This course introduces students to the methods and philosophy of modern statistical data analysis and inference, with a particular focus on applications in the life sciences. Using tables to organise and summarise data; using graphics to present statistical information; measures of location and spread for univariate distributions. An introductory discussion of: normal and binomial distributions; sampling distributions; inference from small and large samples; confidence intervals; hypothesis testing in one- and two-sample cases; p-values; linear regression models 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. The course makes extensive use of the statistical software R (http://www.r-project.org) with the user interface R-Studio (http://www.rstudio.com), both of which are open source.

<table>
<thead>
<tr>
<th>Semester and Year</th>
<th>Semester 1, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mode of Delivery</strong></td>
<td>On campus</td>
</tr>
<tr>
<td><strong>Course Convener</strong></td>
<td>Grace Chiu, Ph.D.</td>
</tr>
<tr>
<td><strong>Office Location:</strong></td>
<td>CBE Building 26C Rm 4.35</td>
</tr>
<tr>
<td><strong>Phone:</strong></td>
<td>6125 7292</td>
</tr>
<tr>
<td><strong>Email:</strong></td>
<td><a href="mailto:u1003134@anu.edu.au">u1003134@anu.edu.au</a></td>
</tr>
<tr>
<td><strong>Consultation hours:</strong></td>
<td>Tu 2-3pm</td>
</tr>
<tr>
<td><strong>Student Administrators</strong></td>
<td>Tracy Skinner</td>
</tr>
<tr>
<td></td>
<td>Level 4, ANUCBE Bldg. 26C</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:Tracy.Skinner@anu.edu.au">Tracy.Skinner@anu.edu.au</a></td>
</tr>
</tbody>
</table>

http://programsandcourses.anu.edu.au/course/STAT1003
COURSE OVERVIEW

Course Learning Outcomes
To achieve an understanding of and facility in the following:
• to summarise and graph data (LO1);
• to work with random variables and probability distributions (LO2);
• to understand and use the normal distribution (LO3);
• to carry out basic statistical inference including confidence intervals, hypothesis testing and regression and ANOVA (LO4)

Research-Led Teaching
Statistics is humanity’s reaction to randomness. Randomness is expressed everywhere in our lives, and examples and source material from the course will be drawn from many areas of research, including the life sciences, medicine, finance, almost any area you can think of. So we will look at many active research areas – data is the life-blood of research, and we will be exploring real data at every opportunity.

Technology, Software, Equipment
This course requires knowledge of word processing and spreadsheet manipulation.

The data analysis software that will be used in the course is R (http://www.r-project.org), interfaced through R-Studio. Both are open source. Be sure to install R before you install R-Studio (http://www.rstudio.com). To check that you have installed both properly, start going through Session One from the online course at http://faculty.washington.edu/kenrice/rintro.

Student Feedback
All CBE courses are evaluated using Student Experience of Learning and Teaching (SELT) surveys, administered by Planning and Statistical Services at the ANU. These surveys are offered online, and students will be notified via email to their ANU address when surveys are available in each course. Feedback is used for course development so please take the time to respond thoughtfully. Course feedback is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching and to improve courses across the university. For more information on student surveys at ANU and reports on feedback provided on ANU courses, visit http://unistats.anu.edu.au/surveys/selt/students/ and http://unistats.anu.edu.au/surveys/selt/results/learning/
COURSE SCHEDULE

(Note: L = Lectures, T = Tutorial)
Updated information will be posted on Wattle.

<table>
<thead>
<tr>
<th>Week/Session</th>
<th>Summary of Activities (this is a rough guide – progress will vary but don’t worry because statistics is all about variation!)</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3L/0T. Introduction and summation</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3L/1T. Descriptive statistics, introduction to R-Studio.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3L/1T. Descriptive statistics. Measures of centre/spread, numerical and graphical descriptions of data</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2L/1T. Review. Introduction to probability rules and probability models. Note Monday 9 March is a Public Holiday</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3L/1T. Discrete Random Variables and Binomial Distribution</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3L/1T. Continuous Random Variables. Normal Distribution, Standardization</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3L/1T. Central limit theorem and sampling distributions.</td>
<td>Mid-semester exam</td>
</tr>
<tr>
<td>8</td>
<td>2L/1T. Point estimation, interval estimation.</td>
<td>Assignment 1 due</td>
</tr>
<tr>
<td>9</td>
<td>3L/1T. Inference, CI’s and testing for one-sample means and proportions.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3L/1T. Inference, CI’s and testing for two-sample means and proportions</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3L/1T. Regression and ANOVA</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3L/1T. Regression and ANOVA/ Revision</td>
<td>Assignment 2 due</td>
</tr>
<tr>
<td>13</td>
<td>3L/1T. Revision</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examination period</td>
<td>Final Exam (timetabled centrally – see timetable.anu.edu.au)</td>
</tr>
</tbody>
</table>
COURSE ASSESSMENT

Assessment Summary
Assessment for this course will be confirmed after consultation with students at the first lecture of the semester. If there are any changes to the assessment, those changes will be publicised on Wattle.

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Value</th>
<th>Due Dates (provisional)</th>
<th>Linked Learning Outcomes (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assignments (2)</td>
<td>Total: 20% (10% per assignment)</td>
<td>April 24 (A1)</td>
<td>Assignment 1: LO1, LO2 Assignment 2: LO3,LO4 (with some mild overlap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>May 22 (A2)</td>
<td></td>
</tr>
<tr>
<td>2. Mid-semester exam</td>
<td>0% (if redeemed) or 20%</td>
<td>Centrally timetabled (Week 7)</td>
<td>LO1 and some of LO2</td>
</tr>
<tr>
<td>3. Final Exam</td>
<td>80% (if mid-semester exam redeemed) or 60% (if not)</td>
<td>Centrally timetabled</td>
<td>All Learning Outcomes</td>
</tr>
</tbody>
</table>

Your raw mark for the course will be the larger of 20% Assignments + 20% Mid-semester exam + 60% Final exam and 20% Assignments + 80% Final exam. YOU DO NOT NEED TO ELECT TO REDEEM YOUR MID-SEMESTER EXAM RESULT - IT WILL BE DONE AUTOMATICALLY IF IT HELPS YOU TO REDEEM IT.

