Course Profile

Welcome to the course profile for STAT7101 in Semester 2, 2005.

Objectives

The aim of STAT7101 is to provide an understanding of the nature of scientific data and the subsequent need for statistical analysis, and to develop your statistical expertise and critical judgement. You will learn about the different types of data and how each can be visualised and summarised, and how you can make conclusions and predictions from the statistical analysis. You will also see that these statistical tools are based on simple mathematical ideas and associated assumptions.

Contents Overview

The course contents will include

• The nature of data and the need for statistical analysis
• Designing surveys and experiments
• Graphical and numerical summaries of data
• Relationships between variables
• Probability models, random variables, conditional probabilities
• Binomial distribution, Poisson distribution, Normal distribution
• Expected values and combinations of random variables
• Sampling distributions, bias and precision
• Confidence intervals for means and proportions
• Odds, odds ratios and logistic regression
• Tests of significance and decision making
• Transformations of data
• Analysis of variance, regression, and correlation
• Goodness-of-fit tests
• Non-parametric procedures

Background

Students should have a sound understanding of mathematics equivalent to Mathematics B or MATH1040.

Resource Page


Blackboard Site

The course Blackboard site elearn.uq.edu.au will be used for communication.
Staff

Dr Katie Makar (Education)

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Teaching Mode

STAT7101 is taught externally. However, a regular tutorial will be offered during semester. The time
and venue for this tutorial will be arranged at the start of semester.

Note that the classes for STAT1201 at St Lucia match the content quite closely and may be attended by
STAT7101 students. Visit mySI-net to find the lecture times and room allocations.

Textbook and Workbook

The prescribed book is A Portable Introduction to Data Analysis (3rd Edition). A complimentary copy will
be sent to you at the start of semester.

Two traditional textbooks are available in the libraries for reference and additional exercises:


You will also receive a workbook which should be used as a study guide to pace your progress through
the textbook. This workbook gives learning goals and overviews of critical concepts, as well as further
exercises and readings related to the case studies (see page 6).
OStats and Practicals

Practicals

During semester you will be expected to complete 11 computer practicals which will be available on the web. You should try to do one of these roughly each week from Week 2. Each one should take about an hour to complete.

In the practicals you will use statistical software (OStats) to explore and analyse data, as well as to learn or reinforce some of the course content. You will be expected to use the skills you develop in the practicals in your project work. The statistical software is also available for use in your other courses.

Each practical involves a small task which you submit on the web. Each practical you complete correctly counts 1% to your overall grade. Results will be posted on the course Blackboard site.

OStats

The OStats statistical software is available for download from the Resource Page and can be used for free by current students and staff at the University of Queensland. Versions are currently available for Mac OS 8-9, Mac OS X, and Windows 98/NT/2000/XP. Please contact Michael Bulmer if you would be interested in a Linux version.

OStats is intended to be a tool and there is no way of entering data directly into it. Instead you should first enter data into something like a spreadsheet, or even a text editor or word processor. You can then copy and paste your data into OStats for exploration and analysis. There will also be data sets provided from the Resource Page which can be copied from the web browser into OStats. You can also save your files in OStats to open again later.
Assessment

Your final grade is calculated by adding up your marks for each of the assessment items, using the weights indicated in this section. Refer to the Assessment Criteria on page 11 for how the marks are translated to grades.

Note that the criteria on page 11 are also used as a general guide for marking each of the assessment items, particularly the projects, in addition to the specific marking guides included for each item.

Survey (1%)

At the start of semester we ask you to complete a basic survey to provide data for use in the lectures, tutorials, and practicals. This survey is completed online, via the Resource Page, and you can do it as part of the practical in Week 2. It should be completed by the end of Week 2 at the latest, and completing it counts 1% towards your final grade.

Haiku Project (1%)

The Haiku Project gives you an opportunity to express your view of statistics at the start of the course. It involves composing a haiku to express your view. This is to be submitted via the Resource Page by 5pm on Friday, August 5th. All submissions that show some effort will receive 1% towards the assessment of the course.

A short-list will be chosen from submissions by STAT1201 and STAT7101 students by a panel and then all students in the course can vote for the best work. There will be a prize for the winning entry of a $50 book voucher to the UQ Bookshop, with two runner-up prizes of $30 and $20.

