UNSW SCIENCE
School of Maths and Statistics

Course outline

MATH2089
Numerical Methods and Statistics

Term 1, 2020
Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Room</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer-in-charge</td>
<td>RC-2052</td>
<td><a href="mailto:david.warton@unsw.edu.au">david.warton@unsw.edu.au</a></td>
</tr>
<tr>
<td>Prof. David Warton (Stats)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Gyani Shankar Sharma (NM)</td>
<td>Ainsworth 408A</td>
<td><a href="mailto:gs.sharma@unsw.edu.au">gs.sharma@unsw.edu.au</a></td>
</tr>
</tbody>
</table>

Please refer to your Timetable on MyUNSW for your Lecture Tut, Lab enrolment days and times.

Note this course has two streams – Numerical Methods and Statistics – taught in different ways:

**Numerical Methods** – core content will be delivered in lectures (2.5/week), then laboratories (odd weeks) and tutorial classes (even weeks) will reinforce the core concepts

**Statistics** – core content will be delivered on-line, through videos on Maple TA, with short accompanying exercises. Lectures (1.5/week) will be used to answer questions and work through additional exercises, then laboratories (Weeks 1, 2, 4, 8, 10) and tutorials (Weeks 3, 5, 7, 9) will reinforce core concepts.

**Administrative Contacts**

Please visit the School of Mathematics and Statistics website for a range of information on School Policies, Forms and Help for Students.

For information on Courses, please go to “Current Students” and either Undergraduate and/or Postgraduate”, Course Homepage” for information on all course offerings,

The “Student Notice Board” can be located by going to the “Current Students” page; Notices are posted regularly for your information here. Please familiarise yourself with the information found in these locations. The School web page is: https://www.maths.unsw.edu.au

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

By email Undergraduate ug.mathsstats@unsw.edu.au

- By phone: 9385 7011 or 9385 7053
- Or in person to the Red Centre building, level 3, rooms 3072 or 3088

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 state your student number in all emails.**
Course Description/Aims

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


In each component, applications will be drawn from a variety of engineering disciplines. Matlab will be used extensively as a practical tool for both numerical and statistical computations and to illustrate theoretical concepts.

Assessment and Deadlines

Statistics

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Week</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online quizzes (lectures, 2% each)</td>
<td>Weeks 2-5, 7-10.</td>
<td>20</td>
</tr>
<tr>
<td>Midterm Test</td>
<td>Week 7</td>
<td>20</td>
</tr>
<tr>
<td>Final exam</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

Lectures are delivered online via Maple TA, with accompanying exercises. These exercises are due weekly throughout the course, from week 2 onwards, at dates as indicated on Maple TA. There are ten lectures – one for each week of the nine weeks of the course, plus Probability (revision).

The midterm test will be held in week 7 outside of regular class times, you will need to book a time on Moodle.

A Matlab quiz is also available on Maple TA, which is not assessable. You are encouraged to do it if you are not familiar with coding in Matlab.
Numerical Methods

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Week</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-term Test</td>
<td>12-1pm on Wednesday Week 6 (25th March) at Sir John Clancy Auditorium</td>
<td>25</td>
</tr>
<tr>
<td>Matlab computer laboratory participation</td>
<td>Throughout term</td>
<td>15</td>
</tr>
<tr>
<td>Final exam</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

Course Schedule

The course will include material taken from some of the following topics. This is should only serve as a guide as it is not an extensive list of the material to be covered and the timings are approximate. The course content is ultimately defined by the material covered in lectures.

Note that classes will continue as usual in Week 6 for Numerical Methods, but there will be no week 6 classes for Statistics.

