



BIOL12105 *Scientific Analysis and Statistics*

Term 2 - 2023

Profile information current as at 26/04/2024 01:44 am

All details in this unit profile for BIOL12105 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview

An understanding of experimental design, statistical methods, ethics and the ability to critically analyse scientific reports is essential for graduates in the sciences. In this unit, you will study experimental design, ethics and commonly used statistical procedures. You will be introduced to hypothesis testing and experimental design, parametric and non-parametric analyses, one, two and multi sample analyses (including one way, two way, and nested ANOVA designs, as well as multivariate analyses), correlation and regression, and data transformation. The learning and teaching strategy uses a clear, conceptual approach, which assumes that you have little or no statistical background.

Details

Career Level: *Undergraduate*

Unit Level: *Level 2*

Credit Points: 6

Student Contribution Band: 7

Fraction of Full-Time Student Load: 0.125

Pre-requisites or Co-requisites

Prerequisite: SCIE11023 Scientific Research Fundamentals or ESSC11004 Study and Research Skills for Health Science or SCIE11024 Science Investigation

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

Offerings For Term 2 - 2023

- Online

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

[Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

[Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Written Assessment**

Weighting: 25%

2. **Practical Assessment**

Weighting: 25%

3. **Online Quiz(zes)**

Weighting: 50%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the [CQUniversity Policy site](#).

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Moodle & in-class feedback

Feedback

Several students again expressed their appreciation of the shorter 'bite-sized' length of the lecture content, allowing them to learn and digest the key points before moving onto the next lecture.

Recommendation

Retain current lecture structure.

Feedback from Moodle feedback

Feedback

Some students expressed a desire to see additional explanation of the relevance of the lecture content to their chosen field of study, with additional examples.

Recommendation

While applied examples are always supplied for each lecture in an attempt to contextualize the concepts, additional examples will be inserted where relevant.

Unit Learning Outcomes

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

1. Describe the uses, pitfalls and limitations of parametric and non-parametric statistical tests
2. Choose an appropriate statistical test for a set of data
3. Correctly use software programs for analysing scientific data
4. Know when experiments require ethical clearance and explain the basic principles of ethical experimentation
5. Critique scientific reports and research proposals in terms of the quality of their experimental design
6. Design realistic experiments with appropriate control and replicates
7. Explain the rationale behind statistical testing and probability levels.

Alignment of Learning Outcomes, Assessment and Graduate Attributes



Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Written Assessment - 25%	•			•	•		
2 - Practical Assessment - 25%		•	•				
3 - Online Quiz(zes) - 50%	•	•		•	•	•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Communication				•	•		•
2 - Problem Solving	•	•	•		•	•	•
3 - Critical Thinking	•	•	•	•	•	•	
4 - Information Literacy							
5 - Team Work							
6 - Information Technology Competence			•				
7 - Cross Cultural Competence							
8 - Ethical practice		•	•		•	•	•
9 - Social Innovation							
10 - Aboriginal and Torres Strait Islander Cultures							

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 25%	•	•	•	•				•		
2 - Practical Assessment - 25%	•	•	•			•				
3 - Online Quiz(zes) - 50%	•	•	•					•		

Textbooks and Resources

Textbooks

BIOL12105

Prescribed

Statistics Explained

Edition: 2nd (2012)

Authors: Steve McKillup

Cambridge University Press

Cambridge, UK

ISBN: 978-0-521-18328-4

Binding: Paperback

[View textbooks at the CQUniversity Bookshop](#)

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- SPSS Statistical software (instructions for accessing will be provided during term)

Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)

For further information, see the Assessment Tasks.