Practicals (11%)

As noted on page 3, the weekly practical tasks count 1% each to your final grade.
Time Series Data (10%)

The aim of this project is to give you experience in collecting data and preparing a report using basic statistical summaries.

Data

Choose some variable which you can measure daily for at least 2 weeks, and which involves some uncertainty in the measurement process. For example, you could measure

- the time you spent studying or sleeping
- the weight of food you consumed
- the rainfall at your house
- the distance you travel each day

Note the date of each entry you record.

Analysis

Your report should start with a description of how the measurements were made and possible sources of measurement variability and bias that might be important.

The report should then summarize the data using relevant graphical methods, such as time plots and histograms, and relevant numerical measures, such as means, standard deviations, and boxplots. Describe the shape and patterns that you see. If there are any unusual observations, discuss their origin and whether or not they should be retained.

Conclude your report with a summary of the behaviour of the variable over time, such as whether it seems stable or if the behaviour is changing.

Submission

The project report is to be prepared and submitted via the web, though any word processor can be used for making drafts. Details will be available on the Resource Page. You can include up to two plots in your report. The report is due by 5pm on Friday, August 26th.

Assessment

This project is worth 10% to your final grade. Marks will be given as follows:

- Description of variable being measured and discussion of the measurement process (2 marks)
- Submission of data via the Resource Page (1 mark)
- Plots and numerical summaries with comments (4 marks)
- Description of behaviour over time (2 marks)
- Overall coherence of discussion (1 mark)
Case Studies (12%)

The web pages www.maths.uq.edu.au/courses/STAT7101/science give a series of case studies involving statistics in science. Each of these features a story aired on ABC’s Quantum or Catalyst science shows. References are given to show the research science that underlies the information given in the stories. Exercises are then given to show how statistical reasoning underlies this research.

For your Case Studies assignment you must answer three of the following questions. Additional questions are available on the web site for practice, but your three assignment questions must come from the five questions given below.

While this sheet is handed out at the start of semester, the required material for this project will not be covered in the course until early May. However, you may watch the videos and consult the references at any time.

1. In the Battles of the Sexes story, physical differences between males and females were identified using a test on throwing performance.
   (a) Briefly describe how the study was conducted, and any limitations it might have.
   (b) A similar experiment by Nelson et al. (1991) evaluated throwing distances of 13 boys and 13 girls at nine years in age. The average distance thrown by girls was 8.8 metres compared to 18.7 metres for boys, with standard deviations of 1.9 metres and 4.5 metres respectively. Calculate a 95% confidence interval for the difference between the mean male and female throwing distances. Is there evidence of a difference?

2. The Battles of the Sexes story showed an experiment on navigation (Malinowski, 2001) where sex differences in mental rotation skills were compared using a Mental Rotations Test.
   (a) Briefly describe how the study was conducted, and any limitations it might have.
   (b) The mean score for men (n = 142) was 24.6 (s = 7.82) and for women (n = 68) was 15.4 (s = 6.01). Conduct a t-test to determine whether males have higher scores than females.

3. The Homeopathy story includes a description of allergy studies conducted by Dr David Reilly to determine whether a homeopathic treatment is the same as a placebo treatment (Taylor et al., 2000).
   (a) Briefly describe how the studies were conducted, and any limitations they might have.
   (b) Reilly included an objective measure of rhinitis severity using a nasal inspiratory peak flow meter. For the morning measurements, the baseline peak flow for the homeopathy group (n = 24) had mean 98.1 L/min compared to the placebo group (n = 27) mean of 103.2 L/min, with standard deviations of 34.5 L/min and 32.9 L/min, respectively. After three weeks the homeopathy group (n = 23) saw a mean increase of 19.5 L/min compared to 5.4 L/min for the placebo group (n = 27), with standard deviations of the increases of 5.7 L/min and 3.3 L/min, respectively. Is there evidence of a difference in the peak flow increase between the two groups?

