MATH2099 Mathematics 2B - 2024

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General Course Information

Course Code : MATH2099
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Linear algebra is a key tool in mathematics and its applications. Topics includevector spaces, linear transformations, change of basis, inner products, orthogonalization, least squares approximation, QR factorization, determinants, eigenvalues and eigenvectors, diagonalization, Jordan forms, matrix exponentials and applications to systems of differential equations, other

applications of linear algebra.

Probability and statistics provide tools to apply and interpret statistical methods in an Engineering context and to build foundations for future courses in their programs. Topics include descriptive statistics, random variables and special probability distributions such as Binomial, Poisson, Exponential and Normal, sampling distribution and the Central Limit Theorem, statistical inference for proportions and means including confidence intervals and hypothesis testing, statistical analysis in the simple linear regression model and analysis of variance. MATLAB will be used in the statistics part of the course as a tool for statistical computations and graphical and numerical illustration of theoretical concepts.

The course is delivered through a series of lectures and tutorials, where students can extend and refine their knowledge of the lecture material.

Course Aims

Statistics:

The primary objective of the statistics stream is to enable students to apply and interpret statistical methods in an Engineering context, and to build foundations for future courses in their UG degree programs.

Linear Algebra:

This course introduces the basic theory of linear algebra which is essential in all mathematics and in a wide range of engineering disciplines. This course will build on the substantial amount of linear algebra included in first year Mathematics courses. The aim of this strand is to provide a solid understanding of important topics in linear algebra, including vector spaces, linear transformations (with emphasis on geometric transformations such as projections, rotations and reflections) and their representation using matrices, Jordan forms, matrix exponentials and their applications. The strand is structured with a strong emphasis on problem-solving tasks in lectures, in tutorials, and in assessment tasks.

Relationship to Other Courses

Prerequisite: MATH1231 or MATH1241 or MATH1251 or DPST1014

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Understand basic definitions and theorems in linear algebra and apply them to specific examples.
CLO2 : Apply concepts and techniques in Linear Algebra to solve appropriate problems.
CLO3 : Apply various graphical and numerical tools used in exploratory data analysis for summarising data.
CLO4 : Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts.

Course Learning Outcomes	Assessment Item
CLO1 : Understand basic definitions and theorems in linear algebra and apply them to specific examples.	• Online Quizzes • Linear Algebra Test • Final Exam
CLO2 : Apply concepts and techniques in Linear Algebra to solve appropriate problems.	• Online Quizzes • Linear Algebra Test • Final Exam
CLO3 : Apply various graphical and numerical tools used in exploratory data analysis for summarising data.	• Statistics Midterm Test • Online Quizzes • Final Exam
CLO4 : Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts.	• Statistics Midterm Test • Online Quizzes • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Online Quizzes Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Weekly (see Moodle announcements for specific due dates and times)
Statistics Midterm Test Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Week 7 EXM (see your myUNSW timetable)
Linear Algebra Test Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Week 9 (During one of the lecture hours)
Final Exam Assessment Format: Individual	60%	Start Date: Not Applicable Due Date: During the exam period

Assessment Details
Online Quizzes

Assessment Overview

Statistics component contributes 10% to the total mark for the course. It consists of completing ten weekly online lectures and quizzes, each worth 1% of the final mark.

There are two Linear Algebra quizzes. Each is worth 5% of the final mark.
Quiz 1 will be made available in Week 3 and covers material presented in lectures from Week 1 and 2.
Quiz 2 will be made available in Week 7 and covers material presented in lectures from Week 3 to 5.

You will receive your marked quiz after each quiz has closed. Additional general feedback may be delivered in lectures.

Course Learning Outcomes

- CLO1 : Understand basic definitions and theorems in linear algebra and apply them to specific examples.
- CLO2 : Apply concepts and techniques in Linear Algebra to solve appropriate problems.
- CLO3 : Apply various graphical and numerical tools used in exploratory data analysis for summarising data.
- CLO4 : Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts.

Detailed Assessment Description

Statistics online lectures and quizzes contribute 10% to the total mark for the course.

Linear Algebra online quizzes contribute 10% to the total mark for the course.

Statistics Midterm Test

Assessment Overview

The Statistics midterm test is scheduled in week 7 and covers all topics presented in the first 5 weeks of the course.

You are allowed only one attempt at the test.

Your test will take place in the computing labs, with a 40-minute duration time. You will have to either select the correct answer or enter a numerical value/a text response. You will be asked to copy and paste data and use MATLAB to answer some questions.

You will receive your marked test and feedback within two weeks after submission.

