Math 257: Linear Algebra with Computational Applications (3 credits)

Course Description

Introductory course incorporating linear algebra concepts with computational tools, with real world applications to science, engineering and data science. Topics include linear equations, matrix operations, vector spaces, linear transformations, eigenvalues, eigenvectors, inner products and norms, orthogonality, linear regression, equilibrium, linear dynamical systems and the singular value decomposition. Credit is not given for both MATH 257 and any of MATH 125, MATH 225, MATH 227, MATH 415 or ASRM 406.

MATH 220 or MATH 221; CS 101 or equivalent programming experience.

Course Content

This is a first course in linear algebra. This covers basic definitions and algorithms of the subject needed in the higher level (engineering, science and economics) courses and more sophisticated mathematical techniques such as the Singular Value Decomposition.

In this course, you learn the mathematical theory and how to implement it in Python. You will discover many of the striking modern applications of linear algebra, such as Google's PageRank algorithm, image and audio compression schemes such as JPEG and MP3, automatic face recognition and other data science and machine learning algorithms.

The course covers similar mathematical theory as MATH 415 but adds a focus on the computational and large data aspect of linear algebra through the lab sessions.

Lectures, Labs, Discussions

This course uses the Moodle online system and PrairieLearn. You will need a stable internet access, sufficient bandwidth and data allowance for using a webcam and microphone on Zoom.

- Lectures: Asynchronous online (four hours a week)
- Labs: Synchronous online on Zoom (two hours a week)
  - Tuesday/Thursday: 10am CDT
- Discussion Sections: Synchronous online on Zoom (two hours a week)
  - Monday/Wednesday: 10am CDT

Exams

This course has three 90-minute midterm tests and a 3-hour final exam. It uses the College of Engineering Computer-Based Testing Facility (CBTF) for its exams: https://cbtf.engr.illinois.edu.The policies of the CBTF are the policies of this course, and academic integrity infractions related to the CBTF are infractions in this course.

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Other Information

- This course is adapted from the UIUC Spring 2021 course taught by Professor Philipp Hieronymi.

- Extensive lecture notes for all lectures and practice problems online. For many students, these notes are enough. If you still want to buy/download a book, here are three options:

    - Philip N. Klein, Coding the Matrix: Linear Algebra through Applications to Computer Science, first edition, Newtonian Press
    - David Cherney, Tom Denton,Rohit Thomas, Andrew Waldron, Linear Algebra, https://www.math.ucdavis.edu/~linear/
    - Gilbert Strang, Linear Algebra and its Applications, fourth edition, Cengage. You are not required to buy any of these textbooks.