# STAT 1003
## Statistical Techniques

### Course Description
This course introduces students to the philosophy and methods of modern statistical data analysis and inference, with a particular focus on applications to the life sciences.

Why and how to use: tables to organise and summarise data; graphics to present statistical information; measures of location and spread for univariate distributions. Concepts of randomness, uncertainty, association versus causation, random variables, probability distributions (including uniform, binomial, normal), and sampling distributions. How to apply these concepts for inference from small and large samples through: confidence intervals; hypothesis testing in one- and two-sample cases; p-values; simple linear regression and analysis-of-variance.

Examples and applications will be drawn extensively from the life sciences, particularly Biology. The course has a strong emphasis on computing and graphical methods, and uses a variety of real-world problems to motivate the theory and methods required for carrying out statistical data analysis. This course makes extensive use of the R statistical analysis package interfaced through R Studio.

<table>
<thead>
<tr>
<th>Mode of Delivery</th>
<th>On campus (plus online materials)</th>
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<tbody>
<tr>
<td>Incompatible Courses</td>
<td>STAT1008</td>
</tr>
<tr>
<td>Course Convener</td>
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<td>Office:</td>
<td>CBE 4.35</td>
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<tr>
<td>Consultation hours:</td>
<td>Mondays 12:15-1:15pm</td>
</tr>
<tr>
<td>Student Administrator</td>
<td>Ms. Tracy Skinner</td>
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<td>Email:</td>
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<tr>
<td>Tutor(s)</td>
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<td>Tim McLENNAN-SMITH <a href="mailto:u4960340@anu.edu.au">u4960340@anu.edu.au</a></td>
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<tr>
<td>Chen TANG <a href="mailto:chen.tang@anu.edu.au">chen.tang@anu.edu.au</a></td>
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COURSE OVERVIEW

Learning Outcomes
1. Summarise and graph data appropriately.
2. Work with random variables and probability distributions and understand the rationale behind them.
3. Understand and use the normal distribution appropriately.
4. Identify when and how to carry out basic statistical inference including confidence intervals, hypothesis testing, simple regression and analysis-of-variance (ANOVA).
5. Identify contexts in which a method may be inappropriate (e.g., using a large sample method when the sample size is small, concluding causation from ANOVA on a study that is not a double-blinded randomised controlled experiment).

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>10%</td>
<td>Week 6</td>
<td>Week 8</td>
</tr>
<tr>
<td>2. Quiz 1 (redeemable by Final Exam)</td>
<td>10% (or 0%)</td>
<td>Week 7</td>
<td>Week 8</td>
</tr>
<tr>
<td>3. Assignment 2</td>
<td>10%</td>
<td>Week 11</td>
<td>Week 13</td>
</tr>
<tr>
<td>4. Quiz 2 (redeemable by Final Exam)</td>
<td>10% (or 0%)</td>
<td>Week 12</td>
<td>Week 13</td>
</tr>
<tr>
<td>5. Final Exam</td>
<td>60% (or 70% or 80%)</td>
<td>Exam Period</td>
<td>TBA by RSFAS</td>
</tr>
</tbody>
</table>

Research-Led Teaching
This course aims to provide you with a foundation in statistical thinking and evidence-based logic, two elements that are integral to your (any) academic program and life in the work force beyond your university degree(s). Almost all areas of research (academic, industrial, etc.) require both elements. Therefore, contents and activities in Stat1003 lectures, tutorials, assignments, and exam draw heavily upon research from a wide range of disciplines from the life sciences, finance, etc. Course contents and activities demonstrate the practical use of course materials on real-life datasets to answer different research questions. Additional articles (e.g., science news, journal publications) will be discussed as examples and case studies in which research questions are tackled step-by-step using concepts covered in the course. Any research that involves data also involves statistical computing. We do so with R (https://www.r-project.org) interfaced through R Studio (https://www.rstudio.com) at an elementary level.

