MATRIX ALGEBRA, MATH 221

1. General Information

- Course: Math 221 (Matrix Algebra), Summer Term 1, 2016.
- Instructor: Rachel Ollivier ollivier@math.ubc.ca
- Course website: includes syllabus and additional information
  http://www.math.ubc.ca/~ollivier/Math221.html
- Text: **Linear Algebra and its Applications** by David C. Lay
  (revised custom edition for the UBC)

Homework: Online homework for the course will be provided via the WeBWorK system. You can find this system by going to the WeBWork site at

https://webwork.elearning.ubc.ca/webwork2/

and logging in with your CWL ID. Note however that the course website may not be active before the first day of classes.

There will be one assignment posted per week, each due on the following week, as per the course schedule. Questions about the HW or the online system may be addressed to either your instructor or to the course TA.

Please note the following items:

(1) You may attempt each question as often as you like until you solve the problem. There is no penalty for a wrong answer. This is to help you correct your own mistakes, and to get instant feedback on your attempts.
(2) The questions are generated randomly, and the numbers are different for each student.
(3) Please try to do the problems by yourself, and without the use of other calulators or software. Since calculators and software are not allowed in the exams, you should practice working without them.
(4) If you really get stuck, you can request help by clicking the email instructor button. However, it may take some time to get a response, so please dont wait till the last minute.
(5) In general, it is a good idea to start the assignments early rather than waiting till the last minute. The deadlines are enforced by the system, and it will shut down automatically when time is up, so give yourself plenty of extra time in case of problems.
(6) Since the deadlines are enforced by the system, there is no extension for the homework.

Note that the textbook also has many practice problems with answers in the back. It is recommended that you try all these problems, so that you may track your understanding.

Tests: There will be two midterm exams (in class) and a final exam. The tests will be closed book-closed notes tests. Calculators will not be allowed.

Grades: Grades will be computed as the maximum of the following:
- Homework 10%, Midterms 20%+20%, Final exam 50% or
- Homework 10%, Best midterm score 20%, Final exam 70%.

The grades of those students who miss a midterm will be computed by the second method.

Synopsis: The course will cover more or less the whole book (with some minor exceptions).

Linear algebra is a fundamental and extremely important topic in mathematics. In fact, many other areas attempt to reduce more complicated questions to problems in linear algebra. For example, calculus tries to reduce questions about curves and surfaces (or higher dimensional shapes) to ones about their tangent lines or tangent planes. These lines and planes are concepts in linear algebra. Perhaps another way of saying this is that the derivative, the key concept in calculus, is a linear map.

This course is a study of linear maps. We will learn what they are, how to manipulate them as well as tools (determinants, eigenvectors/eigenvalues, diagonalization) to better visualize them. Along the way we will also touch on various applications.

2. Schedule

Here is a rough course schedule, subject to later adjustments.

- Week 1.
  1.1 Systems of linear equations,
  1.2 Row reduction and echelon forms
  1.3 Vector equations,
  1.4 The matrix equation $Ax = b$
- Week 2.
  1.5 Solution sets of linear equations,
  1.6 Applications of linear systems
  1.7 Linear independence,
  1.8 Introduction to linear transformations,
  1.9 The matrix of a linear transformation
- Week 3. **Midterm on the Wednesday**
  2.1 Matrix operations,
  2.2 The inverse of a matrix ,
  2.3 Characterizations of invertible matrices
- Week 4.
  2.5 Subspaces of $\mathbb{R}^n$,
  2.6 Dimension and rank,
  3.1 Introduction to determinants
- Week 5. **Midterm on the Wednesday**
  3.2 Properties of determinants,
  4.1 Eigenvalues and eigenvectors,
  4.2 The characteristic equation
  4.3 Diagonalization,
  4.6 Discrete dynamical systems
  5.1 Inner product, length, and orthogonality
- Week 6.
  5.2 Orthogonal sets,
  5.3 Orthogonal projections
  5.5 Least-squares problem,
  5.6 Applications to linear models