Department of Mathematics, University of Toronto
MAT223H1F - Linear Algebra I
Fall 2014

Brief Course Description
Welcome to MAT223H1F Linear Algebra I. This sheet answers the most common questions about the course. Please take a few minutes to read this course information handout carefully and keep a copy for your records.

This is the first undergraduate course in linear algebra taken by students from a variety of disciplines. The course covers: systems of linear equations, matrix algebra, vector geometry, vector spaces, orthogonality, rank, introduction to linear transformations, determinants, eigenvalues and eigenvectors, diagonalization (see pages 5 & 6 for the full list of topics covered and schedule).

Throughout the course, you will have an opportunity to develop your problem solving, reasoning, and logic skills. Students will be required to be able to solve standard computational problems in each section covered, understand all theoretical concepts involved, and be able to do simple, short proofs of particular statements.

You will see some interesting and exciting material in this course. If you run into some trouble along the way, please do not hesitate to contact your instructor or TA for help.

Lectures/Administrative Information

Section	Time	Lecture Room	Instructor	Office
L0101	T1-3, W1	LM 159	M. Mota	BA 6168
L0201	T1-3, R1	MP 203	S. Uppal	ES 3145
L0202	T1-3, R1	WI 1016, LM 162	N. Jung	ES 4141
L0301	T1-3, F1	SS 2102, LM 159	P. Sastry	BA 6236
L5101	T6-9	HS 610	P. Crooks	HU 1029
L5102	M6-9	WI 1016	P. Samuelson	HU 1001A

Course Coordinator: S. Uppal.
Email: uppal@math.utoronto.ca. Please read the "Email Policy" on page 3 of this document before sending an email.
Office hours: Wednesdays 1:10-2:00pm, Thursdays 4:10-6:00pm or by appointment. If you would like to book an appointment outside my regularly scheduled office hours, please send me an email indicating the times you are available to meet. Also, please give at least 24 hours notice for appointments so that there is suitable time to make arrangements.

The course Blackboard website is accessible through the main UofT portal at https://portal.utoronto.ca. All announcements and handouts will be posted on the course website. Please visit the website regularly.

Marking Scheme
Your final grade will be calculated by the following formula:

Midterm Exam I & Midterm Exam II - 40% (combined), Quizzes - 10%, Final Exam - 50%.

Textbook
Jeffrey Holt: *Linear algebra with Applications*, 1st edition. There is also a *Students Solution Manual* available should you wish to purchase it.

Tutorials and Quizzes
Every student should be registered in one tutorial section. **You must register in one of the tutorial time slots through ROSI before the end of the first week of classes**. By the end of the second week of classes tutorial groups and locations will be posted on the course website.

Tutorials begin the 3rd week of classes. During your tutorials your TA will discuss 'tutorial problems' which will be posted on the course website each Friday before your tutorial the following week. The problems are based on the suggested homework problems, emphasize the most important concepts, and are meant to help prepare you for the exams. Feel free to ask questions about the problems you have most difficulty with. Tutorials are an integral part of the course and should be regarded as just as important as lectures.

There will be a 10-15 minute quiz and the end of almost every tutorial (see pages 5 & 6 for the schedule). The quiz will consist of one question based on the suggested problems/tutorial problems for that week. Students are expected to provide their own paper to write the quiz. The marking for the quiz will be out of 4 with 4 being given for a perfect answer ; 3 for incorrect answers that demonstrate a solid understanding of the material but have minor calculation errors; 2 for answers that demonstrate some understanding of the material but are poorly presented and/or have many calculation errors; and 1 or 0 for little to no understanding of the material. In total, there will be nine quizzes but only your best six quizzes will count toward your quiz grade. **Each student must attend their assigned tutorial to write their quiz otherwise your grade will be recorded as 0**. The material for the quiz will be posted on the course website each Friday before your tutorial the following week.

