Linear Algebra - Syllabus Outline

Rakvi

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We will be using "Algebra, Topology, Differential Calculus, and Optimization Theory for Computer Science and Machine Learning" by Jean Gallier and Jocelyn Quaintance as a textbook. Our aim is to cover chapters 1-9 not including chapter 5.

1 Lecture 1

We will start with a brief discussion about linear algebra and a quick overview of its wide ranging applications. We will then move on to discuss about groups, rings and fields based on chapter 2 of the book.

2 Lecture 2 + Lecture 3

We will discuss vector spaces, the notion of linear independence, bases and linear maps. Based on chapter 3.

3 Lecture 4

Continuing with the discussion of linear maps, we will see the correspondence between linear maps and matrices. We will learn writing matrix associated to a linear map with respect to an explicit basis and how does change of basis affects this. Based on chapter 4.

4 Lecture 5+6

Over the course of these two lectures, we will discuss chapter 6 of the textbook which includes topics such as direct sums, direct products, block matrices and rank-nullity theorem.

5 Lecture 7+8

We will dive into discussion of determinants. We will provide a definition of determinants (not just the usual formula) via alternating maps and discuss some of its applications towards solving system of linear equations. Based on chapter 7.

6 Lecture 9+10

We will be discussing chapter 8 in these two lectures which includes topics such as Gaussian Elimination, LU decomposition, Cholesky decomposition and Echelon Form of a matrix. We will see some applications of these in solving system of equations and interpolating functions.

7 Lecture 11+12

In the last couple of lectures we will talk about norms on vector spaces, matrices, condition number of matrices. We will see an application of these in inconsistent linear systems. We will finish the course by matrix exponential, based on chapter 9 of the book.