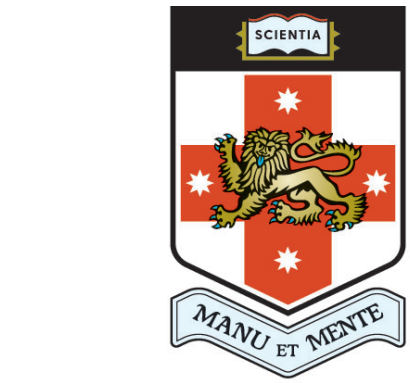

UNSW
SYDNEY

MATH2801/MATH2901

Theory of Statistics/ Higher Theory of Statistics

Semester 1, 2018

CRICOS Provider No: 00098G

MATH2801/MATH2901 – Course Outline

MATH2801 and MATH2901 will be taught as separate courses, although there is much in common across teaching resources and assessment tasks. Except where otherwise indicated, the below information refers to both MATH2801 and MATH2901.

Course Authority/lecturers:

MATH2801	**MATH2901**
Dr Diana Combe RC-1032	Dr Libo Li RC-1035
diana@unsw.edu.au	libo.li@unsw.edu.au

Regular **consultation times** with lecturers will be announced on Moodle and in lectures. Other times may be arranged by appointment. Please use email to arrange an appointment and make sure you use your UNSW email account.

Credit, Prerequisites, Exclusions:
This course counts for 6 Units of Credit (6UOC).

First year mathematics is assumed knowledge for this course:
MATH1231 or MATH1241 or MATH1251 (or, in program 3653, MATH1131 or MATH1141) or MATH1031(CR) (for MATH2801 only).

Excluded: introductory stats courses with theoretical focus: ECON2215, MATH2089, MATH2099, MATH2829, MATH2839, MATH2841, MATH2859, MATH2899.

Assumed knowledge: First year probability theory and integration. Probability theory revision notes and exercises (available from the web-page) will be revised briefly early in the course.

UNSW Moodle: Course notes, tutorial material, announcements, additional resources and internet links copies of other essential information will be provided on the course web pages via UNSW Moodle. **Students are recommended to download the lecture notes and bring them to lectures.**

Lectures: There will be four hours of lectures per week, starting in **week 1** and continuing until the Friday lecture in **week 12**.

	MATH2801	**MATH2901**
Wednesday 2pm–4pm	OMB-149	Webster Theatre A
Thursday 9am-10am	OMB-149	Webster Theatre B
Friday 9am–10am	Colombo Theatre C	Webster Theatre B

Public Holidays in 2018 and lecture arrangements:
In 2018 there are two public holidays affecting MATH2801 and MATH2901 lectures: Easter Friday on March 30th, and Anzac Day on Wednesday 25th April. We will not be scheduling make-up lectures, but there will be recorded material and problems available on Moodle for students to work through in their own time.

Tutorials: Tutorials will be held separately for MATH2801 and MATH2901. Each student will have one tutorial a week, **starting in week 2 and continuing until the end of week 13**. For times and room of your tutorial, see your timetable on MYUNSW. Tutorial questions are available from the course web page and students are strongly recommended to attempt them before class.
Computing: Some questions in assignments or tutorials involve a computing component, and students are expected to use the (free) statistics package `R`. This is available in the computer labs within the School of Mathematics and Statistics and is also downloadable from `cran.r-project.org`. There will be documentation on the course web page to introduce students to `R`.
To help to get you started with `R`, **week 2 tutes are held in the computer labs** and tutorials in later weeks are held in a tutorial room.

Course aims

This course is an introduction to the theoretical underpinnings of statistics, essential knowledge for anyone considering a career in quantitative modeling or data analysis. You will learn probability and distribution theory on which modern statistical practice is founded, and how to apply this theory to answer important practical questions raised in medical research, ecology, the media and more.

