YSC2232 Linear Algebra

NOTE: This draft syllabus may be subject to change.

Instructor: Tim Wertz
Office Location: RC1-01-05E
Office Hours: TBA
Email Address: tim.wertz@yale-nus.edu.sg

Course Description: Linear Algebra is one of the most fundamental fields in mathematics. Its concepts, tools, and techniques appear in a wide variety of fields in pure and applied mathematics, as well as in the physical and social sciences.

The main topics of this course are vector spaces and linear maps between vector spaces. Students will learn the basic theory of vector spaces, including bases, dimension, norms, and inner products. Students will study the theory of linear maps between vector spaces, culminating in the spectral theorems for real and complex operators and the singular value decomposition. Students will also study a broad range of applications of the preceding theoretical concepts.

Prior experience with matrix algebra and proof writing are not strictly required, but students without this exposure should expect to put in extra time familiarising themselves with the basics.

Learning Objectives and Course Goals: By the end of the course, students should be able to

- Recall key definitions, theorems, and examples from the previously listed topics.
- Perform matrix computations by hand.
- Implement important matrix operations and algorithms as functions using the R programming language.
- Determine whether specific examples meet the requirements of those definitions and theorems.
- Identify the relevant definitions, theorems, and examples given a specific problem.
- Apply definitions and theorems to concrete, real-world applications and examples.
- Construct examples and counterexamples related to those definitions and theorems.
- Use the techniques of mathematical proof to write formal solutions to exercises and proofs of theorems.

Pre-requisites: any other MCS course.

Required Textbooks: The primary text will be notes written by the instructor. Students should also have access to the following reference texts: *Linear Algebra Done Right,* 3rd edition, by Sheldon Axler, *Introduction to Applied Linear Algebra* by Boyd and vandenBerghe, *Linear Algebra and Learning from Data* by Gilbert Strang, and *Applied Linear Algebra*, 2nd edition, by Peter J Olver and Chehrzad Shakiban (e-books available for free via the library).

Course Assessment Breakdown:

Homework – 50% (Problem Sets, Coding Assignments, Writing Assignments)
Final Exam – 50%

Description of Assignments:
Homework assignments will come in three varieties: coding (20% of grade), writing (5% of grade), and problem sets (25% of grade).

For the coding assignments, students will be required to implement various operations, examples, and algorithms as functions in R. There will be approximately 5-6 coding assignments in total.

For the problem sets, students will submit written solutions, which must be typeset using LaTeX, to exercises given by the instructor. There will be approximately 10 problem sets in total. Problem sets will contain a mix of computational and proof-based exercises.

For the writing assignments, students will be asked to reflect on certain topics from lectures, readings, or implementation of algorithms.

The final exam will take place at the time scheduled by Registry. Students may access written or printed notes and hard copies of textbooks during the exam, but access to a computer or the internet is prohibited.

Specific information about the timing and due dates of assignments, as well as rubrics for those assignments, will be posted to the Canvas course page by the beginning of the semester.

Late Assignment Policy: Your assignment will be considered late if it misses the deadline without a VR note or Medical Certificate from a Doctor. There will be no make-up assignments, and extensions will only be given in the case of a VR note or MC. Late assignments will receive a score of 0, so it is always better to submit whatever you have finished.

Canvas Page Usage Policy: Submission of homework assignments will be done via Canvas. Topics for class meetings and suggested readings will be posted to Canvas ahead of time, so students should check the course page regularly.

Attendance: In general, attendance at class meetings will not be tracked.

Academic Integrity Policy
Yale-NUS College expects its students to abide by the highest standards of academic integrity as a matter of personal honesty and communal responsibility. Acting with academic integrity requires that (a) students do their own work, (b) students not interfere with the work of others, (c) students accurately and honestly represent the content of their work, and (d) students properly attribute others' work. Violations of the College's academic integrity standards undermine both the community and the individual growth of students. Accordingly, they will be addressed with the utmost seriousness and sanctions ranging from grade penalties to expulsion. Examples of violations of academic integrity include plagiarism, copying or sharing homework answers, submitting work completed for one course as 'new' work for another course, or fabricating or falsifying research data. For more information please visit the Student Services website, Policies and Procedures section: https://studentlife.yale-nus.edu.sg/policies/academic-integrity/

The Yale-NUS Library provides resources on citations and plagiarism here: http://library.yale-nus.edu.sg/plagiarism/

Nondiscriminatory Language and Conduct:
This course encourages non-discriminatory language and conduct. Students should not use racist, sexist or other discriminatory language in class discussions or written work.

Health and Wellness Contacts
If you are experiencing undo stress or feel you might benefit from private counseling, please contact the Yale-NUS Health and Wellness Centre. The wellness centre also offers a wide range of enriching workshops and events. You may also wish to reach out to Vice Rector within your residential College. For this and other kinds of support.
https://studentlife.yale-nus.edu.sg/wellness/