Math 2121 Linear Algebra

Course Outline – 2023-2024 Spring

Course Instructor: Prof. M Yan

4 credits
Prerequisite

A passing grade in AL Pure Mathematics / AL Applied Mathematics; OR MATH 1014 OR MATH 1018 OR MATH 1020 OR MATH 1024

Exclusion

MATH 2111, MATH 2131, MATH 2350

Course Description

Linear structure is the most basic structure in mathematics. The course covers the most basic parts:

1. Three equivalent fundamental concepts:
    a. System of linear equations: row (and column) operations, existence and uniqueness, rank.
    b. Euclidean vector: linear combination, linear independence, subspace, basis, coordinate, dimension.
    c. Linear transformation: matrix of linear transformation, operations of matrix and linear transformation, onto, one-to-one, inverse.
2. Vector space: general vector space, isomorphism, basis, coordinate, matrix of linear transformation, change of basis, direct sum.
3. Topics in linear algebra:
    a. Orthogonality: orthogonal projection, orthogonalisation, orthogonal matrix, QR-decomposition, least square method, inner product, positive definite matrix, adjoint.
    b. Determinant: geometric approach, algebraic approach.
    c. Diagonalisation: eigenspace, diagonalisability, complex eigenvalue, orthogonal diagonalisation of symmetric matrix, singular value decomposition.

Intended Learning Outcome

1. Master the foundational linear algebra calculation of row/column operations, and conceptually interpret the result of the calculation.
2. Master the special linear algebra calculations such as orthogonalisation, least square method, determinant, diagonalisation.
3. Understand the core concepts of linear algebra. Apply the concepts to many practical problems, and solve these problems..
4. Practise on logical reasoning and critical thinking, through more conceptual mathematics.

Teaching Arrangement

Lecture Note: Linear Algebra, by Prof Min Yan.

We adopt the flip classroom method. This means I record the lecture videos before the lecture time. You get prepared by watching the lecture video, before coming to the lecture. In the face-to-face lecture, I ask students to do the exercises from the lecture note, and make comments on their works. Your performance in doing exercises during the lecture will be counted towards the final score.

Homework

Please check the assignment section of canvas for homework. Homework is usually assigned on Friday and the deadline is the following Friday. The answer will be posted by the deadline. After the answer is posted, the homework is not accepted.

Grade

There will be one midterm and one final exam. The final grade consists of 10% homework, 20% performance during lectures, 30% midterm, and 40% final exam.