Teaching Contacts

Andrew Irving Unit Coordinator

a.irving@cqu.edu.au

Schedule

Week 1 - 10 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Unit Introduction• What is science, logic, and reasoning?• The scientific method	McKillup Chapters 1 & 2	

Week 2 - 17 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Types of data• Fundamentals of sampling and experimental design	McKillup Chapters 3 & 4	

Week 3 - 24 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Making decisions from data• The normal distribution	McKillup Chapters 6 - 8	

Week 4 - 31 Jul 2023

Module/Topic	Chapter	Events and Submissions/Topic
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- One sample tests
- Two sample tests
- Decision errors

McKillup Chapters 9 & 10

Week 5 - 07 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Analysis of Variance (ANOVA) • Multiple comparisons 	McKillup Chapters 11 & 12	

Vacation Week - 14 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Week 6 - 21 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Assumptions and transformations for ANOVA • Two-way ANOVA 	McKillup Chapters 13 & 14	Critique of a research project summary Due: Week 6 Monday (21 Aug 2023) 11:45 pm AEST

Week 7 - 28 Aug 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Correlation • Regression 	McKillup Chapters 16 & 17	

Week 8 - 04 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Non-parametric tests • Chi-Square and related tests 	McKillup Chapters 19 & 20	

Week 9 - 11 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Non-parametric correlation 	McKillup Chapter 21	

Week 10 - 18 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Introduction to multivariate analysis • Principal components analysis • Multi-dimensional scaling • Cluster analysis 	McKillup Chapter 22	

Week 11 - 25 Sep 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Choosing the right test • Ethics in research 	McKillup Chapters 23 & 5	Practical analysis of research data Due: Week 11 Monday (25 Sept 2023) 11:45 pm AEST

Week 12 - 02 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Unit revision 		

Review/Exam Week - 09 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
		End-of-term online quiz Due: Review/Exam Week Monday (9 Oct 2023) 9:00 am AEST

Exam Week - 16 Oct 2023

Module/Topic	Chapter	Events and Submissions/Topic
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Term Specific Information

Please note that the lecture and assessment content for this unit is delivered online, and as such, will require your dedication to keep up with the provided learning materials throughout term. The Moodle page will be a central resource for accessing content, assignment instructions, as well as the teaching staff. Additional live "drop in, drop out" Zoom sessions will be run throughout term as an opportunity for you to ask questions and get live feedback from the teaching staff. These additional Zoom sessions are not compulsory to attend, but instead offer an additional forum for you to gain clarity about unit content and assessment requirements. The schedule for these additional live Zoom sessions will be made available on Moodle. There is no residential school for this unit, but there will be an 'at home' practical assessment that you will need to complete.

Assessment Tasks

1 Critique of a research project summary

Assessment Type

Written Assessment

Task Description

You are required to critique a summary description of a research project, using the knowledge you have gained so far in the unit (up to and including week 5 content).

You will be provided with a summary description of a research project that will contain conceptual and technical flaws in the approach to the research (including context/justification), methodology/experimental design, logic of thought, analysis and/or conclusions for you to consider. In your critique submission, you will need to:

- Identify the flaw(s) in approach, logic, methodology, analytical procedures, interpretation/conclusions,
- Describe why you consider it a flaw, and
- Present your specific solution to remedy the flaw, if possible (if you think a solution is not possible, explain why).

Note that statements such as "The entire methodology wasn't presented", "The summary is written in the first person", and other such broad perceived flaws won't attract any marks since this is a summary of a project, and not the full formal description (i.e. marks are awarded for focusing on the scientific validity of what is presented in the summary, and not what isn't presented).

You may present your findings as either regular prose (i.e. akin to an essay or report), as an expanded list of dot points, or as a table (most students find that a table is easiest to keep a logical train of thought between flaw identification, reasoning, and solution). Please choose whichever written format you consider will be most suited to conveying your thoughts.

There is a limit of 1000 words (+/- 10%) for this assignment.

Assessment Due Date

Week 6 Monday (21 Aug 2023) 11:45 pm AEST

Please submit your work as a Word document via Moodle. No PDF files will be accepted.