Statistics

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Topic</th>
<th>Reading (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Descriptive statistics; Probability (revision)</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>2</td>
<td>Random variables</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>3</td>
<td>Special random variables</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>4</td>
<td>Sampling distributions and the Central Limit Theorem</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>5</td>
<td>Confidence intervals for means and proportions</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>6</td>
<td>Self study (Stats component only)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hypothesis testing</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>8</td>
<td>Inference concerning differences in means</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>9</td>
<td>Regression analysis</td>
<td>Lecture Notes</td>
</tr>
<tr>
<td>10</td>
<td>Analysis of variance</td>
<td>Lecture Notes</td>
</tr>
</tbody>
</table>
Numerical Methods

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Topic</th>
<th>Reading (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data representation, error analysis, introduction to MATLAB</td>
<td>1.3-1.6 &amp; class notes</td>
</tr>
<tr>
<td>2</td>
<td>Applied MATLAB programming</td>
<td>class notes</td>
</tr>
<tr>
<td>3</td>
<td>Nonlinear equations: bisection method, fixed point iteration, Newton-Raphson and secant methods</td>
<td>2.3 – 2.6, 2.14</td>
</tr>
<tr>
<td>4</td>
<td>Systems of linear equations: elimination methods, LU factorization, Iterative methods, special linear systems</td>
<td>3.3 - 3.19</td>
</tr>
<tr>
<td>5</td>
<td>Interpolation and polynomial approximation, curve fitting</td>
<td>5.5 - 5.6, 5.8 - 5.10</td>
</tr>
<tr>
<td>6</td>
<td>Numerical differentiation</td>
<td>7.1 – 7.10</td>
</tr>
<tr>
<td>7</td>
<td>Numerical integration</td>
<td>8.1 - 8.12</td>
</tr>
<tr>
<td>8</td>
<td>Euler method, Predictor-corrector methods</td>
<td>9.5-9.6, 9.10</td>
</tr>
<tr>
<td>9</td>
<td>Runge-Kutta method. Boundary value problems</td>
<td>9.7, 10.5-10.6</td>
</tr>
<tr>
<td>10</td>
<td>Parabolic equations. Revision</td>
<td>11.5</td>
</tr>
<tr>
<td>11*</td>
<td>Revision</td>
<td></td>
</tr>
</tbody>
</table>

*Week 11 only applies to courses that have classes that fall on a Public Holiday

Textbooks

Recommended Text

  Duxbury Press, Thomson Publishers. (or 3rd edition of this book)

The recommended text will be available in the High Use Collection in the Library.

Additional Reading


Lecture slides in PDF format will be made available via the UNSW Moodle web site. They are not a substitute for attendance at lectures. Other material, including data files for computer exercises, and solutions to tutorial exercises will also be available from the web site.
Recommended Internet sites
A listing of the programs from the textbook is available from http://cwx.prenhall.com/bookbind/pubbooks/rao/

Course Learning Outcomes (CLO)

• Identify risks associated with floating point computations
• Demonstrate a basic knowledge of the techniques for accurate and efficient solution of models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations
• Apply these techniques to practical problems in Engineering
• Use Matlab for the implementation and application of numerical methods and the visualization of results
• 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
• Apply Matlab for graphical and statistical analysis

Moodle
Log in to Moodle to find announcements, general information, notes, lecture slide, classroom tutorial and assessments etc.
https://moodle.telt.unsw.edu.au

Matlab
Matlab is available on the computers in the School of Mathematics and Statistics computer laboratories on the mezzanine level and ground floor of the Red Centre. Information about how to obtain Matlab is available through the UNSW Moodle.

Also check out the following useful Matlab References, available on Moodle:

• School of Mathematics and Statistics, Introduction to MATLAB.
• School of Mathematics and Statistics, Statistics using MATLAB (SUM).

Computing lab
The main computing laboratory is Room G012 of the 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, on the mezzanine level of the Red Centre.

For more information, including opening hours, see the computing facilities webpage:
https://www.maths.unsw.edu.au/currentstudents/computing-facilities
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 tests on time.

**School 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 Maths Stats web site starting at: https://www.maths.unsw.edu.au/currentstudents/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.

**Academic Integrity and Plagiarism**

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

The UNSW Student Code provides a framework for the standard of conduct expected of UNSW students with respect to their academic integrity and behaviour. It outlines the primary obligations of students and directs staff and students to the Code and related procedures.

