MEDI2201

Clinical Bioinformatics and Biostatistics

Session 2, In person-scheduled-weekday, North Ryde 2024

Macquarie Medical School

Contents

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General Information

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Credit points
10

Prerequisites
STAT170 or STAT1170

Corequisites

Co-badged status

Unit description

Did you know that approximately 80% of published medical research papers contain statistical errors? A huge proportion of professionals do not have the adequate statistical training to effectively communicate and report data from their research studies. Ever wonder why some clinical trials succeed in obtaining their proposed outcome while many fail? Failure in clinical trials could have been prevented with the proper biostatistical knowledge and skills. Using real-world problems that span the cutting-edge research fields of genomics, proteomics and metabolomics, we will show you how to apply computer programming and biostatistical skills to understand and investigate the underlying processes of human diseases and develop or improve treatments.

Targeted at students who have a basic understanding of, but more importantly, a keen interest in computing, programming, and statistics, this unit will allow you to explore coding languages to handle large datasets used in the health and medical research setting, interpret and communicate data generated from clinical research, and gain practical knowledge and training to tackle common biostatistical problems faced by medical professionals. This unit is ideal for students who are interested in a profession as a Data Scientist, Biostatistician, Clinician, Medical Researcher, Epidemiologist and Clinical Research Associate.

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: Apply fundamental knowledge of coding functions and statistical terminology and their relevance in biostatistics and bioinformatics.

ULO2: Appraise statistical approaches underpinning study design for research in genomics, proteomic and metabolomics.

ULO3: Organise and manage datasets generated from next generation sequencing technologies.

ULO4: Implement common statistical approaches to analyse genomic, proteomic and metabolomics data.

ULO5: Interpret statistical and graphical outputs to communicate biological processes that underlie human diseases and treatment response.

General Assessment Information

Grade descriptors and other information concerning grading are contained in the Macquarie University Assessment Policy.

All final grades are determined by a grading committee, in accordance with the Macquarie University Assessment Policy, and are not the sole responsibility of the Unit Convenor.

Students will be awarded a final grade and a mark which must correspond to the grade descriptors specified in the Assessment Procedure (clause 128).

To pass this unit, you must demonstrate sufficient evidence of achievement of the learning outcomes, meet any ungraded requirements, and achieve a final mark of 50 or better.

Further details for each assessment task will be available on iLearn.

Late Submission

Unless a Special Consideration request has been submitted and approved, a 5% penalty (OF THE TOTAL POSSIBLE MARK) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at 11.55pm. A 1-hour grace period is provided to students who experience a technical concern.

For example:

Number of days (hours) late	Total possible marks	Deduction	Raw mark	Final mark
1 day (1-24 hours)	100	5	75	70
2 days (24-48 hours)	100	10	75	65
3 days (48-72 hours)	100	15	75	60
7 days (144-168 hours)	100	35	75	40
>7 days (>168 hours)	100	-	75	0

For any late submissions of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for Special Consideration.

Special Consideration

If you are unable to complete an assessment task on or by the specified date due to circumstances that are unexpected, unavoidable, significantly disruptive and beyond your control, you may apply for special consideration in accordance with the Special Consideration Policy. Applications for special consideration must be supported by appropriate evidence and submitted via ask.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due
Online quizzes	20%	No	Week 4, 6, 8, 11 and 13

Name	Weighting	Hurdle	Due
Assignment	35%	No	Week 9
Final exam	45%	No	Exam Period

Online quizzes

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 15 hours
Due: **Week 4, 6, 8, 11 and 13**
Weighting: **20%**

Online quizzes using multiple choice questions to assess lecture and workshop content.

On successful completion you will be able to:
- Apply fundamental knowledge of coding functions and statistical terminology and their relevance in biostatistics and bioinformatics.
- Appraise statistical approaches underpinning study design for research in genomics, proteomic and metabolomics.
- Implement common statistical approaches to analyse genomic, proteomic and metabolomics data.
- Interpret statistical and graphical outputs to communicate biological processes that underlie human diseases and treatment response.

Assignment

Assessment Type [1]: Case study/analysis
Indicative Time on Task [2]: 30 hours
Due: **Week 9**
Weighting: **35%**

Formal report and analysis on an assigned case study.

On successful completion you will be able to:
- Apply fundamental knowledge of coding functions and statistical terminology and their relevance in biostatistics and bioinformatics.

- Organise and manage datasets generated from next generation sequencing technologies.

- Implement common statistical approaches to analyse genomic, proteomic and metabolomics data.

- Interpret statistical and graphical outputs to communicate biological processes that underlie human diseases and treatment response.

Final exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 30 hours
Due: **Exam Period**
Weighting: **45%**

Formal written exam assessing content delivered across the session using a combination of short answer and multiple choice questions. This task is completed under examination conditions during the university examination period.

On successful completion you will be able to:

- Apply fundamental knowledge of coding functions and statistical terminology and their relevance in biostatistics and bioinformatics.

