The course offers an introduction into modern probability theory, including probability spaces, random variables, conditional probability and independence, limit theorems, Markov chains and martingales with an outlook towards advanced stochastic processes. The course will emphasise practical understanding and applications as well as a solid theoretical foundation for the subject. The course will provide a sound foundation to progress to STAT7006 (Advanced Stochastic Processes), as well as other honours and post-graduate courses emphasising mathematical finance, stochastic analysis and statistical as well as actuarial sciences.

<table>
<thead>
<tr>
<th><strong>Mode of Delivery</strong></th>
<th>On campus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites</strong></td>
<td>As listed in Programs and Courses</td>
</tr>
<tr>
<td><strong>Incompatible Courses</strong></td>
<td>As listed in Programs and Courses</td>
</tr>
<tr>
<td><strong>Co-taught Courses</strong></td>
<td>STAT3004 Graduate students attend joint classes with undergraduates but are assessed separately</td>
</tr>
<tr>
<td><strong>Course Convener:</strong></td>
<td>Associate Professor Boris Buchmann</td>
</tr>
<tr>
<td><strong>Phone:</strong></td>
<td>02 6125 7296</td>
</tr>
<tr>
<td><strong>Email:</strong></td>
<td><a href="mailto:boris.buchmann@anu.edu.au">boris.buchmann@anu.edu.au</a></td>
</tr>
<tr>
<td><strong>Office hours for student consultation:</strong></td>
<td>TBA on WATTLE</td>
</tr>
<tr>
<td><strong>Research Interests:</strong></td>
<td>Stochastic analysis and modelling, statistics, stochastic and Levy processes, extreme value theory</td>
</tr>
<tr>
<td><strong>Administrative enquiries:</strong></td>
<td><a href="mailto:enquiries.rsfas@anu.edu.au">enquiries.rsfas@anu.edu.au</a></td>
</tr>
<tr>
<td><strong>Tutor:</strong></td>
<td>Adam Nie</td>
</tr>
<tr>
<td><strong>Email:</strong></td>
<td><a href="mailto:adam.nie@anu.edu.au">adam.nie@anu.edu.au</a></td>
</tr>
<tr>
<td><strong>Office hours for student consultation:</strong></td>
<td>TBA on WATTLE</td>
</tr>
</tbody>
</table>

SEMMESTER 1
2018

http://programsandcourses.anu.edu.au/course/STAT7018
COURSE OVERVIEW

Learning Outcomes

On satisfying the requirements of this course, students will have the knowledge and skills to:
1. Explain in detail the fundamental concepts of probability theory and its position in modern statistical and mathematical sciences and applied contexts;
2. Demonstrate and communicate accurate and efficient use of probability theory techniques;
3. Thoroughly demonstrate capacity for mathematical reasoning through analysing, proving and explaining concepts from probability theory;

Assessment Summary

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Value</th>
<th>Due Date</th>
<th>Date for Return of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assignment 1</td>
<td>40/3%</td>
<td>Week 4</td>
<td>Week 5-6</td>
</tr>
<tr>
<td>2. Assignment 2</td>
<td>40/3%</td>
<td>Week 8</td>
<td>Week 9-10</td>
</tr>
<tr>
<td>3. Assignment 3</td>
<td>40/3%</td>
<td>Week 12</td>
<td>Week 13-14</td>
</tr>
<tr>
<td>4. Final Exam</td>
<td>60%</td>
<td></td>
<td>Exam period</td>
</tr>
</tbody>
</table>

Research-Led Teaching

The course provides the up-to-date introduction in the mathematical underpinning of modern probability theory, that is the mathematical theory of uncertainty. Contrived in the 20 century, it is the foundation of any modern research in the area of probability and stochastic processes. Apart from this, it provides useful tools in any area of research dealing with reasoning and uncertainty such as mathematics, statistics, economics, finance, computer science and engineering.

Feedback

Staff Feedback

Student feedback will be given in the following forms in this course:

- Written comments, both individually and to the whole class.
- Verbal comments to the whole 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 Rule before the commencement of their course.