Feedback
Staff Feedback
Feedback from the lecturer and/or tutors will aim to facilitate the learner’s ongoing self assessment of his/her progress in achieving the learning objectives of the course. In the recent offerings of the course, such feedback might have been limited to in-person consultation during staff office hours. In this semester, the Course Convenor will explore different modes of administering such feedback in addition to individualised consultation, e.g., through not-for-marks pop quizzes for which the entire audience takes part in the grading. Limited written comments will also be provided through the grading of formal
assessments (for marks). Due to the large enrolment, in-person consultation remains to be the only guarantee for staff feedback on the learner’s progress in the course.

**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

**Required Resources**

- Course text (e-book):
  *OpenIntro Statistics, 3rd Edition*
  by Diez DM, Barr CD, Çetinkaya-Rundel M
  https://www.openintro.org/stat/textbook.php

- hand-held calculator (any type)

**Examination material or equipment**

This information will be provided on the course Wattle site.

**Recommended Resources**

This information will be provided on the course Wattle site.
<table>
<thead>
<tr>
<th>Week</th>
<th>Summary of Activities</th>
<th>Assessment</th>
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</thead>
<tbody>
<tr>
<td>1 (15–19 Feb)</td>
<td>Introduction to Statistics (discipline) and data</td>
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<tr>
<td>2 (22–26 Feb)</td>
<td>Summarising and understanding data; introduction to R Studio</td>
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<tr>
<td>3 (29 Feb – 4 Mar)</td>
<td>Summarising and understanding data – continued</td>
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<tr>
<td>4 (7–11 Mar)</td>
<td>Introduction to random events, probability rules and probability models</td>
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<tr>
<td>5 (15–18 Mar)</td>
<td>Introduction to random variables and probability distribution models; the binomial distribution</td>
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<tr>
<td>6 (21–24 Mar)</td>
<td>The normal (Gaussian) distribution</td>
<td>Assignment 1</td>
</tr>
<tr>
<td>7 (29 Mar – 1 Apr)</td>
<td>Introduction to sampling distributions; the central limit theorem (CLT)</td>
<td>Quiz 1 (in-class)</td>
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<tr>
<td>8 (18–22 Apr)</td>
<td>Inference for population means and proportions: 1-sample confidence intervals</td>
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<tr>
<td>9 (26–29 Apr)</td>
<td>Inference – continued: 1-sample hypothesis tests</td>
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<tr>
<td>10 (2–6 May)</td>
<td>Inference – continued: 2-sample CIs and hypothesis tests</td>
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<tr>
<td>11 (9–13 May)</td>
<td>Simple linear regression</td>
<td>Assignment 2</td>
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<tr>
<td>12 (16–20 May)</td>
<td>Regression – continued; Introduction to ANOVA</td>
<td>Quiz 2 (in-class)</td>
</tr>
<tr>
<td>13 (23–27 May)</td>
<td>Catch-up / Review</td>
<td></td>
</tr>
<tr>
<td>(2–18 Jun)</td>
<td>Examination period</td>
<td>Final Exam</td>
</tr>
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</table>
ASSESSMENT REQUIREMENTS

The value of each assessment task can be a rough guideline for the relative work load you might invest in the task. For example, if you require 30 hours of studying to pass the Final Exam, you might spend roughly 5 hours of studying to pass either of the two in-class quizzes.

Assessment Tasks

Participation
If you do not attend lecture in person on the day of a quiz, you will receive 0 marks for that assessment, irrespective of the reason for your absence. See Assessment Tasks 2 and 4 below.