Relation to other mathematics courses: MATH2801/2901 is the entry-point for a statistics major and a prerequisite for most higher level statistics courses. It is compulsory for students doing a statistics major. It is also compulsory for mathematics majors to ensure an introduction to statistics as a discipline for studying stochastic (random) systems, as opposed to the deterministic. Statistics has important connections with many branches of mathematics and offers an interesting career path for the mathematically minded. This course is very useful for students who need an introduction to the fundamentals of statistics, from a mathematical perspective. MATH2901 will spend more time on proof and theoretical considerations, extension material and challenge questions. MATH2801 will focus more on core material and developing key skills in mathematical statistics.

Teaching strategies underpinning the course

New ideas and skills are introduced and demonstrated in lectures, then students develop these skills by applying them to specific tasks in tutorials and assessments.

We believe that effective learning is best supported by a climate of inquiry, in which students are actively engaged in the learning process. This course has a strong emphasis on problem-solving tasks in tutorials and in assessments. Students are expected to devote the majority of class and study time to the solving of such tasks.

Student Learning Outcomes

By the end of this course you should be able to:

- Apply probability rules in a given setting to calculate key quantities
- Use R to summarise data using descriptive statistics
- Use key theoretical tools to explore the properties of random variables
- Apply key methods of statistical inference in applied settings
- Use R to perform arithmetical and statistical computations
- *Derive fundamental results in the theory of probability and random variables
- *Apply core skills in new contexts

* Higher-order skills only expected of Distinction/High Distinction students.

Relation to graduate attributes – The above outcomes are related to the development of several Science Faculty Graduate Attributes.
Coursework will develop your analytical skills, hence there is a major focus on Attribute **1. – Research, inquiry and analytical thinking abilities**.
Foundation skills in theoretical statistics are essential for higher-level learning in statistics, so you will improve Attribute **2. – Capability and motivation for intellectual development** in statistics.
Discussions in class and written submissions for assessment will develop your skills at Attribute **4. – Communication** of statistical ideas.
Computing skills developed in this course will develop Attribute **6. Information Literacy**.

Assessment

UNSW assesses students under a standards based assessment policy. For how this is applied in the School of Mathematics and Statistics, see
http://www.maths.unsw.edu.au/currentstudents/assessment-policies

Assessment in MATH2801/2901 consists of:
two assignments (10% each), a mid-session test (20%) and a final examination (60%).

Assessment	date	weight
Assignment 1	9am Tuesday 20th March	10%
Assignment 2	9am Tuesday 22nd May	10%
Class test	9am Thursday 26th April (during lecture time)	20%
Final exam	During UNSW exam period	60%

The final examination for MATH2801/2901 will be held during the UNSW examination period, at a time and place to be announced later in the semester.

Every class is different and some variation from the above assessment schedule may be prudent. In the case of assessment dates, no changes will be made without consultation with the class as well as confirmation being announced on the course web page.

Assignments: The rationale for assignments is to give students feedback on their progress and mastery of the material, and to obtain measures of student progress towards the stated learning outcomes. Assessing using take-home assignments rather than under exam conditions offers the opportunity to assess more challenging questions, and gives you the opportunity to think more deeply about your responses. It also enables the assessment of computer-aided data analysis and problem solving.

Some questions may involve a computing component, for which you are required to use the (free) statistics package `R`, downloadable from `cran.r-project.org`.

Each assignments will be available on Moodle two weeks before the submission date. Assignments are to be submitted electronically - precise details of how they are to be presented/submitted will be given on Moodle.

Assignment 1 is due at 9am on Tuesday 20th March (Tuesday, week 4).
Having an assignment so early in the course gives students timely feedback, particularly on the setting out of their solutions, before the class test and other assessments.
Assignment 2 is due 9am on Tuesday 22nd May (Tuesday, week 12).

Students are strongly encouraged and expected to attempt both assignments as they are important part of the course at the time when they are due.
Late assignments: Late assignments may be accepted up to a week after the assignment is due, however any late assignments will occur a late penalty in the marks awarded.