4. The Cholesterol story describes the study conducted by Whyte et al. (1977) in Papua New Guinea. One part of this study involved comparing the cholesterol levels of six subjects who were given a cholesterol supplement. The following table shows the plasma cholesterol levels at the end of the 28-day control period prior to the supplement, at the end of the 35-day period with the supplement, and at the end of the 35-day control period after the supplement.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Body Weight</th>
<th>Control (28 Days)</th>
<th>Test (35 Days)</th>
<th>Control (35 Days)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>68</td>
<td>4.74</td>
<td>4.79</td>
<td>4.90</td>
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<td>3</td>
<td>58</td>
<td>4.40</td>
<td>4.56</td>
<td>5.00</td>
</tr>
<tr>
<td>4</td>
<td>53</td>
<td>4.61</td>
<td>4.84</td>
<td>4.51</td>
</tr>
<tr>
<td>5</td>
<td>62</td>
<td>4.51</td>
<td>4.35</td>
<td>4.51</td>
</tr>
<tr>
<td>6</td>
<td>71</td>
<td>3.81</td>
<td>3.88</td>
<td>4.35</td>
</tr>
</tbody>
</table>

(a) Briefly describe how the study was conducted, and any limitations it might have.

(b) Carry out an appropriate $t$-test to see whether there is any difference in the mean plasma cholesterol levels between the initial control period and at the end of the supplement period.

5. The *Cholesterol* story describes a study by Clifton and Nestel (1992) on whether there were sex differences in the response of plasma lipids to dietary fat and cholesterol.

(a) Briefly describe how the study was conducted, and any limitations it might have.

(b) The results found that the 25 women on the supplement had an average increase in HDL of 0.20 mmol/L, with a standard error of 0.04 mmol/L. The 26 men on the supplement had an average increase in HDL of 0.11 mmol/L, with a standard error of 0.03 mmol/L. Is there any evidence of a difference in the mean HDL increase between males and females?

Submission

Your assignment must be neatly hand-written and submitted to Katie by Friday, October 14th. Each question will be worth 4% to your final grade and will be marked with 1% for each part (a) and 3% for each part (b).

References

You may need to consult the following papers when preparing your assignment. These are included in the course workbook.


Scholarly Paper Review (10%)

The aim of this project is to find a scholarly paper through the library that uses statistical inference, illustrating a confidence interval or a test of significance. You will then critically review the article’s use of these statistical methods in relation to the aims of their study. Articles will actually involve many uses of statistics. You only need to identify one confidence interval or significance test and discuss it.

There are courses running in the libraries which can show you how to access electronic journals and databases, as listed on

www.library.uq.edu.au/training/session2.html

Most papers in medical journals, scientific journals, and many in educational journals will use statistics. Avoid actual statistics journals as these mostly won’t have applications! The paper you obtain must have page numbers.

Note that each paper can only be reviewed by one student in STAT1201/STAT7101. Once you have found the paper you want to review, follow the ‘Paper Review’ link on the Resource Page and check that it is not already listed by another student. If it is okay then register it for yourself.

Submission

The project report is to be prepared and submitted via the web, though any word processor can be used for making drafts. Details will be available on the Resource Page. The report must be finalized by 5pm on Friday, October 21st.

As part of the submission, you must print or photocopy the first page of the paper and submit it to Katie before the due date. Write your name and student number at the top of the page.

Assessment

Your report of no more than 500 words on the paper should include

- a summary of the paper’s topic and objective (2 marks)
- a description of the experimental or survey protocol used, with comments on design aspects, if any, that may limit the study (2 marks)
- a summary of a statistical conclusion (2 marks)
- an explanation in layman’s terms of what the statistical conclusion suggests (2 marks)
- a bibliographic reference for the article (1 mark)
- a copy of the first page of the paper, submitted separately (1 mark)
Mid-Semester Exam (15%)

There will be a 1-hour mid-semester exam held in Week 8. This exam can either be sat at UQ or at your school. Arrangements will be made on an individual basis. This exam will be worth 15% of your grade.

The mid-semester exam will be a written exam in which you have to give solutions to statistical problems. A sample exam is included in the course workbook.

A calculator will be required for doing the mid-semester exam. Graphics calculators are allowed. You can refer to a single A4 sheet of notes (two-sided) during the exam.

Final Exam (40%)

A 2-hour examination will be held in the November examination period, covering the material in the whole course. This exam can either be sat at UQ or at your school. Arrangements will be made on an individual basis.

The final exam will be a written exam that presents a data set and asks a series of statistical questions about it. The exam is worth 40% of your final grade. A sample exam is included in the course workbook.

