



**UNSW**  
SYDNEY

**Faculty of Science**  
**School of Mathematics & Statistics**

**MATH2099**  
**MATHEMATICS 2B**

**Term 2, 2019**

# Information about the course MATH2099

**Credit, Prerequisites, Exclusions.** This course counts for 6 units of credit (6UOC). The prerequisite for enrolling in this course is MATH1231 or MATH1241 or MATH1251. Exclusions: MATH2501, MATH2509, MATH2601, MATH2801, MATH2841, MATH2859, MATH2901. This course is only available to students for whom it is specifically required as part of their program.

**Course structure.** This course consists of two strands, one on linear algebra and one on statistics. Information about each strands is included in the next two sections of the course outline.

**UNSW Moodle.** Further information, lecture notes, problems and other material will be provided via UNSW Moodle.

<https://moodle.telt.unsw.edu.au/login/index.php>.

You should check the course web site regularly for new and updated information.

## Course aims

This course gives an introduction to linear algebra and statistics essential in a wide range of engineering disciplines.

## Assessment

The final grade in MATH2099 will be based on the sum of the scores from each of the assessment components

Statistics and Algebra Online Quizzes	17.5%
Statistics Mid-term Test	10%
Algebra Class Test	12.5%
Final Examination	60%

Final grades may be adjusted by moderation with the approval of the appropriate departmental meeting. Note that to pass MATH2099, **you must obtain a mark of at least 40% in both the linear algebra strand and the statistics strand.**

## Statistics and Algebra Online Quizzes

The online quizzes use a system called Maple TA. Information on how to access and use Maple TA is provided on UNSW Moodle. For information about the online quizzes of each strand, see the sections on statistics strand and linear algebra strand.

The online quizzes can be attempted anywhere via a computer with internet access. You can also use the computers in the Red Centre Computer Laboratories. Information can be found at

<https://www.maths.unsw.edu.au/currentstudents/computing-information>

## Statistics Mid-term Test

Statistics Mid-term Test will be conducted in a computer laboratories during Week 6. This will take place in your regular lab class.

## Algebra Class Test

The algebra class test will be conducted in the tutorial class in which you are officially enrolled in Week 9.

## Examination

The final examination for MATH2099 will be held in the examination period at the end Term 2, 2019. There will be one two-hour paper, shared between linear algebra and statistics.

## Schedule of all Assessments

Week	Assessments	Date
2	Introductory Matlab quizzes	Before 4pm Friday Week 2
3	Algebra online quiz 1	Before 4pm Friday Week 3
4	Statistics online quiz 1	Before 4pm Friday Week 4
5	Algebra online quiz 2	Before 4pm Friday Week 5
6	Statistics med-term test	Week 6 Statistics Lab Class
7	Algebra online quiz 3	Before 4pm Friday Week 7
8	Statistics online quiz 2	Before 4pm Friday Week 8
9	Algebra class test	Week 9 Algebra Tutorial
10	Statistics online quiz 3	Before 4pm Friday Week 10
	Final Examination	Exam period

# Information about the statistics strand

**Lecturer** for the statistics strand:

Jia Deng, [jia.deng@unsw.edu.au](mailto:jia.deng@unsw.edu.au), Red Centre 1033.

You will be assigned a tutor for the statistics tutorials and computer laboratory classes. Your tutor should be your first point of contact for any questions about this course.

**Lectures.** There will be 3 hours statistics lecture in weeks 1, 3, 5, 7 and 2 hours in weeks 2, 4, 6, 8, 9, 10.

**Tutorials.** There will be one tutorial or computer laboratory per week from Week 1 to Week 10.

**Aims.** This primary objective of the statistics strand 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.

**Statistics Preparation.** The statistic strand builds on the probability lectures included in first year Mathematics (MATH1231/1241). This material will be reviewed in MATH2099, but only briefly. If you did not do first year Mathematics at UNSW or if you have had a gap of a year or more since you did MATH1231 or MATH1241, it is very important that you make yourself familiar with the first year probability at the beginning of term so that you are not left behind. The lecture notes will include sufficient material for revision of these key ideas.