Course Learning Outcomes

- CLO3 : Apply various graphical and numerical tools used in exploratory data analysis for summarising data.
- CLO4 : Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts.

Assessment Length

40 min

Linear Algebra Test

Assessment Overview

The linear algebra test covers all topics up to and including Jordan forms, contributing to 10% of the total mark of the course.

The test will be 1 hour in duration and will be delivered during a scheduled lecture in Week 9.

You will receive your marked tests and solutions within two weeks of submission.

Course Learning Outcomes

- CLO1 : Understand basic definitions and theorems in linear algebra and apply them to specific examples.

- CLO2 : Apply concepts and techniques in Linear Algebra to solve appropriate problems.

<u>Assessment Length</u>

50 min

Final Exam

<u>Assessment Overview</u>

The final exam will be 2 hours in duration and held during the official university examinations period, with each component (linear algebra and statistics) contributing half of the marks.

The exam is designed to summarise your learning and problem-solving skills on all topics delivered across all weeks of the term, including material from lectures, tutorials and labs. You will have to either select the correct answer or enter a calculated value, as well as a text response. You will be asked to copy and paste data and use MATLAB to answer some questions.

Feedback is available through inquiry with the convenor.

<u>Course Learning Outcomes</u>

- CLO1 : Understand basic definitions and theorems in linear algebra and apply them to specific examples.
- CLO2 : Apply concepts and techniques in Linear Algebra to solve appropriate problems.
- CLO3 : Apply various graphical and numerical tools used in exploratory data analysis for summarising data.
- CLO4 : Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts.

<u>Assessment Length</u>

2 hours

General Assessment Information

<u>Grading Basis</u>

Standard

<u>Requirements to pass course</u>

To pass this course, you must achieve at least 50% in your final combined mark for the course. Additionally, you must achieve at least 40% in Linear Algebra and 40% in Statistics, that is, a minimum of 20/50 in each component.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Linear Algebra: Linear equations, matrices and vector spaces Statistics: Descriptive statistics; Probability (revision)
Week 2 : 3 June - 9 June	Lecture	Linear Algebra: Linear transformation Statistics: Random variables.
Week 3 : 10 June - 16 June	Lecture	Linear Algebra: Orthogonality Statistics: Special random variables
Week 4 : 17 June - 23 June	Lecture	Linear Algebra: Least squares, determinants Statistics: Sampling distributions and the Central Limit Theorem
Week 5 : 24 June - 30 June	Lecture	Linear Algebra: Eigenvalues and eigenvectors Statistics: Confidence intervals for means and proportions
Week 7 : 8 July - 14 July	Lecture	Linear Algebra: Symmetric matrices and quadratic forms Statistics: Hypothesis testing
Week 8 : 15 July - 21 July	Lecture	Linear Algebra: Jordan forms Statistics: Inference concerning differences in means
Week 9 : 22 July - 28 July	Lecture	Linear Algebra: Matrix exponentials Statistics: Regression analysis
Week 10 : 29 July - 4 August	Lecture	Linear Algebra: Systems of ordinary differential equations Statistics: Analysis of variance

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Recommended Resources

Recommended Text for Statistics:

J. Devore and N. Farnum, Applied Statistics for Engineers and Scientists, 3rd Edition, 2013, Duxbury Press, Thomson Publishers (or 2nd edition of this book).

Additional Reading for Statistics:

D. Montgomery and G. Runger, Applied Statistics and Probability for Engineers, 7th edition, 2019, Wiley (or a previous edition of this book).

There is no set textbook for Linear Algebra, but the following references may be useful:
1. First year algebra notes.
2. J.B. Fraleigh, Linear Algebra, Pearson Education, 2022.
3. R.O. Hill, B. Kolman, Elementary Linear Algebra with Applications, Pearson Education, 9th edition, 2017.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	John Steele					Yes	No
	Eka Shinjikashvili					Yes	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant

circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)
- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)

School-specific Information

School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the web site starting at: [The School of Mathematics and Statistics assessment policies](#)

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that

incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

Computing Lab

The main computing laboratory is room G012 of the Anita B.Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the [computing facilities webpage](#). Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

School Contact Information

Please visit the [School of Mathematics and Statistics website](#) for a range of information.

For information on Courses, please go to "Student life & resources" and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within "Student life & resources" page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

Undergraduate

E: ug.mathsstats@unsw.edu.au

P: 9385 7011 or 9385 7053

Postgraduate

E: pg.mathsstats@unsw.edu.au

P: 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please use your UNSW student email and state your student number in all emails to us.**