the computation of  $A^{-1}$
- \* 3. Special kinds of matrices

## Ch.3 The Trace & the Determinant (14 pages)

1. Definition of the trace and determinant
2. Basic properties of the determinant
3. Determinants of products & related results

## Ch.4 Vector Spaces, subspaces, & their bases (24 pages)

1. Abstract vector spaces & subspaces
2. Linear combinations & linear independence
3. Bases & dimensions of vector spaces
4. The four fundamental subspaces of a matrix
5. Row rank, column rank, nullity & co-nullities.
6. Finding bases for the four fundamental subspaces.

## Ch.5 Linear Maps & their Matrix Representations (15 pages)

1. Linear maps & their transposes
2. Matrix Representations of Linear Maps
3. Change of basis matrices & Similar matrices

## Ch.6 Inner product spaces & orthogonality (19 pages)

1. Applications of the dot product
2. Orthogonal subspaces
3. Least squares problems
4. The Gram-Schmidt orthonormalization

## Ch.7 Simplification of the representations of linear maps (12 pages)

1. Eigen values & their corresponding eigenvectors
2. Properties of eigenvalues & eigenvectors
3. Diagonalization & matrix exponentiation