## Student Learning Outcomes

For the statistics strand, students are expected to:

- apply various graphical and data analysis methods for summarizing and understanding data;
- apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts;
- use Matlab for statistical analysis.
- interpret results of statistical analyses

We believe that effective learning is best supported by a climate of inquiry, in which students are actively engaged in the learning process. Hence this strand is structured with a strong emphasis on problem-solving tasks in lectures, in tutorials, and in assessment tasks. Students are expected to devote the majority of their class and study time to such tasks. New ideas and skills are first introduced and demonstrated

in lectures, and then students develop these skills by applying them to specific tasks in tutorials and assessments. This strand has a major focus on inquiry and analytical thinking. We will also explore capacity and motivation for intellectual development through the solution of both simple and complex mathematical models of problems, and the interpretation and communication of the results.

## Statistics lecture schedule

Week	Lectures	Tutorials/labs	Assessments
1	Introduction Descriptive Statistics	Matlab intro (lab)	
2	Probability	Descriptive stats (lab)	Matlab quiz
3	Random variables	Probability (tutorial)	
4	Special distributions	Random variables (lab)	Stats quiz 1
5	Sampling distributions The Central Limit Theorem	Special distributions (tutorial)	
6	Confidence intervals for means and proportions	Sampling distribution (lab)	Mid-term test
7	Hypothesis testing	Confidence intervals (tutorial)	
8	Inference concerning mean differences	Hypothesis testing (lab)	Stats quiz 2
9	Regression	Mean differences (tutorial)	
10	ANOVA	Regression, ANOVA (lab)	Stats quiz 3

It is intended that the topics will be covered in the given order. Any variation from this will be indicated by the lecturer.

## Further information about statistics assessments

**Assessment criteria.** The main criterion for marking all written assessment tasks will be clear and logical presentation of correct solutions.

The grading criterion for online assessments will be correct answers correctly entered in the required syntax.

## Statistics tests

**Rationale.** Tests will give students feedback on their progress and mastery of the material.

Task	Material tested	Weighting
Matlab quiz	Matlab computing skills	5%
Stats quiz 1	Descriptive statistics, probability	5%
Stas mid-term Test	All topics up to and including Estimation	20%
Stats quiz 2	Confidence intervals and hypothesis testing	5%
Stats quiz 3	Mean differences and regression	5%

The Matlab and statistics online quizzes each contribute 5% of your marks for the statistics strand (to a total of 20%). The quizzes will be administered through UNSW Moodle and Maple TA. Further details will be provided on Moodle. Here are some guidelines you should follow when taking each quiz:

- For the Matlab online quizzes due in Week 2 you are allowed as many attempts as you want. Your best mark will count.
- For the Statistics on-line quizzes (due Weeks 4, 8, 10), you are allowed a maximum of 3 attempts.
- Once you begin an attempt at a quiz, you have a fixed time to finish that attempt.
- You should only start an attempt at a quiz if you plan to finish it in that sitting.
- Once you answer a question, select Save Answer. You will still be allowed to modify your response. Selecting Finish submits your responses to MapleTA which cannot be changed.
- Do not close MapleTA or your web browser during a quiz. You will **not** be able to continue that attempt the next time you login.
- It is expected that you work on each quiz **alone**.

The statistics mid-term test contributes 20% of your marks in this strand. The test will be held in the computer labs during your regular lab class in Week 6 and administered on Maple TA. For the mid-term test you are only permitted one attempt, using a lab computer during your regular lab class. Practice tests will be available on Maple TA in week 5.

If you are absent from the mid-term test because of illness or other circumstances beyond your control, you must apply for Special Consideration on-line within 3 days of the test. Since each online quiz will be available for at least one week, under

normal circumstances no medical certificates or other reasons will be accepted for missing these quizzes, unless they cover the full week on which the quiz was due.

## **Examination**

The statistics part of the final examination will contribute half of the marks for the final examination, i.e. 60% of your assessment marks of this strand.