Mid-session test: The mid-session test will be held on Thursday 26th April at 9am during the usual lecture time. More information about **where** the class test will be held and **what will be assessed** in the class test will be made available closer to the time in lectures and on Moodle. Students may provide their own UNSW-approved calculator for the mid-session test (calculators will not be provided).
Rationale: The mid-session test is held under exam conditions. It is designed to give students feedback on progress and mastery of the first parts of the course, **under exam conditions** and to evaluate progress towards the stated learning outcomes.

Illness and misadventure and the mid-session: If you miss the mid-session test due to illness or misadventure, then ensure you read the UNSW procedure for applying for Special Consideration and apply within 3 days in order to apply to sit for an additional assessment task. Also email the lecturer within 3 days so that you can arrange to take the additional assessment task if eligibility is approved.

Final examination

A 2 hour examination held during the examination period. A final exam is designed to assess student progress and mastery of the entire course. The final exam for MATH2901 exam will be more difficult than the final exam for MATH2801, however the exams will share some common questions or parts of questions. Further details about the final exam will be available closer to the time in lectures and on Moodle.

Assessment criteria

The main criteria for marking all assessment tasks will be clear and logical presentation of correct solutions. You will be assessed on the process by which you arrive at solutions as well as the solution itself, so it is important to include your working, and to set it out in a logical fashion.

Some of the assessment in MATH2801 and MATH2901 will involve common tasks.

Additional resources and support

UNSW Moodle All course materials will be available on UNSW Moodle course pages for MATH2801 and MATH2901.

Tutorial Exercises Each week, tutorial exercises will be chosen for the coming tutorial, and announced in lectures and on the web page. Please attempt these before your tutorial and bring copies of the tutorial questions with you to class.

Lecture notes Lecture notes and additional material are available from the web page. Lecture exercises are usually not completed in the notes – some will be worked through in lectures, the others should be attempted in your own time.

Textbooks The content of the course will be defined by the lectures. The following are recommended additional references.

Robert V. Hogg, Joseph W. McKean and Allen T. Craig (2005) "Introduction to mathematical statistics", sixth edition. Pearson Education, Upper Saddle River NJ. (In the library, Call number: `S 519.5/98 D` (High Use Collection)).

Note that Hogg *et al* not only covers MATH2801/2901 content, but also MATH3811, so it would be a useful resource for you throughout a statistics major.

John A. Rice (2007) "Mathematical Statistics and Data Analysis", third edition. Duxbury, Belmont CA. (Call number: 519.9/569 L (High Use Collection)).

Note that the book by Rice does not follow the content of MATH2801/2901 as closely as Hogg *et al*, but would be a useful source for alternative explanations of key concepts and practice exercises.

Dirk P. Kroese and Joshua C. C. Chan (2014) "Statistical Modeling and Computation: An Inclusive Approach to Statistics", Springer.

Course schedule

It is intended that the following topics will be covered in the given order.

Introduction
Part One – Summarising data - Descriptive statistics
Part Two – Modelling data - Random Variables, Common Distributions, Bivariate Distributions
Part Three – Collecting data - Introduction to Study Design
Part Four – Inference from data - Estimators and their properties, Distribution of sums and averages, Parameter estimation and inference, Hypothesis Testing, Small-sample inference for normal samples, Inference for categorical data.

Administrative matters

School Rules and Regulations: See the School of Mathematics and Statistics web page for general policy on additional assessment, and for fuller details of the general rules regarding attendance, release of marks, special consideration etc.

http://www.maths.unsw.edu.au/currentstudents/assessment-policies

Academic integrity, referencing and plagiarism

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage.
At UNSW, this means that your work must be your own, and others ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Issues you must be aware of regarding the university's policies on academic honesty and plagiarism can be found at `https://student.unsw.edu.au/plagiarism` and at the *ELISE* site `http://subjectguides.library.unsw.edu.au/elise`.
Additional resources concerning conduct obligations of students can be found on the *Conduct and Integrity Unit* site `https://student.unsw.edu.au/conduct` .