

Math 2040 Matrix Theory and Linear Algebra 2

Andrew Irwin

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Syllabus

Instructor: Andrew Irwin, Chase 225, a.irwin@dal.ca.

Office hours: By appointment.

Class meeting times: MWF 8:35-9:25 in LSC-C236.

Textbook: P Selinger et al (2018) Matrix Theory and Linear Algebra.

This is a free, open-source textbook available as a PDF on Brightspace. You can buy a printed copy from lulu.com (<http://www.lulu.com/shop/peter-selinger/matrix-theory-and-linear-algebra-black-and-white/paperback/product-23838005.html>). Allow about 3 weeks for printing and delivery.

I plan to cover topics from the Appendix and Chapters 9, 10, and 11.

Course Overview and Learning outcomes

Students will learn advanced concepts of linear algebra, including real and complex vector spaces, inner product spaces, linear transformations, and orthogonality. We will discuss the use of vectors and linear algebra for representing and manipulating data for statistical analysis and data representing images and sounds. We will discuss several applications of the linear algebra theory in detail including least squares curve fitting, principle component analysis, error correcting codes, linear transformations of images, and the decomposition of sounds into component frequencies.

This course is a continuation of Math 1030 (previously known as 2030.)

Detailed learning outcomes are enumerated at the start of each section of the textbook.

At the end of the course, you should have expanded your knowledge of linear algebra and learned about several common applications of the theory. You should be able to describe the corresponding definitions and algorithms studied, explain the connection between the ideas and the applications, and be able to perform computations related to the applications.

Course objectives can be completed with a pencil and paper – there is no need for a calculator or computer. Although computers are routinely used in applications of linear algebra, that is not our focus in this course.

Course activities and evaluation scheme

- Lectures
- Assignments (9 in total, 15%)
- Tests (two, 20% each)
- Final exam (45%)

Numerical grades will be converted to letter grades using the Dalhousie Common Grade Scale (https://www.dal.ca/campus_life/academic-support/grades-and-student-records/grade-scale-and-definitions.html).

Prerequisites

Linear Algebra (Math 1030/2030) and Calculus (Math 1000 or 1500 or 1215).

Course policies

You can get help with this course in the Math Learning Centre (Chase building, 1st floor, room 119). Normal hours are Monday-Wednesday 10:00am-6:00pm and Thursday-Friday 10:00am-5:00pm. More information can be found online (<https://www.dal.ca/faculty/science/math-stats/about/learning-centre.html>). Help is provided on a first-come first-served basis. You are encouraged to work in groups or individually at one of the large tables.

The work you submit for grading (homework, tests, exams) must be your own work.

Calculators, textbooks, and notes are not permitted for the mid-term tests or the final examination.

Late homework will not be accepted except with the instructor's prior permission. Please contact me by email if you anticipate a problem with a deadline and have a reasonable excuse.

There will be no opportunity to write the mid-term tests at another time. If you miss a test without permission you will earn a 0. If you are excused from the test, the weight of the test will be added to the final exam.

If you anticipate missing any of the course work for any reason, please complete the 'Student declaration of absence' on BrightSpace. You can find this under Assessments > Assignments. Please do not obtain doctor's notes.

University policies and statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate.

- Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

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- Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia). Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

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- Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html (https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

- Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness. Statement: <http://www.dal.ca/cultureofrespect.html> (<http://www.dal.ca/cultureofrespect.html>)

- Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit the office (Rm 3037, McCain Building), e-mail (elders@dal.ca (<mailto:elders@dal.ca>)) or leave message (902-494-6803). Information: https://www.dal.ca/campus_life/communities/indigenous.html (https://www.dal.ca/campus_life/communities/indigenous.html)

- Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html (https://www.dal.ca/academics/important_dates.html)

- University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html (https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

Student Resources and Support

Advising

- General Advising https://www.dal.ca/campus_life/academic-support/advising.html (https://www.dal.ca/campus_life/academic-support/advising.html)
- Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/academic-advising.html> (<https://www.dal.ca/faculty/science/current-students/academic-advising.html>)
- Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html (https://www.dal.ca/campus_life/communities/indigenous.html)
- Black Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html (https://www.dal.ca/campus_life/communities/black-student-advising.html)
- International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html (https://www.dal.ca/campus_life/international-centre/current-students.html)

Academic supports

- Library: <https://libraries.dal.ca/> (<https://libraries.dal.ca/>)
- Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html (https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)
- Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html (https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

- Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>
(<https://libraries.dal.ca/services/copyright-office.html>)
- Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>
(<https://libraries.dal.ca/services/copyright-office/fair-dealing.html>)

Other supports and services

- Student Health Services: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html (https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)
- Counselling: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness/make-an-appointment (https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness/make-an-appointment).
- Student Advocacy: <https://www.dsu.ca/services/community-student-services/student-advocacy-service> (<https://www.dsu.ca/services/community-student-services/student-advocacy-service>) error
- Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilites/where-to-get-help/ombudsperson.html (https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilites/where-to-get-help/ombudsperson.html) error

Safety

- Research Lab Safety
https://www.dal.ca/content/dam/dalhousie/pdf/dept/safety/lab_policy_manual_2007.pdf
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- Biosafety: <https://www.dal.ca/dept/safety/programs-services/biosafety.html>
(<https://www.dal.ca/dept/safety/programs-services/biosafety.html>)
- Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>
(<https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>)
- Radiation Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>
(<https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>)
- Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>
(<https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>)