Midterm Exams
There will be two 1hr 50min minute midterm exams common to all sections scheduled Friday October 17, and Friday November 14 from 4:10-6:00pm with an early sitting from 2:10-4:00pm for those with a conflict. Exact details about exam coverage, exam locations and registration for the early sitting will be posted on the website roughly two weeks before the test date. **There will be no make-up exams**.

Midterm I & II account for 40% of your final grade combined. The higher of your two midterm exam grades will account for 25% of your final grade; the lower 15%. This only applies to students who write both exams. If you only write one midterm exam due to illness, it will count for 20% of your final grade and your final exam will count for 70% of your final grade.

If you miss the midterm for a legitimate reason which you can document, your grading scheme will be adjusted by increasing the final exam component of your mark. The documentation must be submitted to the course coordinator no later than 7 days after the date of the exam/quiz otherwise your grade for the exam/quiz will be recorded as zero. From the Faculty of Arts & Science:

"You will need official documentation that confirms you were unable to do what you were supposed to do on the dates you were supposed to do it, i.e., documentation must indicate incapacity, and give the dates or

period affected. Generally speaking, the stronger your documentation, the stronger your case...Those doctors notes with Patient was ill or Off work scribbled on little prescription pads wont be accepted. Also, the Medical Certificate must indicate that the doctor diagnosed and treated you when you were ill; **it cannot just report that you told the doctor after-the-fact that you were ill previously**."

Generally, an illness must be serious enough that it prevents you from writing an exam. For example, a headache is not sufficient to warrant absence. The only accepted note is a fully completed University of Toronto Verification of Student Illness or Injury form. You can find a copy of the form here:

http://www.illnessverification.utoronto.ca/

It must be original and completed by a qualified medical doctor (e.g., not an acupuncturist, chiropractor, or other health care professional). The doctors OHIP registration number must be provided on the note.
Under no circumstances can the final exam count for more than 80% of your final mark.

Questions and Answers Website

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. Piazza has a LaTex equation editor for simple math formatting. You can also take photos of your written work so you may ask questions without keying in elaborate expressions.

Piazza will be used only as a question and answer forum about the course material. No administrative information such as exam information, handouts, grades etc will be posted on Piazza - this information will be posted on the main course webpage on Blackboard. Joining Piazza is optional - if you wish join, you will first need to register using your @utoronto.ca email account at

piazza.com/utoronto.ca/fall2014/mat223h1f

Email Policy
All email correspondence must be done through your @mail.utoronto.ca email account. I will not respond to emails sent from hotmail, gmail, yahoo and the like. Also, please be sure to put MAT223H1F in the subject line or your email may get filtered to my junk mail.

Email correspondence is to be used for **non-teaching purposes** only. This may include setting up an appointment with your instructor or clarification of the course structure. I may not respond to an email which deals with specific questions about course concepts or homework/tutorial problems - please post such questions on Piazza or ask your instructor after class or during office hours. **If the answer to your question is contained within the course outline or announcement page of the course webpage, you will not receive a response to your email**.

Accessibility Needs
The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible: disability.services@utoronto.ca or http://studentlife.utoronto.ca/accessibility

Academic Integrity
Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree

that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves.

Familiarize yourself with the University of Torontos Code of Behaviour on Academic Matters:

http://www.governingcouncil.utoronto.ca/policies/behaveac.htm

It is the rule book for academic behaviour at the U of T, and you are expected to know the rules. Potential offences include, but are not limited to:

In papers and assignments:

- Using someone elses ideas or words without appropriate acknowledgement
- Copying material word-for-word from a source (including lecture and study group notes) and not placing the words within quotation marks.
- Submitting your own work in more than one course without the permission of the instructor.
- Making up sources or facts.
- Including references to sources that you did not use.
- Obtaining or providing unauthorized assistance on any assignment including working in groups on assignments that are supposed to be individual work, or having someone rewrite or add material to your work while editing.
- Lending your work to a classmate who submits it as his/her own without your permission.

On tests and exams:

- Using or possessing any unauthorized aid, including a cell phone.
- Looking at someone elses answers
- Letting someone else look at your answers.
- Misrepresenting your identity.
- Submitting an altered test for re-grading.