## **Additional resources and support**

### **Tutorial Exercises**

Sets of tutorial exercises will be available on Moodle. These problems are for YOU to do to enhance mastery of the course. Some of the problems will be done in tutorials, but you will learn a lot more if you try to do the problems yourself before the tutorial.

### **Lecture material**

Lecture material will be available through Moodle. Please bring a hard (or soft) copy to all lectures.

### **Consultation**

Your lecturer will have regular consultation times which will be announced in lectures and on Moodle.

### **Textbooks**

There is no set textbook for this course and we shall not produce a coursepack, but the following references may be useful.

- J. Devore and N. Farnum, Applied Statistics for Engineers and Scientists, 2nd Edition, 2005 Duxbury Press, Thomson Publishers. (or 3rd edition of this book)
- D. Montgomery and G. Runger, Applied Statistics and Probability for Engineers, 5th Edition, 2011, Wiley (or a previous edition of this book)

Other texts on introductory statistics for engineers would do similarly well.

# Information about the linear algebra strand

**Lecturer** for the linear algebra strand:

Chi Mak, [chi.mak@unsw.edu.au](mailto:chi.mak@unsw.edu.au), Red Centre 4073.

You will be assigned a tutor for the linear algebra tutorials. Your tutor should be your first point of contact for any questions about this course.

**Lectures.** There will be 2 hours algebra lecture in weeks 1, 3, 5, 7, 9, 10 and 3 hours in weeks 2, 4, 6, 8.

**Tutorials.** There will be one tutorial per week from Week 1 to Week 10.

**Aims.** Linear algebra is a key tool in all of mathematics and its applications. For example, the output of many electrical circuits depends linearly on the input (over moderate ranges of input), and successfully correcting the trajectory of a space probe involves repeatedly solving systems of linear equations in hundreds of variables. Linear methods are vital in ecological population models, and in mathematics itself. You have begun to understand systems of linear equations and matrices, vector spaces and linear transformations in first year mathematics courses. In MATH2099, you will learn about geometric transformations: projections (which can also be viewed as least squares approximations), rotations and reflections. You will see how to view many linear transformations as being made up of “stretches” in various directions, (the diagonalisation process), and the more general Jordan form. This will allow you to calculate functions of matrices (such as the exponential of a matrix) and hence to solve systems of linear differential equations.

**Linear Algebra Preparation.** The linear Algebra strand builds on the substantial amount of linear algebra included in first year Mathematics courses. This material will be reviewed in MATH2099, but only briefly. If you did not do first year Mathematics at UNSW or if you have had a gap of a year or more since you did MATH1131 and MATH1231, it is very important that you make yourself familiar with the first year work at the beginning of term so that you are not left behind. Note that first year background includes not only manipulation of matrices and systems of equations but also important concepts such as spanning, linear independence and linearity of transformations.

## Student Learning Outcomes

For the linear algebra strand, students are expected to:

- understand the basic theory of linear algebra; and
- increase their problem solving abilities.

We believe that effective learning is best supported by a climate of inquiry, in which

students are actively engaged in the learning process. Hence this strand is structured with a strong emphasis on problem-solving tasks in lectures, in tutorials, and in assessment tasks. Students are expected to devote the majority of their class and study time to such tasks. New ideas and skills are first introduced and demonstrated in lectures, and then students develop these skills by applying them to specific tasks in tutorials and assessments. This strand has a major focus on inquiry and analytical thinking. We will also explore capacity and motivation for intellectual development through the solution of both simple and complex mathematical models of problems, and the interpretation and communication of the results.

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

## Linear algebra lecture and assessment schedule

Week	Lectures	Assessments
1	Linear equations and matrices Vector spaces	
2	Vector spaces Linear transformations	
3	Linear transformations	Algebra quiz 1
4	Orthogonality and least squares	
5	Determinants Eigenvalues and eigenvectors	Algebra quiz 2
6	Eigenvalues and eigenvectors Symmetric matrices and quadratic forms	
7	Jordan forms	Algebra quiz 3
8	Jordan forms Matrix exponentials	
9	Systems of ordinary differential equations	Algebra class test
10	Systems of ordinary differential equations Revision	

It is intended that the topics will be covered in the given order. Any variation from this will be indicated by the lecturer.