Assessment Tasks

Participation: There will be no formal assessment for participation

Assessment Task 1: Assignment 1

Details of task: Answer specified questions from the topics presented in weeks 1-6 of the course. Both manual as well as R use will be required.

Value: 10%

Presentation requirements: Print out computer output and hand in the assignment in “report form”. The idea is to position appropriate computer output at a reasonable spot within a word-processed document that incorporates your written answers (e.g. R markdown – see samples on Wattle). Please hand in the assignments as a single stack of paper stapled in the top left corner. Do not bind your solution or use plastic or other folders or protectors or binders. There are no marks for “fancy” presentations.

Estimated return date: It is expected that marked assignments will be returned in the tutorials in the week following their submission date (taking into account official university teaching breaks).

Assessment Task 2: Assignment 2

Details of task: Answer specified questions on topics presented in weeks 6-10 of the course. There may be the need for some limited computer output, though probably less than for Assignment 1.
Value: 10%

Presentation requirements: As for Assignment 1, although it is anticipated there will be less computer output.

Estimated return date: It is expected that marked assignments will be returned in the tutorials in the week following their submission date (taking into account official university teaching breaks).

Assignment submission

Hard Copy Submission: Assignments must be submitted to the School Office and include a cover sheet. There will be assignment submission boxes with the course code and tutorial number on them in the 4th Floor foyer outside the School Office in CBE Building 26C. Please make sure that you put your assignment in the correct box. Email and fax submissions are not acceptable. You must keep a copy of assessment materials submitted for your records.

Extensions and penalties

Generally, late assignments will only be accepted on medical grounds on presentation of appropriate documentation (e.g. medical certificate). If assignments are submitted after the due date then a mark of 0 will be awarded for the assignment.

Returning assignments

Assignments will be returned in tutorials after they are marked. Your tutor will advise when the assignments will be returned. If you are unable to retrieve your assignment at a tutorial, uncollected assignments will be placed in the filing cabinets in the foyer of the Research School of Finance, Actuarial Studies and Applied Statistics on the 4th Floor of CBE Building 26C where you can collect them yourself. When collecting assignments, please do not collect assignments for friends and so on – only take your own.

Resubmission of assignments

There is no resubmission of assignments in this course.

Examination(s)

The assessment for the course will include a 1-hour mid-semester exam which is redeemable and will be held during the week before the mid-semester break and will be worth 20% of your course mark (unless you redeem the mid-semester exam). There will also be a three-hour Final Examination that will be worth either 60% or 80% (if you redeem your mid-semester exam). Both exams will be centrally timetabled, so exact dates, times and venues will be advised when those details become available. This advice will appear on the course web site on Wattle. Whether or not the mid-semester exam is redeemed is based entirely on whether it is better for you to do so. At the end of the semester, two marks will be computed: one with the mid-term exam, and one without, and you will be given as your raw mark the higher of these two marks. That is, your raw mark for the course will be the larger of 20% Assignments + 20% Mid-semester exam + 60% Final exam and 20% Assignments + 80% Final exam.

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.
Referencing requirements
It is unlikely you will need to reference sources in this course (there are no essays, etc.)

Examination material or equipment
All exams for the course are open book, and you are welcome to bring lecture notes, tutorials and solutions, books (except library books for equity reasons), and so on. Note that the use of electronic equipment like laptops, tablets and mobile phones is not permitted in examination venues, so these materials will not be able to be used in examinations. The idea behind using open-book exams is that you do not need to rote learn formulas and so on, and can bring in formula sheets and so on. The idea is to focus on conceptual understanding and deep learning rather than superficial learning and memorisation.

READING LISTS

The recommended textbook for the course is “Mind on Statistics, 2nd Edition” by MacGillivray, Utts and Heckard, published by Cengage.

Both the books can be purchased at the Co-op bookshop.

Buying the books is not compulsory as you can simply use the notes provided on Wattle as course material, but both the books are full of excellent examples and problems that will really supplement your learning of statistics. There will be copies of the prescribed text made available for short-term loan on reserve at the ANU library as well. But it will NOT be necessary for you to buy the books to do the course. It is, however, very highly recommended.

TUTORIAL AND/OR SEMINAR REGISTRATION
Enrolment in tutorials will be completed online using the CBE Electronic Teaching Assistant (ETA). To enrol, follow these instructions:

1. Go to http://eta.fec.anu.edu.au
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 Wednesday 25 February to finalise their enrolment in tutorials. After this time, students will be unable to change their tutorial enrolment.

COMMUNICATION

Email
If necessary, the lecturers and tutors for this course will contact students on their official ANU student email address. Information about your enrolment and fees from the Registrar and Student Services’ office will also be sent to this email address.

Announcements
Students are expected to check the Wattle site for announcements about this course, e.g. changes to timetables or notifications of cancellations. Notifications of emergency cancellations of lectures or tutorials will be posted on the door of the relevant room.

Course URLs
All course materials will be available on Wattle, the University's online learning environment. Log on to Wattle using your student number and your ISIS password. (https://wattle.anu.edu.au).

POLICIES

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

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 Student Academic Integrity Policy before the commencement of their course.

Other key policies include:

• Student Assessment (Coursework)
• Student Surveys and Evaluations
• College policies on extensions, late submissions etc.