Outline

(Draft)

Week 1. Vectors in Linear Algebra

1.1. Opening Remarks
1.2. What is a Vector?
1.3. Simple Vector Operations
1.4. Advanced Vector Operations
1.5. LAFF Package Development: Vectors
1.6. Slicing and Dicing
1.7. Enrichment
1.8. Wrapping Up

Week 2. Linear Transformations and Matrices

2.1. Opening Remarks
2.2. Linear Transformations
2.3. Mathematical Induction
2.4. Representing Linear Transformations as Matrices
2.5. Enrichment
2.6. Wrapping Up

Week 3. Matrix-Vector Operations

3.1. Opening Remarks
3.2. Special Matrices
3.3. Operations with Matrices
3.4. Matrix-Vector Multiplication Algorithms
3.5. Enrichment
3.6. Wrapping Up

Week 4. From Matrix-Vector Multiplication to Matrix-Matrix Multiplication

4.1. Opening Remarks
4.2. Preparation
4.3. Matrix-Vector Multiplication with Special Matrices
4.4. Matrix-Matrix Multiplication (Product)
4.5. Enrichment
4.6. Wrapping Up

Week 5. Matrix-Matrix Multiplication

5.1. Opening Remarks
5.2. Observations
5.3. Algorithms for Computing Matrix-Matrix Multiplication
5.4. Enrichment
5.5. Wrapping Up

Week 6. Gaussian Elimination
6.1. Opening Remarks
6.2. Gaussian Elimination
6.3. Solving Ax = b via LU Factorization
6.4. Enrichment
6.5. Wrapping Up

Week 7. More Gaussian Elimination and Matrix Inversion
7.1. Opening Remarks
7.2. When Gaussian Elimination Breaks Down
7.3. The Inverse Matrix
7.4. Enrichment
7.5. Wrapping Up

Week 8. More on Matrix Inversion
8.1. Opening Remarks
8.2. Gauss-Jordan Elimination
8.3. (Almost) Never, Ever Invert a Matrix
8.4. Enrichment
8.5. Wrapping Up

Week 9. Vector Spaces
9.1. Opening Remarks
9.2. When Systems Don't Have a Unique Solution
9.3. Review of Sets
9.4. Vector Spaces
9.5. Span, Linear Independence, and Bases
9.6. Wrapping Up

Week 10. Vector Spaces, Orthogonality, and Linear Least Squares
10.1. Opening Remarks
10.2. How the Row Echelon Form Answers (Almost) Everything
10.3. Orthogonal Vectors and Spaces
10.4. Approximating a Solution
10.5. Motivating Example, Part II
10.6. Computing an Orthonormal Basis
10.7. Motivating Example, Part III
10.8. What does this all mean?
10.9. Wrapping Up

Week 11. Orthogonal Projection and Low Rank Approximation
11.1. Opening Remarks
11.2. Projecting a Vector onto a Subspace
11.3. Orthonormal Bases
11.4. Change of Basis
11.5. Wrapping Up

Week 12. Eigenvalues and Eigenvectors
12.1. Opening Remarks
12.2. Preliminaries
12.3. Two by Two Matrices
12.4. Three by Three Matrices
12.5. Arbitrary Size Matrices
12.6. Symmetric Matrices
12.7. Practical Algorithms
12.8. Wrapping Up