STAT6039
Principles of Mathematical Statistics

Course Description
A first course in mathematical statistics with emphasis on applications; probability, random variables, moment generating functions and correlation, sampling distributions, estimation of parameters by the methods of moments and maximum likelihood, hypothesis testing, the central limit theorem, simple linear regression.

Mode of Delivery
On campus by way of lectures and tutorials

Prerequisites
To enrol in this course you must have completed MATH1113 or MATH1116 or MATH1014, and either STAT1003 or STAT1008; or be enrolled in the Master of Actuarial Studies, Master of Actuarial Practice or Master of Statistics.

Incompatible Courses
None

Course Convener
Dr Borek Puza
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Email: borek.puza@anu.edu.edu

Office hours for student consultation:
The half-hour period immediately following each lecture

Research Interests:
Bayesian statistics, Monte Carlo methods, confidence estimation

Administrator
Anna Pickering
Phone: +61 2 612 59045
Email: anna.pickering@anu.edu.au

Lecturer
Dr Borek Puza, with details as above

Tutors
Details regarding tutors and their consultation times will be made available on Wattle in the first two weeks of lectures.

http://programsandcourses.anu.edu.au/course/STAT6039

SEMESTER 1
2016
COURSE OVERVIEW

Learning Outcomes

Upon successful completion of the requirements for this course, students should have the knowledge and skills to demonstrate a high level of understanding and be able to communicate the following topics:

- LO1: Introductory probability including combinatorics and Bayes’ theorem
- LO2: Discrete random variables and their probability distributions
- LO3: Continuous random variables and their probability distributions
- LO4: Multivariate random variables and their probability distributions
- LO5: Sampling distributions and the central limit theorem
- LO6: The method of moments and maximum likelihood estimation
- LO7: Confidence estimation and hypothesis testing
- LO8: Simple linear regression

Assessment Summary

<table>
<thead>
<tr>
<th>Item</th>
<th>Title</th>
<th>Value</th>
<th>Due Date</th>
<th>Linked Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assignment 1</td>
<td>10%</td>
<td>12 noon Wednesday 23 March</td>
<td>LO1; Chapters 1 and 2.</td>
</tr>
<tr>
<td>2</td>
<td>Assignment 2</td>
<td>10%</td>
<td>12 noon Wednesday 18 May</td>
<td>LO1, LO2, LO3, and LO4; Chapters 1 to 6</td>
</tr>
<tr>
<td>3</td>
<td>Mid-semester Exam</td>
<td>20% or 0% (redeemable as per below)</td>
<td>Probably in Week 7 or 8 (to be announced later)</td>
<td>LO1 and LO2; Chapters 1, 2 and 3</td>
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<tr>
<td>4</td>
<td>Final Exam</td>
<td>60% or 80%</td>
<td>Final examination period</td>
<td>LO1 to LO8; Chapters 1 to 11</td>
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</tbody>
</table>

Research-Led Teaching

If time permits, the lecturer may illustrate selected topics by discussing relevant examples from papers he has published in the fields of Bayesian statistics, Monte Carlo methods and confidence estimation. These examples will not be assessable.

Feedback

Staff Feedback

We use feedback from students, professional bodies and staff to make regular improvements to the course. In response to this feedback, design improvements from the previous version of the course include:

- The tutorial and assignments will feature more difficult problems.
- More examples will be provided in lectures to illustrate the theory.
- Several past exam problems will be reviewed and solved in class.
Student Feedback

ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways students have to provide feedback is through Student Experience of Learning Support (SELS) surveys. The feedback given in these surveys is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching, and opportunities for improvement.

For more information on student surveys at ANU and reports on the feedback provided on ANU courses, go to

http://unistats.anu.edu.au/surveys/selt/students/ and
http://unistats.anu.edu.au/surveys/selt/results/learning/

Policies

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University’s academic standards, and implement them. You can find the University’s education policies and an explanatory glossary at: http://policies.anu.edu.au/

Students are expected to have read the Academic Misconduct Rules 2014 before the commencement of their course.

Other key policies include:

- Student Assessment (Coursework)
- Student Surveys and Evaluations

Additional course costs

None, apart from that of a scientific calculator.

Examination material or equipment

This will be posted on Wattle in due course.

Recommended Resources

No computing is required for this course. However, you will need a scientific calculator. Also, it is recommended that students learn to use the R programming language, as available for free at r-project.org/. Knowledge of this language is purely optional but may be useful to students when performing calculations. Students will not be able to use R during the exams.
## COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Summary of Activities</th>
<th>Assessment</th>
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<td></td>
<td>Orientation Week</td>
<td></td>
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<tr>
<td>1</td>
<td>Chapter 1: Introduction</td>
<td></td>
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<tr>
<td>2</td>
<td>Chapter 2: Probability</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chapter 2: Probability</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Chapter 3: Discrete random variables</td>
<td></td>
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<tr>
<td>5</td>
<td>Chapter 4: Continuous random variables</td>
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<tr>
<td>6</td>
<td>Chapter 5: Multivariate random variables</td>
<td>Assignment 1 due at 12 noon on Wed 23 March</td>
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<tr>
<td>7</td>
<td>Chapter 6: Functions of random variables</td>
<td>Mid-semester Exam (possibly)</td>
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<td></td>
<td>Two-week teaching break</td>
<td></td>
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<tr>
<td>8</td>
<td>Chapter 7: Sampling distributions and the central limit theorem</td>
<td>Mid-semester Exam (possibly)</td>
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<tr>
<td>9</td>
<td>Chapter 8: Point and interval estimation</td>
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<td>10</td>
<td>Chapter 9: Methods for point estimation</td>
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<td>11</td>
<td>Chapter 10: Hypothesis testing</td>
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<tr>
<td>12</td>
<td>Chapter 11: Simple linear regression (taught to all students but assessable only for STAT6039 students; not assessable for STAT2001 students)</td>
<td>Assignment 2 due at 12 noon on Wed 18 May</td>
</tr>
<tr>
<td>13</td>
<td>Revision</td>
<td></td>
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## ASSESSMENT REQUIREMENTS

Assessment for this course consists of two assignments and two exams as detailed below. Attendance and participation in lectures and tutorials is not assessable. This course is co-taught with STAT2001 Introductory Mathematical Statistics. STAT6039 students will have slightly different learning outcomes and assessment. They will also be allocated to separate tutorial groups. Tutorial questions will be the same for both cohorts.

