Math 307, Section 201
Applied Linear Algebra

Lectures: MWF 12:00-1:00pm in SWNG-122
Instructor: Yaniv Plan
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Text: There is no required textbook for this course. Instead there is a set of typed notes designed for this course, available on the course website. You will also find the hand-written notes from the class lectures.

If you would like to consult a book you may find these useful:

Linear Algebra and its Applications by Gilbert Strang.
Elementary Linear Algebra with Applications by Howard A. Anton and Chris Rorres.

Webpage: Available through Canvas.

Course Outline: This course is organized around a collection of interesting applications. Examples include:

- Interpolation
- Finite difference approximations
- Formula matrix of a chemical system
- Least Squares
- Fourier series
- Graphs and Networks
- FFT
- JPEG compression
- Power method
- Recursion relations
- The Anderson tight binding model
- Markov chains
- Google PageRank
- Principal co-ordinate analysis

We will study a selection of these in this class. Each application will be preceded by discussion of the relevant concepts from Linear Algebra. These will be partly review from your previous linear algebra course and partly new material. You will also learn how to do Linear Algebra on a computer using MATLAB or Octave.

Timetable (rough):

Chapter 1: Linear Equations *Topics:* Solving linear equations, vector and matrix norms, condition number, singular value decomposition. *Applications:* Lagrange interpolation, splines, finite difference approximation	8 hours
Chapter 2: Subspaces, Basis and Dimension *Topics:* Vector spaces, subspaces, basis, dimension, basis for N(A), R(A), N(A^T) and R(A^T) *Applications:* Chemical systems, Graphs and resistor networks	8 hours
Chapter 3: Orthogonality *Topics:* Orthonormal bases and orthogonal matrices, Complex vector spaces *Applications:* Least squares, Fourier bases	6 hours
Chapter 4: Eigenvalues and Eigenvectors *Topics:* Eigenvalues and eigenvectors *Applications:* Effective resistance, Power method, Markov chains, Anderson tight binding model, Google PageRank, Principal co-ordinate analysis (if time permits)	12 hours

Grading Scheme: Your grade will be determined by the Written Homework, Web Homework, Midterm, and Final Exam, as follows.

H = score on Written Homework. Lowest Homework will be dropped.
WebH = score on Web Homework.
M = score on Midterm.
E = score on Final Exam.

Final Grade = 0.1 * H + 0.1 * Webhw + (0.4 -0.1 WebH) * M + 0.5* E

Scaling: The instructor reserves the right to revise or round off grades if the circumstances warrant. Scaling of the raw grade may be required.

Midterms & Final Exam: There will be a final cumulative exam that will be held in April. Students are advised not to make travel plans during the exam time. There will be one 50-minute written midterm held in class. The midterm date is

- **Wednesday, February 27**

If a student misses a midterm, that student shall provide a formal documented excuse such as a doctor's note within 72 hours or a mark of zero (0) will be entered for that midterm. If you are to miss a midterm due to religious observance, two weeks written notice is required by the student. See the UBC full policy on this for more information. There will be NO make-up midterms. Any tests missed with legitimate reasons will have their final exam re-weighted.

Assignments: There will be weekly written homework assignments and web homework assignments with dates TBD posted in the Course Calendar. The written homeworks are due at the beginning of class each Friday. Late homework will not be accepted. The lowest written homework score will be dropped.

Extra help:

- Math learning centre offers tutoring https://www.math.ubc.ca/~MLC/, including tutors specialized in applied linear algebra, see the MLC calendar.
- The AMS offers tutoring services http://tutoring.ams.ubc.ca/.

Cheating: It is the student's obligation to inform himself or herself of the applicable standards for academic honesty. Students must be aware that standards at the University of British Columbia may be different from those in secondary schools or at other institutions. If a student is in any doubt as to the standard of academic honesty in a particular course or assignment, then the student must consult with the instructor as soon as possible, and in no case should a student submit an assignment if the student is not clear on the relevant standard of academic honesty.