Assessment Task 1: Assignment 1
Details of task:
Answer specified questions based on materials from Weeks 1–5 (including R computing). Collate the answers, computer output, and written discussions into a formal report. For this, you are encouraged to use R markdown – see samples throughout the Wattle course site; alternatively consider Word Online (sign in with your ANU ID u???????@anu.edu.au), Evernote, Google documents, Markdown, etc. (The idea is to position appropriate computer output at a reasonable spot within a word-processed document that incorporates your typewritten answers.) You must submit your assignment as a single PDF file of maximum size 50MB through Turnitin on Wattle. If you must hand-write parts of your answers, then ensure that your handwriting is legible, and scan in the handwritten parts to an electronic format (e.g., by using your smartphone camera), then import the scan into your report before converting the final document to PDF format. There are no marks for “fancy” presentations that do not pertain to demonstrating your understanding of the course materials. Although verbal discussions with others (fellow students, tutors, lecturer) are encouraged, the contents of your assignment must be produced by you as an individual and must comply with academic integrity policies given at http://www.anu.edu.au/students/program-administration/assessments-exams/academic-honesty-plagiarism and https://www.cbe.anu.edu.au/students/student-information/examinations-assessment/plagiarism-and-academic-misconduct

Value: 10%
Estimated return date: Week 8

Assessment Task 2: Quiz 1 (redeemable by the Final Exam)
Details of task:
The 40-minute closed-book quiz will take place during a scheduled lecture in Week 7 (exact date TBA on the Wattle course site), covering materials from Weeks 1–6. This is not a formal exam, and the weighting will be moved to the final exam if you are absent for the quiz.

Value: 10% (redeemable)
Estimated return date: Week 8
Assessment Task 3: Assignment 2
Details of task:
Identical to Assessment Task 1 except for questions based on materials from Weeks 6–10.
Value: 10%
Estimated return date: Week 13

Assessment Task 4: Quiz 2 (redeemable by the Final Exam)
Details of task:
The 40-minute closed-book quiz will take place during a scheduled lecture in Week 12 (exact date TBA on the Wattle course site), covering materials from Weeks 1–11. This is not a formal exam, and the weighting will be moved to the final exam if you are absent for the quiz.
Value: 10% (redeemable)
Estimated return date: Week 13

Assessment Task 5: Final Exam
Details of task:
3-hour closed-book exam covering all course materials
Value: 60% (counting both quizzes) or 70% (counting one quiz only) or 80% (not counting quizzes), whichever is more favourable to the student
Estimated return date: TBA on the course Wattle site

Quizzes and Final Examination
Allowed materials:
Quizzes and Final Exam: hand-held calculator (any type), pen(cil)s.
Final Exam only: paper dictionary, notes on 3 sheets of double-sided A4 paper.
Prohibited materials:
Quizzes and Final Exam: communication devices (computers, tablets, mobile phones, smart watches, etc.).

Assignment submission
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 Turnitin FAQs website.

Online Submission: 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.

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 assignments will be graded and returned electronically via Wattle.

**Resubmission of assignments**
Resubmission of an assignment is not allowed under any circumstance.

**Referencing requirements**
Although formal scholarly referencing may not be necessary for the assignments, you must adhere to academic integrity policies (see details of Assessment Tasks 1 and 3).

**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 Registration**
Enrolment in tutorials will be completed online using the CBE Electronic Teaching Assistant (ETA). To enrol, follow these instructions:

2. You will see the Student Login page. To log into the system, enter your University ID (your student number) and password (your ISIS password) in the appropriate fields and hit the Login button.
3. Read any news items or announcements.
4. Select "Sign Up!" from the left-hand navigation bar.
5. Select your courses from the list. To select multiple courses, hold down the control key. On PCs, this is the Ctrl key; on Macs, it is the ⌘ key. Hold this key down while selecting courses with the mouse. Once courses are selected, hit the SUBMIT button.
6. A confirmation of class enrolments will be displayed. In addition, an email confirmation of class enrolments will be sent to your student account.
7. For security purposes, please ensure that you click the LOGOUT link on the confirmation page, or close the browser window when you have finished your selections.
8. If you experience any difficulties, please contact the School Office (see page 1 for contact details).
9. Students will have until 5pm February 25 to finalise their enrolment in tutorials. After this time, students will be unable to change their tutorial enrolment.

**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/)