STAT830
Prelude to Bioinformatics
S1 Day 2015
Dept of Statistics

Contents

General Information 2
Learning Outcomes 2
Assessment Tasks 3
Delivery and Resources 5
Unit Schedule 6
Policies and Procedures 7
Graduate Capabilities 8
Changes from Previous Offering 10

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General Information

Unit convenor and teaching staff
Lecturer
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E4A 537
TBA

Credit points
4

Prerequisites
Admission to MBiotech or MBiotechMCom or MBioBus or MLabQAMgt or PGDipLabQAMgt or PGCertLabQAMgt or GradDipLabQAMgt or GradCertLabQAMgt

Corequisites

Co-badged status

Unit description
This unit introduces the statistical and probabilistic concepts that are the basis for the study of bioinformatics. Topics include an introduction to probability and conditional probability, probability distributions, sampling distributions and an introduction to Markov processes. Particular attention is paid to how they relate to specific applications in the field of bioinformatics. A basic understanding of calculus will be an advantage.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at http://students.mq.edu.au/student_admin/enrolmentguide/academicdates/

Learning Outcomes

1. Understand basic notions and fundamentals of Probability Theory.
2. Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.
4. Understand basic properties of Markov Chains. Be able to recognise Markov processes and understand how they can be used in applications.
5. Be able to apply the Probability Theory in DNA sequencing analysis.
6. Be familiar with basic principles of statistical data modelling using parametric and nonparametric methods.

**Assessment Tasks**

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>10%</td>
<td>Week 3</td>
</tr>
<tr>
<td>Test 2</td>
<td>10%</td>
<td>Week 6</td>
</tr>
<tr>
<td>Assignment</td>
<td>20%</td>
<td>Week 8</td>
</tr>
<tr>
<td>Test 3</td>
<td>10%</td>
<td>Week 11</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50%</td>
<td>University exam timetable</td>
</tr>
</tbody>
</table>

**Test 1**
Due: **Week 3**
Weighting: **10%**

Test 1 will be held in the tutorial time and will be 30 minutes long.

This Assessment Task relates to the following Learning Outcomes:
- Understand basic notions and fundamentals of Probability Theory.

**Test 2**
Due: **Week 6**
Weighting: **10%**

Test 2 will be held in the tutorial time and will be 30 minutes long.

This Assessment Task relates to the following Learning Outcomes:
- Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.
- Recognise validity of conditions for Hardy-Weinberg Equilibrium.
Assignment
Due: **Week 8**
Weighting: **20%**

Assignment questions will be made available through iLearn. Assignment is due 4.05 pm Monday 27/04/15 (Week 8) in tutorial class.

This Assessment Task relates to the following Learning Outcomes:
- Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.
- Recognise validity of conditions for Hardy-Weinberg Equilibrium.

Test 3
Due: **Week 11**
Weighting: **10%**

Test 3 will be held in the tutorial time and will be 30 minutes long.

This Assessment Task relates to the following Learning Outcomes:
- Understand basic properties of Markov Chains. Be able to recognise Markov processes and understand how they can be used in applications.
- Be able to apply the Probability Theory in DNA sequencing analysis.
- Be familiar with basic principles of statistical data modelling using parametric and nonparametric methods.

Final Examination
Due: **University exam timetable**
Weighting: **50%**

A three-hour final examination for this unit will be held during the University Examination period. You are permitted ONE A4 page of paper containing reference material printed or handwritten on both sides. The page will not be returned at the end of the final examination.

Calculators will be needed but must not be of the text/programmable type.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations at
The Macquarie university examination policy details can be viewed at 
http://www.mq.edu.au/policy/docs/examination/policy.htm

This Assessment Task relates to the following Learning Outcomes:

• Understand basic notions and fundamentals of Probability Theory.

• Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.

• Recognise validity of conditions for Hardy-Weinberg Equilibrium.

• Understand basic properties of Markov Chains. Be able to recognise Markov processes and understand how they can be used in applications.

• Be able to apply the Probability Theory in DNA sequencing analysis.

• Be familiar with basic principles of statistical data modelling using parametric and nonparametric methods.

Delivery and Resources

Classes

Lectures begin in Week 1. Tutorials begin in Week 2.