## Further information about algebra assessments

**Assessment criteria.** The main criterion for marking all written assessment tasks will be clear and logical presentation of correct solutions.

The grading criterion for online assessments will be correct answers correctly entered in the required syntax.

## Algebra tests

**Rationale.** Tests will give students feedback on their progress and mastery of the material.

Task	Material tested	Weighting
Algebra online quiz 1	Linear equations and matrices, Vector spaces	5%
Algebra online quiz 2	Linear transformation, Orthogonality and least squares	5%
Algebra online quiz 3	Determinants, Eigenvalues and eigenvectors Symmetric matrices and quadratic forms	5%
Algebra Class Test	All topics up to and included Jordan forms	25%

The three algebra online quizzes of equal weighting contribute a total of 15% of your marks of the linear algebra strand. For each quiz, you are allowed a maximum of **3 attempts**. The best mark of your attempts of a quiz will be the mark for that quiz. The quizzes will be administered through UNSW Moodle and Maple TA. Further details will be provided on Moodle.

Since each online quiz will be available for at least one week, so under normal circumstances no medical certificates or other reasons will be accepted for missing these quizzes.

The algebra class test contributes 25% of your marks in this strand. You must sit the class test in the tutorial in which you are officially enrolled. **Any student sitting the test in the wrong class, without having obtained permission beforehand, will receive a mark of zero for the test. Unless there are exceptional circumstances, permission for a change of class will not be given in the week of the test – students must ask at least one full week beforehand.**

If you are absent from the class test because of illness or other circumstances beyond your control, you must apply for Special Consideration on-line within 3 days of the test.

## Examination

The linear algebra part of the final examination will contribute half of the marks for the final examination, i.e. 60% of your assessment marks of this strand.

# Additional resources and support

## Tutorial Exercises

Sets of tutorial exercises will be available on Moodle. These problems are for YOU to do to enhance mastery of the course. Some of the problems will be done in tutorials, but you will learn a lot more if you try to do the problems yourself before the tutorial.

## Lecture material

Lecture material will be available through Moodle. Please bring a hard (or soft) copy to all lectures.

## Consultation

Your lecturer will have regular consultation times which will be announced in lectures and on Moodle.

## Textbooks

There is no set textbook for this course and we shall not produce a coursepack, but the following references may be useful.

- First year algebra notes.
- J.B. Fraleigh and R.A. Bearegard, “Linear Algebra”, Addison–Wesley, 3rd edition, 1995.
- R.O. Hill, “Elementary Linear Algebra with Applications”.

# Course Evaluation and Development

The School of Mathematics evaluates each course each time it is run. Feedback on the course is gathered, using among other means, UNSW myExperience Learning and Teaching Survey. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback.

## Administrative matters

The School of Mathematics and Statistic assessment policies can be found at <https://www.maths.unsw.edu.au/currentstudents/assessment-policies>.

### Academic Misconduct

The University of New South Wales has rules relating to academic misconduct. They can be found at <https://www.maths.unsw.edu.au/currentstudents/policy-academic-misconduct>.

### Rules for the Conduct of Examinations

The University of New South Wales has rules for the conduct of examinations. They can be found at <https://www.maths.unsw.edu.au/currentstudents/rules-exams>.

### Application for Special Consideration

Please adhere to the University special consideration policy and procedures provided on the Special Consideration web page <https://student.unsw.edu.au/special-consideration>.

For final exams with special consideration granted, the Exams Unit will email the rescheduled supplementary exam date, time and location to your student zID email account directly.

For successful applications for special consideration only:  
Please ensure you regularly check your student email account (zID account) for the information on new dates to attend an assessment, or dates for any supplementary exam both in Term and Final.

The supplementary exam period/dates for the final exam can be found at <https://student.unsw.edu.au/exam-dates>

Please ensure you are aware of these dates and that you are available during this time.

## **Disability Support Services**

If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Disability Support Services who provide confidential support and advice. Their web site is

<https://student.unsw.edu.au/disability>

Disability Support Services (DSS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by DSS.