Other key policies include:

- Student Assessment (Coursework)
- Student Surveys and Evaluations

Required Resources

Prescribed Text


Examination material

Final Exam

- two sheets of A4 paper with notes on both sides
- paper-based dictionary, no approval required (must be clear OF ALL annotations)
- calculator (any - programmable or not)

Recommended Resources

Recommended Reading


<table>
<thead>
<tr>
<th>Week/Session</th>
<th>Summary of Activities</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Orientation Week</td>
<td>Assignment 1 (out)</td>
</tr>
<tr>
<td>1</td>
<td>Probability Triplet: Uniform distribution and Events, Sets, Basic Definition, Construction of Probability Triplets, Extension Theorem</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Random Variables, Independence, Continuity of Probabilities, Limit Events, Tail Fields</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Expected Values of Simple Random Variables, General Nonnegative-Random Variables, Integration–Connection</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Inequalities, Convergence of Random Variables, Laws of Large Numbers</td>
<td>Assignment 1 (due)</td>
</tr>
<tr>
<td>5</td>
<td>Distribution of Random Variables, Change of Variable and Examples</td>
<td>Assignment 2 (out)</td>
</tr>
<tr>
<td>6</td>
<td>Stochastic Processes, Discrete Markov Chains</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Limit Theorems, Differentiation of Expectation, Moment Generating Functions, Large Deviations, Fubini’s Theorem, Convolution</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Weak Convergence, Characteristic Functions, Continuity Theorem, Central Limit Theorem</td>
<td>Assignment 2 (due)</td>
</tr>
<tr>
<td>9</td>
<td>Decomposition of Probability Laws, Lebesgue and Hahn decomposition, General Measures</td>
<td>Assignment 3 (out)</td>
</tr>
<tr>
<td>10</td>
<td>Conditional Probability and Expectations Conditioning on Random variables and Subfields</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Martingales, Stopping Times, Convergence Maximal Inequality</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Outlook: General Stochastic Processes</td>
<td>Assignment 3 (due)</td>
</tr>
<tr>
<td></td>
<td>Examination period</td>
<td>Final exam</td>
</tr>
</tbody>
</table>
**ASSESSMENT REQUIREMENTS**

The ANU is using Turnitin to enhance student citation and referencing techniques, and to assess assignment submissions as a component of the University's approach to managing Academic Integrity. For additional information regarding Turnitin please visit the ANU Online website.

Students may choose not to submit assessment items through Turnitin. In this instance you will be required to submit, alongside the assessment item itself, copies of all references included in the assessment item.

As a further academic integrity control, students may be selected for a 15 minute individual oral examination of their written assessment submissions.

Any student identified, either during the current semester or in retrospect, as having used ghost writing services will be investigated under the University’s Academic Misconduct Rule.

**Assessment Tasks**

**Participation**

**Assessment Tasks 1-3: Compulsory Assignments 1-3**

**Details of task:** Assignments serve as a research-type assessment, so that ideas are reinforced on a regular basis by problem solving. As designated on the Course Schedule, three assignments will be made available though WATTLE at the beginning of Week 1, 5 and 9. Due date is at the end of Week 4, 8 and 12.

**Value:** Each worth 40/3% of the Final Raw Mark

**Estimated return date:** 1 – 2 weeks

**Assessment Task 2:** Final Compulsory Exam

**Details of task:** The final exam assess the students’ overall learning outcomes

**Value:** 60% of the Final Raw Mark

**Examination(s)**

There is a final compulsory exam.

**Assignment submission**

**Online Submission:** Unless an exemption has been approved by the Associate Dean (Education) a submission must be through Turnitin. Assignments are submitted using Turnitin in the course Wattle site. You will be required to electronically sign a declaration as part of the submission of your assignment. Please keep a copy of the assignment for your records.

**Extensions and penalties**

Extensions and late submission of assessment pieces are covered by the Student Assessment (Coursework) Policy and Procedure.

The Course Convener may grant extensions for assessment pieces that are not examinations or take-home examinations. If you need an extension, you must request it in writing on or before the due date. If you have documented and appropriate medical evidence that demonstrates you were not able to request an extension on or before the due date, you may be able to request it after the due date.

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
Assignments will be returned online.

Resubmission of assignments
Assignments may not be resubmitted.

Referencing requirements
Appropriate referencing will be necessary for the Assignments. For more information see: http://www.anu.edu.au/students/learning-development/academic-integrity/how-referencing-works

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.

Privacy Notice
The ANU has made a number of third party, online, databases available for students to use. Use of each online database is conditional on student end users first agreeing to the database licensor’s terms of service and/or privacy policy. Students should read these carefully.

In some cases student end users will be required to register an account with the database licensor and submit personal information, including their: first name; last name; ANU email address; and other information.

In cases where student end users are asked to submit ‘content’ to a database, such as an assignment or short answers, the database licensor may only use the student’s ‘content’ in accordance with the terms of service – including any (copyright) licence the student grants to the database licensor.

Any personal information or content a student submits may be stored by the licensor, potentially offshore, and will be used to process the database service in accordance with the licensors terms of service and/or privacy policy.

If any student chooses not to agree to the database licensor’s terms of service or privacy policy, the student will not be able to access and use the database. In these circumstances students should contact their lecturer to enquire about alternative arrangements that are available.

Tutorial Seminar Registration
Tutorial 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 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/](http://students.anu.edu.au/studentlife/)