Students must attend two 1-hour lectures and two 1-hour tutorial per week.

The lecture notes will be made available on iLearn before the lecture.

Tutorial exercises will be set weekly and will be available on iLearn before the tutorial.

The timetable for classes can be found at http://www.timetables.mq.edu.au

iLearn

All unit materials including lecture notes, tutorials and instructions for assessment tasks and administrative updates, will be posted on iLearn at

https://ilearn.mq.edu.au/login/MQ/

Software

The statistical software R will be used. This is a free software environment for statistical computing and graphics and can be downloaded from the website

http://www.r-project.org/
R is also available in the computer labs in E4B. It is convenient to bring USB drive when using these computers.

Lab opening hours and conditions of use can be found at
http://www.businessandeconomics.mq.edu.au/new_and_current_students/undergraduate/student_resources/labs

**Required and recommended texts and materials**

There is no required textbook for this unit.

*Recommended reference sources are:*


**Unit Schedule**

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Lecture Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Introduction</td>
</tr>
<tr>
<td>W2</td>
<td>Random Variables, Probability Functions, Characteristics of Random Variables.</td>
</tr>
<tr>
<td>W3-W4</td>
<td>Hardy-Weinberg Equilibrium</td>
</tr>
</tbody>
</table>
### Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](http://mq.edu.au/policy/docs/). Students should be aware of the following policies in particular with regard to Learning and Teaching:


In addition, a number of other policies can be found in the [Learning and Teaching Category](http://mq.edu.au/policy/docs/) of Policy Central.

### Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student_conduct/](https://students.mq.edu.au/support/student_conduct/)

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<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>W5-W6</td>
<td>Statistical problems in DNA sequencing</td>
</tr>
<tr>
<td>W7-W8</td>
<td>Hypothesis testing and its applications</td>
</tr>
<tr>
<td>W9-W10</td>
<td>Markov Processes and their applications</td>
</tr>
<tr>
<td>W11-W12</td>
<td>Nonparametric statistics and its applications</td>
</tr>
<tr>
<td>W13</td>
<td>Review</td>
</tr>
</tbody>
</table>
Results
Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in *eStudent*. For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

Student Support
Macquarie University provides a range of support services for students. For details, visit [http://students.mq.edu.au/support/](http://students.mq.edu.au/support/)

Learning Skills
Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- **Workshops**
- **StudyWise**
- **Academic Integrity Module for Students**
- **Ask a Learning Adviser**

Student Enquiry Service
For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

Equity Support
Students with a disability are encouraged to contact the **Disability Service** who can provide appropriate help with any issues that arise during their studies.

IT Help

When using the University’s IT, you must adhere to the **Acceptable Use Policy**. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities
PG - Critical, Analytical and Integrative Thinking
Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:
Learning outcomes

- Understand basic notions and fundamentals of Probability Theory.
- Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.
- Recognise validity of conditions for Hardy-Weinberg Equilibrium.
- Understand basic properties of Markov Chains. Be able to recognise Markov processes and understand how they can be used in applications.
- Be able to apply the Probability Theory in DNA sequencing analysis.

Assessment tasks

- Test 1
- Test 2
- Assignment
- Test 3
- Final Examination

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- Understand basic notions and fundamentals of Probability Theory.
- Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.
- Recognise validity of conditions for Hardy-Weinberg Equilibrium.
- Understand basic properties of Markov Chains. Be able to recognise Markov processes and understand how they can be used in applications.
- Be familiar with basic principles of statistical data modelling using parametric and nonparametric methods.

Assessment tasks

- Test 1
- Test 2
PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- Familiarity with classes of discrete and continuous random variables and their distribution functions. Evaluate probabilities of events, expected values, variances and higher moments of random variables.
- Recognise validity of conditions for Hardy-Weinberg Equilibrium.
- Understand basic properties of Markov Chains. Be able to recognise Markov processes and understand how they can be used in applications.

Assessment tasks

- Test 2
- Assignment
- Test 3
- Final Examination

Changes from Previous Offering

An additional material has been developed as in current offering the unit will be delivered in a new format with 2 hours of lectures and 2 hours of tutorials instead of '1 hour lecture plus 1 hour tutorial ' previously. In the assessment part one out of two assignments will be replaced by class test.