This course introduces survival models and discusses their rationale, their estimation and their application to mortality. Topics covered will include: an introduction to the life table; survival models; estimation procedures for lifetime distributions; statistical models of transfers between multiple states; maximum likelihood estimation of transition intensities for such models; binomial model of mortality including estimation and comparison with multiple state models; exposed-to-risk; and methods for smoothing crude mortality rate data.
COURSE OVERVIEW

Learning Outcomes

1. Communicate the concept of survival models.
2. Communicate in detail the estimation procedures for lifetime distributions.
3. Implement statistical models of transfer between multiple states, including processes with single or multiple decrements, and derive relationships between probabilities of transfer and transition intensities.
4. Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
5. Comprehensively describe how to estimate transition intensities depending on age, exactly or using the census approximation.
6. Communicate in detail how to test crude estimates for consistency with a standard table or a set of graduated estimates, and describe the process of graduation.

Assessment Summary

The value of each assessment task below can be a rough guideline for the relative work load you might invest in the task. For example, if you require 20 hours of studying to excel in the Midterm Exam, you might spend roughly 15 hours on the Term Project in order to excel in that assessment task.

<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. Midterm Exam (redeemable)</td>
<td>20% (or 0%)</td>
<td>Week 6 or 7</td>
<td>Week 8 or 9</td>
</tr>
<tr>
<td>2. Term Project</td>
<td>15%</td>
<td>Week 11</td>
<td>before Final Exam</td>
</tr>
<tr>
<td>3. Final Exam</td>
<td>65% (or 85%)</td>
<td>Exam Period</td>
<td>TBA by RSFAS</td>
</tr>
</tbody>
</table>

Research-Led Teaching

This course builds upon the foundation in statistical thinking and evidence-based logic that you have acquired from previous statistics courses. The course contents and activities are designed to help you to learn to apply and hone this foundation to achieve the above learning outcomes, and to prepare yourself for the remainder of your academic program and life in the work force. Course contents and activities involve statistical computing with R (https://www.r-project.org) interfaced through R Studio (https://www.rstudio.com) at an intermediate level to demonstrate the practical use of course materials on real-life datasets. Additional research articles (e.g., reports, journal publications) will be discussed as examples and case studies in which research questions relevant to the course are tackled step-by-step.
Feedback

Staff Feedback

“Feedback is not a unilateral act by tutors or trainers, but is a set of interlinked activities. “The overriding purpose of feedback is the refinement of the learner’s capacity to use information to judge themselves in similar situations.”


Feedback from the lecturer and tutors will aim to facilitate the learner’s ongoing self assessment of his/her progress in achieving the learning objectives of the course. To this end, the learner would converse in-person with the lecturer and tutors through their office hours or individualised appointments. Limited written comments will also be provided through the grading of formal assessments. Due to the large combined enrolment, (a) in-person consultation remains to be the only guarantee for staff feedback on the learner’s progress in the course, (b) staff replies to students’ e-mails are not guaranteed, and (c) in order to safeguard student privacy, staff members need to be sure that they are dealing with the right student, therefore course-related messages sent from non-ANU email accounts will be ignored.

Student Feedback

“Learning involves bridging the gap between desired and actual performance.
“Effective learning requires dialogue.
“Students need always to be positioned ... as pro-active learners who can initiate feedback-seeking behaviour.”


ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways in which students can 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

Course text:

Additional course costs

Optional purchase of handheld calculator (can be programmable but cannot be a connected device) to be used during exams.

Examination material or equipment

Allowed materials:
Handheld calculator (see above), pen(cil)s, paper dictionary, notes on double-sided A4 sheets (1 sheet for Midterm Exam, 3 sheets for Final Exam)

Prohibited materials:
Communication devices (computers, tablets, mobile phones, smart watches, etc.)