Return Date to Students

Week 8 Monday (4 Sept 2023)

Your work will be returned to you via Moodle.

Weighting

25%

Minimum mark or grade

50 %

Assessment Criteria

This assessment is worth 25 % of your overall unit grade, and will be marked according to the following criteria:

Flaw identification (33.33 % of final mark)

Reasoning why you think it's a flaw (33.33 % of final mark)

Solution to the flaw (33.33 % of final mark)

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Please submit your work as a Word document via Moodle. No PDF files will be accepted.

Learning Outcomes Assessed

- Describe the uses, pitfalls and limitations of parametric and non-parametric statistical tests
- Know when experiments require ethical clearance and explain the basic principles of ethical experimentation
- Critique scientific reports and research proposals in terms of the quality of their experimental design

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Ethical practice

2 Practical analysis of research data

Assessment Type

Practical Assessment

Task Description

You are required to evaluate the data acquired from three different experiments, suggest an appropriate statistical test for each, do the tests using the IBM SPSS statistics computer program, and interpret your results. An assessment template with the experimental data and questions to answer will be provided on the Moodle site. You will be able to type your answers directly into this template, and resubmit the file to Moodle for assessment. You will need to download/access the SPSS computer program for this assessment. Instructions on how to do this will be provided during the term.

Assessment Due Date

Week 11 Monday (25 Sept 2023) 11:45 pm AEST

Please submit your work as a Word document via Moodle. No PDF files will be accepted.

Return Date to Students

Review/Exam Week Monday (9 Oct 2023)

Your work will be returned to you via Moodle.

Weighting

25%

Minimum mark or grade

50 %

Assessment Criteria

This assessment is worth 25 % of your overall unit grade, and will be marked based on providing correct answers to the questions asked for each of the three experimental data sets provided to you. Each data set has 8 questions, with one point awarded per correct answer. Broadly, questions are focused on choosing the appropriate statistical test for the data provided, using it correctly, and providing a thorough and correct interpretation of the test.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Please submit your work as a Word document via Moodle. No PDF files will be accepted.

Learning Outcomes Assessed

- Choose an appropriate statistical test for a set of data
- Correctly use software programs for analysing scientific data

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence

3 End-of-term online quiz

Assessment Type

Online Quiz(zes)

Task Description

You will be required to complete an end of term online quiz that will test your knowledge of the entire content of the unit. The quiz will be in a similar format to a traditional end-of-term exam, requiring you to complete the task within a defined period of time (3 hours will be allowed once you start the quiz within a 24 hour window starting 9am Monday 9th of October). Some basic calculations will be required as practiced in the lecture content.

Number of Quizzes

1

Frequency of Quizzes

Other

Assessment Due Date

Review/Exam Week Monday (9 Oct 2023) 9:00 am AEST

Please complete the quiz on Moodle as instructed, ensuring you submit before the quiz closes at 9am Tuesday 10th October

Return Date to Students

Exam Week Friday (20 Oct 2023)

Your quiz will be marked online through Moodle.

Weighting

50%

Minimum mark or grade

50 %

Assessment Criteria

This quiz is worth 50 % of your overall unit grade. Each question in the quiz will be worth a different amount of marks depending on its complexity. Please attempt ALL questions to ensure you can get the highest mark possible. It is usually a good strategy to first attempt those questions that have the highest marks allocated to them, in case you run short of time. Example questions from previous end-of-term quizzes/exams will be provided as a study aid to you on Moodle.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Please complete the quiz on Moodle as instructed.

Learning Outcomes Assessed

- Describe the uses, pitfalls and limitations of parametric and non-parametric statistical tests
- Choose an appropriate statistical test for a set of data
- Know when experiments require ethical clearance and explain the basic principles of ethical experimentation
- Critique scientific reports and research proposals in terms of the quality of their experimental design
- Design realistic experiments with appropriate control and replicates
- Explain the rationale behind statistical testing and probability levels.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?



Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem