



STAT7830

Statistical Methods in Bioinformatics

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

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General Information

Unit convenor and teaching staff

Unit Convenor/Lecturer

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Contact via Email

12WW 610

see iLearn

Credit points

10

Prerequisites

Admission to MRes

Corequisites

Co-badged status

STAT8830

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 <https://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Communicate the knowledge of fundamentals of Probability and Statistics using specific terminology.

ULO2: Use relevant terminology and describe the distribution functions and characteristics of some discrete and continuous random variables.

ULO3: Evaluate probabilities of events, expected values and variances of random variables.

ULO4: Apply statistical and probabilistic modelling approach to genetic data.

ULO5: Apply fundamental principles of statistical data analysis.

General Assessment Information

- If there are circumstances, that mean you will miss an assessment you should apply for Special Consideration via ask.mq.edu.au
- All assessment tasks must be submitted by the official due date and time.
- In the case of late submission for an assignment, if special consideration has NOT been granted, a 12-hour grace period will be given after which the following deductions will be applied to the awarded assessment mark: 12 to 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until five days beyond the due date (including weekends and/or public holidays).

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	10%	No	Week 4
Test	30%	No	Week 8
Assignment 2	10%	No	Week 11
Practical Test	50%	No	Week 12

Assignment 1

Assessment Type ¹: Quantitative analysis task

Indicative Time on Task ²: 28.5 hours

Due: **Week 4**

Weighting: **10%**

Reinforce and apply skills learned in computer labs through data analysis. The tasks given during computer lab sessions are to be completed within the allocated time and submitted via iLearn.

On successful completion you will be able to:

- Apply fundamental principles of statistical data analysis.

Test

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 1 hours

Due: **Week 8**

Weighting: **30%**

This is a paper based mid-semester test. Further information will be provided in the iLearn site of the unit.

On successful completion you will be able to:

- Use relevant terminology and describe the distribution functions and characteristics of some discrete and continuous random variables.
- Evaluate probabilities of events, expected values and variances of random variables.
- Apply statistical and probabilistic modelling approach to genetic data.

Assignment 2

Assessment Type ¹: Quantitative analysis task

Indicative Time on Task ²: 28.5 hours

Due: **Week 11**

Weighting: **10%**

Reinforce and apply skills learned in computer labs through data analysis. The tasks given during computer lab sessions are to be completed within the allocated time and submitted via iLearn.

On successful completion you will be able to:

- Apply fundamental principles of statistical data analysis.

Practical Test

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 2 hours

Due: **Week 12**

Weighting: **50%**

The practical test is designed to examine data analysis and R output interpretation skills taught in the unit.

On successful completion you will be able to:

- Communicate the knowledge of fundamentals of Probability and Statistics using specific terminology.
- Apply fundamental principles of statistical data analysis.

¹ If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this

type of assessment

- the [Writing Centre](#) for academic skills support.

² Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

Classes

Lectures begin in Week 1. SGTA begin in Week 2.

Students must attend two hours of lectures and two hours of SGTA per week. The lecture notes will be made available on iLearn before the lecture.

SGTA exercises will be set weekly and will be available on iLearn before each class.

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

iLearn

All unit related materials including lecture notes, SGTA's and instructions for assessment tasks and administrative updates, will be published on iLearn at

<https://ilearn.mq.edu.au/login/>

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/>

Texts and materials:

There is no required textbook for this unit.

Recommended reference sources:

1. W. P. Krijnen Applied Statistics for Bioinformatics using R, 2009: <http://cran.r-project.org/doc/contrib/Krijnen-IntroBioInfStatistics.pdf>
2. S. Draghici Statistics and Data Analysis for Microarrays Using R and Bioconductor. Chapman & Hall/CRC Mathematical and Computational Biology, 2nd Edition, 2012
3. W. J. Ewens and G. R. Grant. Statistical Methods in Bioinformatics, an Introduction. Springer, 2000
4. K. Lange. Mathematical and Statistical Methods for Genetic Analysis, Statistics for Biology and Health. Springer, 2002

Unit Schedule

Weeks	Lecture Topics	Due
W1	Introduction	
W2	Discrete random variables and their characteristics	
W3 - W5	Hardy-Weinberg Equilibrium (HWE); Departures from HWE; Statistical testing of HWE.	Week 4 Assignment 1
W6 - W7	HWE for X-linked loci. Introduction to continuous random variables: Uniform Distribution.	
MID-SESSION BREAK		
W8	Continuous random variables and their characteristics	Test
W10 - W11	Hypothesis testing and its applications	Week 11 Assignment 2
W12	Markov Chains and their applications	Practical Test

Policies and Procedures

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

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au)

[du.au](#)) and use the [search tool](#).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)

- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)

Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.