A calculator will be required for doing the final exam. Graphics calculators are allowed. You can refer to a single A4 sheet of notes (two-sided) during the exam.
**Assessment Guidelines**

**Assessment Timetable**

Below is a summary of the assessment during the semester.

<table>
<thead>
<tr>
<th>Week</th>
<th>Assessment Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Survey due</td>
<td>1%</td>
</tr>
<tr>
<td>Aug 5</td>
<td>Haiku Project due</td>
<td>1%</td>
</tr>
<tr>
<td>5</td>
<td>Time Series Project due</td>
<td>10%</td>
</tr>
<tr>
<td>Aug 26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mid-Semester Test</td>
<td>15%</td>
</tr>
<tr>
<td>11</td>
<td>Case Studies due</td>
<td>12%</td>
</tr>
<tr>
<td>Oct 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Paper Review due</td>
<td>10%</td>
</tr>
<tr>
<td>Oct 21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exams</td>
<td>Final Exam</td>
<td>40%</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Practicals</td>
<td>11%</td>
</tr>
</tbody>
</table>

**Late Assessment**

Late haiku projects, time series reports, case studies, and paper review reports will not be accepted unless arrangements have been made with Katie or Michael. This will typically require evidence of an illness or bereavement.

**Assessment Policy**

Students should be familiar with the rules which relate to assessment in their degrees as well as general university policy such as found in the General Award Rules. These are all set out on the Program and Course Information page on the UQ website www.uq.edu.au/student/courses
Assessment Criteria

To earn a Grade of 7, you must achieve a final mark between 85-100% by demonstrating an excellent understanding of the course material. You will be able to analyse a broad range of data settings, providing insight and thoroughness in the form of necessary assumptions and other factors that might affect the analysis. You will demonstrate excellent proficiency in communicating statistical ideas in writing and a high level of accuracy in graphical and numerical work.

To earn a Grade of 6, you must achieve a final mark between 75-84% by demonstrating a comprehensive understanding of the course material. You will be able to analyse most data settings, identifying important assumptions and other factors that might affect the analysis. You will demonstrate proficiency in communicating statistical ideas in writing and a high level of accuracy in graphical and numerical work.

To earn a Grade of 5, you must achieve a final mark between 65-74% by demonstrating an adequate understanding of the course material. You will be able to analyse many data settings, identifying the key assumptions that might affect the analysis. You will demonstrate the ability to write statistical reports and show accuracy in graphical and numerical work.

To earn a Grade of 4, you must achieve a final mark between 50-64% by demonstrating an understanding of the basic concepts of the course. You will be able to analyse the important data settings, identifying some key assumptions that might affect the analysis. You will demonstrate the ability to write statistical reports and show accuracy in graphical and numerical work.

To earn a Grade of 3, you must achieve a final mark between 45-49% by demonstrating some knowledge of the basic concepts of the course. You will be able to analyse the important data settings. You will demonstrate the ability to write statistical reports and show accuracy in graphical and numerical work.

To earn a Grade of 2, you must achieve a final mark between 20-44% by demonstrating some knowledge of the basic concepts of the course. You will be able to partially analyse a few important data settings. Written reports may be poor and accuracy in graphical and numerical work may be low.

To earn a Grade of 1, you must achieve a final mark between 0-19%. You will be able partially analyse very few data settings. Written reports will be poor and accuracy in graphical and numerical work will be low.
Graduate Attributes

The University has a statement of Graduate Attributes which describes core attributes to be developed in an undergraduate program. The following graduate attributes, taken from the University statement, will be emphasized in this course. Brief comments on how these will be developed are given. The full University statement is at www.uq.edu.au/hupp/index.html?policy=3.20.5

In-Depth Knowledge of the Field of Study

Through theory and applications in lectures and through hands-on work in projects and practicals you will develop

- A comprehensive and well-founded knowledge of the field of study.
- An understanding of how other disciplines relate to the field of study.

Effective Communication

Communication skills will be developed through informal interactions in tutorials and the collaborative project work. Written communication will be emphasised in reviewing scientific papers and writing project reports, which will also require the use of information resources. Through these activities you should develop

- The ability to collect, analyse, and organise information and ideas, and to convey those ideas clearly and fluently, in both written and spoken forms.
- The ability to interact effectively with others in order to work towards a common outcome.
- The ability to select and use the appropriate level, style and means of communication.
- The ability to engage effectively and appropriately with information and communication technologies.

