

Department of Mathematics, University of Toronto
MAT224H1S - Linear Algebra II
Winter 2013

Brief Course Description

Welcome to MAT224H1S Linear Algebra II. 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 second course in Linear Algebra expands on the breadth and depth of the material from MAT223 - Linear Algebra I. By its nature the material is more theoretical, read more exciting, than MAT223 but we will also see some interesting applications along the way. It is hoped that by the end of the course you have raised your mathematical maturity, problem solving, and reasoning skills. See the weekly class schedule below for a full list of topics covered.

It will be assumed you know the material from Linear Algebra I, which is a prerequisite, particularly the concept of a vector space, null space & column space, orthogonality, orthogonal projections, diagonalization of matrices.

You will see some fabulous 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	SS 1087, SS 1073	O. Yacobi	BA 6120
L0201	W3-5, R3	PB B250, MP103	S. Uppal	ES 3145
L5101	T6-9	MP 102	M. El Smaily	HU 1001A

The course coordinator is S. Uppal. e-mail: uppal@math.toronto.edu
Office hours: Tuesday 3:10-4pm, Wednesday 12:10-2:00pm, or by appointment.

The course Blackboard website is accessible through the main UofT portal - <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:

Problem Sets - 20%, Midterm Exam - 30%, Final Exam - 50%.

Textbook

Damiano & Little: *A Course in Linear Algebra*. There is no solutions manual for this book but there are solutions in the back of the textbook for some exercises.

Tutorials

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 second 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 class. During your tutorials the TA will discuss some problems from the problems sets. 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. See below for the weekly tutorial schedule.

Problem Sets

There will be six problem sets given throughout the term with only the best four counting towards your final grade. Problem sets require a good effort and a suitable amount of time should be spent on them. While problem sets are worth a relatively small percentage of your final grade, doing well on problem sets typically results in good marks on exams and a good overall grade. No surprise here.

Problem Set Schedule:

Problem Set 1 will be given Friday January 18 and due Tuesday January 29;

Problem Set 2 will be given Friday January 25 and due Tuesday February 5;

Problem Set 3 will be given Friday February 1 and due Tuesday February 12;

Problem Set 4 will be given Friday March 1 and due Tuesday March 12;

Problem Set 5 will be given Friday March 8 and due Tuesday March 19;

Problem Set 6 will be given Friday March 15 and due Tuesday March 26.

Each problem set will consist of "essentail" problems which are to be handed in, and "suggested" problems which are not to be handed in but are similar to problem set questions and will be discussed in tutorials. .

Midterm Exams

There will be one 110 minute midterm exam to be written on Thursday February 28 from 6:10-8:00pm with an early sitting from 4:10-6:00pm for those with a conflict with the regularly scheduled time. Exact details about exam coverage etc will be discussed in class and posted on the website roughly two weeks before the test date.

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 Medical Certificate. You can find a copy of the form here:

<http://www.healthservice.utoronto.ca/pdfs/medcert.htm>

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. Piazza is a free platform for instructors and TAs to efficiently manage out-of-class Q&A. On the class dashboard, students can post questions and collaborate Wikipedia- style to edit responses to these questions. Instructors can also answer questions, endorse student answers, and edit or delete any posted content. 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. If you have any problems or feedback for the developers, email team@piazza.com.

Find our class page at: <https://piazza.com/utoronto.ca/winter2013/mat224h1s/home>

You will need to register/login with your @utoronto.ca email account.

Email Policy

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 Toronto's 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 else's 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 else's 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.

Weekly Class Schedule

Your instructor may be slightly ahead or behind this schedule.

Week 1 beginning January 7.

Lecture: Complex Numbers, Fields, Vector Spaces over a Field.

Section 5.1

Section 5.2

Note: It is highly recommended that you review Chapter 1 of the textbook (Vector Spaces) and familiarize yourself with all the topics involved. This material was covered in MAT223 and is essential material for understanding Sections 5.1, 5.2.

Week 2 beginning January 14.

Lecture: Linear Transformations, Linear Transformations between Finite Dimensional Vector Spaces, Kernel & Image.

Section 2.1

Section 2.2

Section 2.3

Week 3 beginning January 21. **Tutorials begin.**

Lecture: Dimension Theorem, Applications of Dimension Theorem, Composition of Linear Transformations.

Section 2.3

Section 2.4

Section 2.5

Week 4 beginning January 28.

Lecture: Inverse of Linear Transformation, Isomorphism, Change of Basis.

Section 2.6

Section 2.7

Week 5 beginning February 4.

Lecture: Eigenvalues & Eigenvectors, Diagonalizability.

Section 4.1

Section 4.2

Week 6 beginning February 11.

Lecture: Geometry in \mathbb{R}^n , Orthogonal Projections & Gram-Schmidt.

Section 4.3

Section 4.4

Week 7 beginning February 25. **Midterm Exam.**

Lecture: Symmetric Matrices, Spectral Theorem.

Section 4.5

Section 4.6

Week 9 beginning March 4.

Lecture: Geometry in a Complex Vector Space. Adjoint, Self-Adjoint & Normal Linear Transformations.

Section 5.3

Week 10 beginning March 11.

Lecture: Triangular Form, Canonical Form for Nilpotent Mappings.

Section 6.1

Section 6.2

Week 11 beginning March 18.

Lecture: Jordan Canonical Form, Computing Jordan Form.

Section 6.3

Section 6.4

Week 12 beginning December March 25.

Lecture: Characteristic Polynomial & Minimal Polynomial. Catch up/Review for Final Exam.

Section 6.5