- Appraise statistical approaches underpinning study design for research in genomics, proteomic and metabolomics.

- Organise and manage datasets generated from next generation sequencing technologies.

- Interpret statistical and graphical outputs to communicate biological processes that underlie human diseases and treatment response.

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[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

As a student enrolled in this unit, you will engage in a range of online and/or face-to-face learning activities, including self-readings notes, lectures, online discussion and workshops. Details can be found on the MEDI2201 iLearn site for this unit.

Technology Used

Active participation in the learning activities throughout the unit will require students to have access to a laptop or similar device. Students who do not own their own laptop computer may borrow one from the university library.

Unit Schedule

Week	Topic	Learning activities	Assessment
1	Lecture: Basic statistics & beyond, part 1 Coding: An introduction to programming in R	Lectures (online) Workshop (face-to-face)	
2	Lecture: Basic statistics & beyond, part 2 Coding: Common biostatistical methods	Lectures (online) Workshop (face-to-face)	
3	Lecture: Basic statistics & beyond, part 3 Coding: Data manipulation and biostatistical methods	Lectures (online) Workshop (face-to-face)	
4	Lecture: Applications in public health, part 1 Coding: Custom functions for public health applications	Lectures (online) Workshop (face-to-face)	Online quiz
5	Lecture: Applications in public health, part 2 Coding: Functions to estimate size and confouders	Lectures (online) Workshop (face-to-face)	
6	Lecture: Applications in genomics, part 1 Coding: Quality control filtering of genomic data	Lectures (online) Workshop (face-to-face)	Online quiz
7	Lecture: Applications in genomics, part 2 Coding: Genetic association studies	Lectures (online) Workshop (face-to-face)	
8	Revision	Workshop (face-to-face)	Online quiz
	RECESS		
9	Lecture: Applications in proteomics, part 1 Coding: NONE	Lectures (online) Workshop (face-to-face)	Case study analysis
10	Lecture: Applications in proteomics, part 2 Coding: NONE	Lectures (online) Workshop (face-to-face)	

Week	Topic	Learning activities	Assessment
11	Lecture: Applications in metabolomics, part 1 Coding: ROC analysis	Lectures (online) Workshop (face-to-face)	Online quiz
12	Lecture: Applications in metabolomics, part 2 Coding: Data analysis workflow	Lectures (online) Workshop (face-to-face)	
13	Revision	Workshop (face-to-face)	Online quiz
	EXAM PERIOD		Final exam

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (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). 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) 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 Advocacy provides independent advice on MQ policies, procedures, and processes

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.

Changes from Previous Offering

- The coding material will be taught in the programming language R instead of MATLAB.
- Online quizzes are now worth 4% each, totalling 20% of the final grade.
- The case study analysis is an individual project worth 35% of the final grade.
- The mid-session exam has been removed.
- The coding componenet of the final exam has been removed, and the final exam is now worth 45%.

Inclusion and Diversity

Social inclusion at Macquarie University is about giving everyone who has the potential to benefit from higher education the opportunity to study at university, participate in campus life and flourish in their chosen field. The University has made significant moves to promote an equitable, diverse and exciting campus community for the benefit of staff and students. It is your responsibility to contribute towards the development of an inclusive culture and practice in the areas of learning and teaching, research, and service orientation and delivery. As a member of the Macquarie University community, you must not discriminate against or harass others based on their sex, gender, race, marital status, carers' responsibilities, disability, sexual orientation, age, political conviction or religious belief. All staff and students are expected to display appropriate behaviour that is conducive to a healthy learning environment for everyone.

Professionalism

In the Faculty of Medicine, Health and Human Sciences, professionalism is a key capability embedded in all our courses.

As part of developing professionalism, students are expected to attend all small group interactive sessions including workshops, online practical, tutorial, and team-based learning activities. Some learning activities are recorded (e.g., face-to-face lectures), however you are encouraged to avoid relying upon such material as they do not recreate the whole learning experience and technical issues can and do occur. As an adult learner, we respect your decision to choose how you engage with your learning, but we would remind you that the learning opportunities we create for you have been done so to enable your success, and that by not engaging you may impact your ability to successfully complete this unit. We equally expect that you show respect

for the academic staff who have worked hard to develop meaningful activities and prioritise your learning by communicating with them in advance if you are unable to attend a small group interactive session.

Another dimension of professionalism is having respect for your peers. It is the right of every student to learn in an environment that is free of disruption and distraction. Please arrive to all learning activities on time, and if you are unavoidably detained, please join activity as quietly as possible to minimise disruption. Phones and other electronic devices that produce noise and other distractions must be turned off prior to entering class. Where your own device (e.g., laptop) is being used for class-related activities, you are asked to close down all other applications to avoid distraction to you and others. Please treat your fellow students with the utmost respect. If you are uncomfortable participating in any specific activity, please let the relevant academic know.

Unit information based on version 2024.04 of the Handbook