### Assessment Tasks

#### Participation
For this course, participation is not assessable.

#### Assessment Task 1: Assignment 1
**Details of task:**
This assignment covers Chapters 1 and 2 and is worth 10% of the total assessment. The assignment should be done alone and submitted by 12 noon on Wednesday 23 March.

#### Assessment Task 2: Assignment 2
**Details of task:**
This assignment covers Chapters 1 to 6 and is worth 10% of the total assessment. The assignment should be done alone and submitted by 12 noon on Wednesday 18 May.
Assessment Task 3: Mid-semester Exam
Details of task:
This exam covers Chapters 1, 2 and 3 and is worth 20% of the total assessment, or 0% (as detailed below under Examinations). The exam will be in either Week 7 or Week 8 (with the exact date and venue to be announced and placed on Wattle in due course).

Assessment Task 4: Final Exam
Details of task:
This exam covers Chapters 1 to 11 and is worth 60% of the total assessment, or 80% (as detailed below under Examinations). The exam will be in the final examination period (with the exact date and venue to be announced and placed on Wattle in due course).

Examinations

Both the mid-semester and final exams will be open book, with no restrictions on permitted material, apart from items excluded by general ANU policy (such as mobile phones). Programmable calculators are permitted. The mid-semester exam will cover Chapters 1-3. The final exam will cover Chapters 1-11.

The mid-semester exam is redeemable, meaning that you will get the better of the two breakdowns 20 + 60 and 0 + 80. That is, if you do better in the final exam than in the mid-semester exam, your mid-semester exam will not count and your final exam will count 80%. If you do not sit the mid-semester exam, your final exam will definitely count 80%. Although the mid-semester exam is redeemable and optional, it is advised that students do it if possible.

It should be noted that some exam questions may be significantly more difficult than questions in lectures, tutorials and assignments. Prior to each exam, several past exams with solutions will be made available on Wattle. In addition to giving an idea of the upcoming exam, past exams provide a useful source of additional exercises, and students are highly recommended to study them in detail. A few past exam questions will be discussed in class.

Assignment submission

Assignments should be neatly handwritten or typed. Each assignment should be placed in the appropriate box outside the RSFAS Office on the 4th floor of the CBE Bldg (26C) by the due date. Assignments should be accompanied by a cover sheet as provided on Wattle. Students should put their ANU ID number on the cover sheet but not their name. Email and fax submissions are not acceptable. Students should keep a copy of assessment materials submitted for their own record.

Extensions and penalties

No submission of assessment tasks without an extension after the due date will be permitted. If an assessment task is not submitted by the due date, a mark of 0 will be awarded.
Returning assignments

Marked assignments can be collected from the filing cabinets in the foyer outside the RSFAS Office on the 4th floor of the CBE Building (26C).

Resubmission of assignments

It will not be possible for assignments to be resubmitted.

Referencing requirements

In assignments and exams, students must appropriately reference any results, words or ideas that they take from another source which is not their own. A guide can be found at: https://academicskills.anu.edu.au/resources/handouts/referencing-basics

Scaling

Your final mark for the course will be based on the raw marks allocated for each of your assessment items. However, your final mark may not be the same number as produced by that formula, as marks may be scaled. Any scaling applied will preserve the rank order of raw marks (i.e. if your raw mark exceeds that of another student, then your scaled mark will exceed the scaled mark of that student), and may be either up or down.

Tutorial and/or Seminar Registration

Tutorial and/or Seminar signup for this course will be done via the Wattle website. Detailed information about signup times will be provided on Wattle or during your first lecture. When tutorials are available for enrolment, follow these steps:

1. Log on to Wattle, and go to the course site.
2. Click on the link “Tutorial signup here” (or “Tutorial enrolment”)
3. On the right of the screen, click on the tab “Become Member of …..” for the tutorial class you wish to enter.
4. Confirm your choice

If you need to change your enrolment, you will be able to do so by clicking on the tab “Leave group…” and then re-enrol in another group. You will not be able to enrol in groups that have reached their maximum number. Please note that enrolment in ISIS must be finalised for you to have access to Wattle.

SUPPORT FOR STUDENTS

The University offers a number of support services for students. Information on these is available online from http://students.anu.edu.au/studentlife/
Prescribed Texts


Recommended Reading


Communication

The lecturer can be contacted by email, by phone or in person. The best way to make an appointment with the lecturer is to speak with him directly after a class given by him.

Whenever emailing the lecturer or a tutor please use your official ANU student email address. If necessary, the lecturers and tutors for this course will contact students using this email address. Information about your enrolment and fees from the Registrar and Student Services' office will also be sent to this email address.

Students should check the course Wattle site regularly, at least once every two days, for news and announcements, e.g. corrections to course material, changes to timetables, and notifications of cancellations. Notifications of emergency cancellations of lectures or tutorials will be posted on the door of the relevant room.

Other URLs

- The College of Business and Economics website (http://cbe.anu.edu.au/students/student-information/college-courses/)

- Wattle (https://wattle.anu.edu.au), the University's online learning environment. Log on to Wattle using your student number and your ISIS password.