Independence and Creativity

Project work is designed to encourage independence and creativity and develop

- The ability to identify problems, create solutions, innovate and improve current practices.

Critical Judgement

Analytical and critical thinking will be illustrated in lectures and in textbook readings. Activities in tutorials and project work will build on this to develop

- The ability to define and analyse problems
- The ability to apply critical reasoning to issues through independent thought and informed judgement
- The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.

Ethical And Social Understanding

An important part of statistics is the design of experiments within a social and ethical context. This will be emphasized in lecture examples to help develop

- An appreciation of the philosophical and social contexts of a discipline.
Other Policies and Procedures

Academic Integrity and Plagiarism

Below is the University’s definition of plagiarism:

Plagiarism is the action or practice of taking and using as one’s own the thoughts or writings of another (without acknowledgement). The following practices constitute acts of plagiarism and are a major infringement of the University’s academic values:

- where paragraphs, sentences, a single sentence or significant part of a sentence which are copied directly, are not enclosed in quotation marks and appropriately footnoted;
- where direct quotations are not used, but are paraphrased or summarised, and the source of the material is not acknowledged either by footnoting or other simple reference within the text of the paper;
- where an idea which appears elsewhere in print, film or electronic medium is used or developed without reference being made to the author or the source of that idea.

When a student knowingly plagiarises someone’s work, there is intent to gain an advantage and this may constitute misconduct.

Students are encouraged to study together and to discuss ideas, but this should not result in students handing in the same or similar project work (unless the students are working as a pair). Do not allow another student to copy your work. While students may discuss approaches to tackling an assignment problem, care must be taken to submit individual and different reports. Submitting the same or largely similar reports for a project may constitute misconduct.

For more information on the University policy on academic integrity and plagiarism, please refer to www.uq.edu.au/hupp/index.html?policy=3.40.12

Supplementary Examinations

A supplementary examination may be awarded in one course to students who obtain a grade of 2 or 3 in the final semester of their program and require this course to finish their degree. You should check the rules for your degree program for information on the possible award of supplementary examinations. Applications for supplementary examinations must be made to the Director of Studies in the Faculty.

Special Examinations

If a student is unable to sit a scheduled examination for medical or other adverse reasons, she/he can and should apply for a special examination. Applications made on medical grounds should be accompanied by a medical certificate; those on other grounds must be supported by a personal declaration stating the facts on which the application relies.

Applications for special examinations for central and end-of-semester exams must be made through the Student Centre. Applications for special examinations in school exams are made to the course coordinator.

More information on the University’s assessment policy may be found at www.uq.edu.au/hupp/index.html?policy=3.30.5
Feedback on Assessment

You may request feedback on assessment in this course progressively throughout the semester from the course coordinator. Feedback on assessment may include discussion, written comments on work, model answers, lists of common mistakes and the like.

Students may peruse examinations scripts and obtain feedback on performance in a final examination provided that the request is made within six months of the release of final course results. After a period of six months following the release of results, examination scripts may be destroyed.

Information on the University’s policy on access to feedback on assessment may be found at www.uq.edu.au/hupp/index.html?policy=3.30.6

Students with Disabilities

Any student with a disability who may require alternative academic arrangements in the course is encouraged to seek advice at the commencement of the semester from a Disability Adviser at Student Support Services.

A large-print edition of the textbook may be purchased from the Bookshop’s Print On Demand service.

Assistance for Students

Students with English language difficulties should contact the course coordinator or tutors for the course.

Students with English language difficulties who require development of their English skills should contact the Institute for Continuing and TESOL Education on extension 56565.

The Learning Assistance Unit located in the Relaxation Block in Student Support Services. You may consult learning advisers in the unit to provide assistance with study skills, writing assignments and the like. Individual sessions are available. Student Support Services also offers workshops to assist students. For more information, phone 51704 or on the web at www.sss.uq.edu.au.

Student Liaison Officer

The School of Physical Sciences has a Student Liaison Officer as an independent source of advice to assist students with resolving academic difficulties. The Student Liaison officer during 2005 will be Dr Peter Adams (pa@maths.uq.edu.au), Room 67-547, Extension 53276.