Recommended Resources

This information will be provided on the course webpage on Wattle.
## COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Summary of Activities</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(20–24 Feb) Introduction to survival models</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(27 Feb – 3 Mar) Overview of estimation methods</td>
<td></td>
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<tr>
<td>3</td>
<td>(6–10 Mar) Kaplan–Meier estimation</td>
<td></td>
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<tr>
<td>4</td>
<td>(14–17 Mar) Kaplan–Meier estimation – continued; Nelson–Aalen estimation</td>
<td></td>
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<tr>
<td>5</td>
<td>(20–24 Mar) Cox proportional hazards (regression) model; two-state models</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(27–31 Mar) Two-state models – continued</td>
<td>Midterm Exam?</td>
</tr>
<tr>
<td>7</td>
<td>(19–21 Apr) Multi-state models</td>
<td>Midterm Exam?</td>
</tr>
<tr>
<td>8</td>
<td>(24–28 Apr) Exposed-to-risk and mortality rates</td>
<td></td>
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<tr>
<td>9</td>
<td>(1–5 May) Graduation methods for crude mortality rates</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>(8–12 May) Graduation methods – continued</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>(15–19 May) Other parametric survival models</td>
<td>Term Project</td>
</tr>
<tr>
<td>12</td>
<td>(22–26 May) Case studies / Catch-up / Review</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1–17 Jun) Examination Period</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

## ASSESSMENT REQUIREMENTS

“It is necessary to look beyond the immediate task: acts of assessment must be designed to leave learners better equipped to learn further.

“Learners need to develop a view about what constitutes quality work if they are to demonstrate it for themselves.”


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](http://www.anu.edu.au) 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.
Assessment Tasks

Assessment Task 1: Midterm Exam (redeemable)
Details of task:

90-minute closed-book exam covering materials from Weeks 1–5. There will be no special/supplementary examinations for the Midterm Exam, as it is redeemable by the final exam (i.e. the midterm weighting will be moved to the final exam automatically if this reweighting raises the student’s course grade).

Assessment Task 2: Term Project (Assignment)
Details of task:

Exact requirements/rubrics will be available on the course webpage on Wattle.

Task overview: In a team of approximately 3 students (the exact size requirement TBA on the course webpage on Wattle), you will be required to conduct a mini case study based on an assigned news article/technical report/journal article which includes a dataset. For the case study, your team will be required to produce a formal scientific report that includes a write-up on each of these items: the research question(s), the approach(es) taken by the investigators in the provided article/report, your data analysis using R (https://www.r-project.org) that reproduces the investigators’ findings, the limitations of the investigators’ approach(es), and what (and why) you believe the investigators should have done differently. Appropriate referencing must be included throughout your report. To produce your scientific report, you are highly encouraged to utilise R Markdown interfaced through R Studio (http://rmarkdown.rstudio.com) — see open-source examples and .Rmd files throughout the course webpage on Wattle.

Unless an individual has been approved for special considerations, each student on your team will receive an identical grade for this assessment, irrespective of the actual amount of effort an individual contributes.)

Assessment Task 3: Final Exam
Details of task:

3-hour closed-book exam covering all course materials.

Term Project submission

Online Submission: Assignments are submitted using Turnitin on the course webpage on Wattle. Prior to submission, you should practice using the Turnitin system here. Students can upload draft versions to the designated Turnitin web link on the Wattle course page, and change those drafts every 24 hours up until the due date.

When you submit the final version of your project to Turnitin, 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.

Submissions outside of the designated Turnitin web link will be ignored. Standard late penalties (see below) apply to submissions to Turnitin after the due date.
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.

Late submission of assessment tasks without an extension are penalised at the rate of 5% of the possible marks available per working day or part thereof. Late submission of assessment tasks is not accepted after 10 working days after the due date, or on or after the date specified in the course outline for the return of the assessment item.

Returning assignments

The Term Project will be graded and returned electronically via Wattle.

Resubmission of assignments

Resubmission of the Term Project is not allowed under any circumstance.

Referencing requirements

Appropriate scholarly referencing must be included in your report for the Term Project. For more information, see http://www.anu.edu.au/students/learning—development/academic—integrity/how—referencing—works and the web links therein.

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 be no lower than 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.

**Computer Lab Registration**

Computing Lab (Tutorial) signup for this course will be done via the course webpage on Wattle. Detailed information about signup times will be provided on Wattle. When labs 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/)