In addition, it is important that students understand that it is not permissible to buy essay/writing services from third parties as the use of such services constitutes plagiarism because it involves using the words or ideas of others and passing them off as your own. Nor is it permissible to sell copies of lecture or tutorial notes as students do not own the rights to this intellectual property.

If a student breaches the Student Code with respect to academic integrity, the University may take disciplinary action under the **Student Misconduct Procedure**.

The UNSW Student Code and the Student Misconduct Procedure can be found at: https://student.unsw.edu.au/plagiarism
An online Module “Working with Academic Integrity” (https://student.unsw.edu.au/aim) is a six-lesson interactive self-paced Moodle module exploring and explaining all of these terms and placing them into your learning context. It will be the best one-hour investment you’ve ever made.

**Plagiarism**

Plagiarism is presenting another person’s work or ideas as your own. Plagiarism is a serious breach of ethics at UNSW and is not taken lightly. So how do you avoid it? A one-minute video for an overview of how you can avoid plagiarism can be found https://student.unsw.edu.au/plagiarism.

**Additional Support**

**ELISE (Enabling Library and Information Skills for Everyone)**

ELISE is designed to introduce new students to studying at UNSW.

Completing the ELISE tutorial and quiz will enable you to:

- analyse topics, plan responses and organise research for academic writing and other assessment tasks
- effectively and efficiently find appropriate information sources and evaluate relevance to your needs
- use and manage information effectively to accomplish a specific purpose
- better manage your time
- understand your rights and responsibilities as a student at UNSW
- be aware of plagiarism, copyright, UNSW Student Code of Conduct and Acceptable Use of UNSW ICT Resources Policy
- be aware of the standards of behaviour expected of everyone in the UNSW community
- locate services and information about UNSW and UNSW Library

Some of these areas will be familiar to you, others will be new. Gaining a solid understanding of all the related aspects of ELISE will help you make the most of your studies at UNSW.

The *ELISE* training webpages:

https://subjectguides.library.unsw.edu.au/elise/aboutelise

**Equitable Learning Services (ELS)** 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 Equitable Learning Services (previously known as SEADU) who provide confidential support and advice.

They assist students:

- living with disabilities
- with long- or short-term health concerns and/or mental health issues
• who are primary carers
• from low SES backgrounds
• of diverse genders, sexes and sexualities
• from refugee and refugee-like backgrounds
• from rural and remote backgrounds
• who are the first in their family to undertake a bachelor-level degree.

Their web site is: https://student.unsw.edu.au/els/services

Equitable Learning Services (ELS) 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 ELS.

Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact your Lecturer-in-charge in the first instance.

**Academic Skills Support and the Learning Centre**

The Learning Centre offers academic support programs to all students at UNSW Australia. We assist students to develop approaches to learning that will enable them to succeed in their academic study. For further information on these programs please go to:
http://www.lc.unsw.edu.au/services-programs

**Applications for Special Consideration for Missed Assessment**

Please adhere to the Special Consideration Policy and Procedures provided on the web page below when applying for special consideration.
https://student.unsw.edu.au/special-consideration

Please note that the application is not considered by the Course Authority, it is considered by a centralised team of staff at the Nucleus Student Hub.

The Lecturer will contact you (via student email account) after special consideration has been granted to reschedule your missed assessment, for a *lab test* or *paper-based test* only.

For applications for special consideration for *assignment extensions*, please note that the new submission date and/or outcome will be communicated through the special consideration web site only, no communication will be received from the School.

For Dates on Final Term Exams and Supplementary Exams please check the “Key Dates for Exams” ahead of time to avoid booking holidays or work obligations.
https://student.unsw.edu.au/exam-dates
If you believe your application for Special Consideration has not been processed, you should email specialconsideration@unsw.edu.au immediately for advice.

Course Evaluation and Development (MyExperience)

Student feedback is very important to continual course improvement. This is demonstrated within the School of Mathematics and Statistics by the implementation of the UNSW online student survey myExperience, which allows students to evaluate their learning experiences in an anonymous way. myExperience survey reports are produced for each survey. They are released to staff after all student assessment results are finalised and released to students. Course convenor will use the feedback to make ongoing improvements to the course.