Misrepresentation:

- Falsifying or altering any documentation required by the University, including doctors notes.
- Falsifying institutional documents or grades.

The University of Toronto treats cases of academic misconduct very seriously. All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code. The consequences for academic misconduct can be severe, including a failure in the course and a notation on your transcript. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact me. If you have questions about appropriate research and citation methods, seek out additional information from me, or from other available campus resources like the U of T Writing Website. If you are experiencing personal challenges that are having an impact on your academic work, please speak to me or seek the advice of your college registrar.

Schedule and Suggested Problems
As a general rule, you should try to solve as many problems as possible (in a timely fashion). The more problems you try, the better your understanding will be. I suggest you attempt to solve, at the minimum, all the odd numbered questions from the list below. The answers to all the odd numbered questions are in the back of the textbook (the Students Solution Manual has full solutions to all the odd problems).

Your instructor may be slightly ahead or behind this schedule. **This schedule is subject to change**.

Week 1 beginning September 8.

Lecture: Systems of Linear Equations.

- Introduction to the course.
- Section 1.1: Lines and linear equations. # **1-60**.
- Section 1.2: Linear Systems and Matrices (Elementary operations & Guassian Elimination). # **1-56**.

Week 2 beginning September 15.

Lecture: Euclidean Space.

- Section 2.1: Vectors. # **1-80**.
- Section 2.2: Span. # **1-74**.

Week 3 beginning September 22. **Tutorials begin. Quiz 1**.

Lecture: Euclidean Space (continued), Matrices.

- Section 2.3: Linear Independence. # **1-66**.
- Section 3.1: Linear Transformations $\mathbb{R}^m \to \mathbb{R}^n$. # **1-66**.

Week 4 beginning September 29. **Quiz 2**.

Lecture: Matrices (continued).

- Section 3.2: Matrix Algebra. # **1-64**.
- Section 3.3: Inverses. # **1-70**.

Week 5 beginning October 6. **Quiz 3**.

Lecture: Subspaces.

- Section 4.1: Introduction to Subspaces. # **1-72**.
- Section 4.2: Basis and Dimension. # **1-68**.

Week 6 beginning October 13. **Midterm Exam I. Quiz 4**.

Lecture: Subspaces (continued), Determinants.

- Section 4.3: Row and Column Spaces. # **1-60**.
- Section 5.1: The Determinant Function. # **1-82**.

Week 7 beginning October 20. **Quiz 5**.

Lecture: Determinants (continued).

- Section 5.2: Properties of the Determinant. # **1-72**.
- Section 5.3: Applications of the Determinant (skip adjoints and Cramer's Rule). # **19-36, 61-62**.

Week 8 beginning October 27. **Quiz 6**.

Lecture: Eigenvalues & Eigenvectors.

- Section 6.1: Eigenvalues and Eigenvectors. # **1-66**.
- Section 6.3: Change of Basis. # **1-50**.

Week 9 beginning November 3. **Quiz 7**

Lecture: Eigenvalues & Eigenvectors (continued), Orthogonality.

- Section 6.4: Diagonalization. # **1-64**.
- Section 8.1: Dot Products and Orthogonal Sets. # **1-72**.

Week 10 beginning November 10. **Midterm Exam II, Quiz 8**.

Lecture: Orthogonality (continued). Vector Spaces.

- Section 8.2: Projection and the Gram-Schmidt Process. # **1-58**.
- Section 7.1: Vector Spaces and Subspaces. # **1-28, 33-49**.

Week 11 beginning November 17. **No Monday or Tuesday classes**.

Lecture: Vector Spaces (continued).

- Section 7.2: Span and Linear Independence. # **1-54**.

Week 12 beginning November 24. **Quiz 9**.

Lecture: Vector Spaces (continued).

- Section 7.2: Span and Linear Independence. # **1-54**.
- Section 7.3: Basis and Dimension. # **1-58**.

Week "13" beginning December 1. **Monday & Tuesday classes only.**

Lecture: Catch Up/Review for Final Exam.