UNSW Course Outline

BINF3010 Applied Bioinformatics - 2024

Published on the 23 May 2024

General Course Information

Course Code : BINF3010
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Computer Science and Engineering
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Bioinformatics (the use of computing methods for the management and analysis of molecular biology data) has become an integral component of biomolecular sciences, especially genomics and proteomics. This course focuses on the principles and practical use of bioinformatics

methods and resources for the analysis of DNA and protein sequences and structures, as well as results from genomic, transcriptomic and proteomic experiments, with emphasis on their evolutionary underpinnings and statistical foundations. This course does not require programming, however it does involve the use of Linux.

Course Aims

Bioinformatics now pervades biological research, and new methods and technologies are constantly developed. This course is aimed at teaching bioinformatics from a *user*'s perspective (as opposed to that of a *developer*), to emphasise the use of bioinformatics to assist in biological discovery.

BINF3010 is the second bioinformatics course taken by students in a bioinformatics major, and is also available as an elective for students in a biology major who want to apply bioinformatics as part of biology research.

BINF9010 is available as an elective for postgraduate students with the assumed biology knowledge.

Since bioinformatics constantly evolves the goal is not to teach the use of specific tools and methods but to focus on *principles*, *limitations* and *assumptions* of common approaches to provide the means for students to research and evaluate new methods and apply them intelligently to produce meaningful results.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Explain the fundamental biology concepts that provide the context for bioinformatics, including sequence, structure and function as they relate to biological information macromolecules and molecular evolution
CLO2 : Use the UNIX shell to manage and analyse biological sequence and functional genomics data
CLO3 : Choose and use bioinformatics tools and databases to analyse biological sequences, structures and functional genomics data
CLO4 : Identify the strengths and limitations of the main approaches used in sequence and structural bioinformatics, functional genomics and systems biology
CLO5 : Analyse data from high-throughput molecular biology experiments using the R environment
CLO6 : Interpret and analyze data generated by proteomics experiments using bioinformatics
CLO7 : Choose and apply computational methods for predicting protein tertiary structure

Course Learning Outcomes	Assessment Item
CLO1 : Explain the fundamental biology concepts that provide the context for bioinformatics, including sequence, structure and function as they relate to biological information macromolecules and molecular evolution	• Mid Term Exam • Final Exam
CLO2 : Use the UNIX shell to manage and analyse biological sequence and functional genomics data	• Quizzes
CLO3 : Choose and use bioinformatics tools and databases to analyse biological sequences, structures and functional genomics data	• Quizzes
CLO4 : Identify the strengths and limitations of the main approaches used in sequence and structural bioinformatics, functional genomics and systems biology	• Mid Term Exam • Final Exam
CLO5 : Analyse data from high-throughput molecular biology experiments using the R environment	• Quizzes • Final Exam
CLO6 : Interpret and analyze data generated by proteomics experiments using bioinformatics	• Quizzes • Final Exam
CLO7 : Choose and apply computational methods for predicting protein tertiary structure	• Mid Term Exam • Quizzes

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Echo 360

Other Professional Outcomes

UNSW Graduate Capabilities

This course contributes to the development of the following graduate capabilities:

The skills involved in scholarly enquiry - students need to research, compare and evaluate different bioinformatics methods as part of the practical work and final examination

An in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context - bioinformatics is presented in the context of its applications to biology, and of the computer science methods it draws on

The capacity for analytical and critical thinking and for creative problem-solving - laboratory work and assignments require students to solve a range of problems by choosing appropriate bioinformatics methods and applying them

The ability to engage in independent and reflective learning - the midsession and final

examinations require students to reflect and provide a critical synthesis of the course contents

The skills required for collaborative and multidisciplinary work - the laboratory exercises are to be carried out in teams of mixed student background

The skills of effective communication - written communication is assessed principally through laboratory reports and the examinations. Effective communication between students of different backgrounds is also necessary for carrying out the laboratory assignments.

Additional Course Information

Assumed Knowledge

This course is about using bioinformatics methods for biological research. It is not about developing new bioinformatics methods. As such it assumes a working knowledge of molecular biology. Biology provides the context of the content and all the examples used in its presentation, and students with no knowledge of biology are likely to fail the course (this is especially important for postgraduate BINF9010 students as no biology prerequisite is available for these students). In terms of computing, the course only assumes ability to use computers, although a working knowledge of the UNIX command line and of the basics of the R statistical computing environment is an advantage. Some resources will be provided for students new to UNIX and R.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quizzes Assessment Format: Individual	30%	
Mid Term Exam Assessment Format: Individual	35%	
Final Exam Assessment Format: Individual	35%	

Assessment Details

Quizzes

Assessment Overview

Eight quizzes (one per week) assessing completion of lab work. Quizzes are administered through the LMS and are auto-marked by comparison to the true answers. Correct answers and

feedback are provided through the LMS after marking

Course Learning Outcomes

- CLO2 : Use the UNIX shell to manage and analyse biological sequence and functional genomics data
- CLO3 : Choose and use bioinformatics tools and databases to analyse biological sequences, structures and functional genomics data
- CLO5 : Analyse data from high-throughput molecular biology experiments using the R environment
- CLO6 : Interpret and analyze data generated by proteomics experiments using bioinformatics
- CLO7 : Choose and apply computational methods for predicting protein tertiary structure

Mid Term Exam

Assessment Overview

A 2 hour exam assessing weeks 1-5 content and consisting of short essay-type questions. The exam is marked by the lecturers who taught the content, based on correctness, relevance, completeness and clarity of the answers, and demonstration of understanding and integration of the content. Marks and some feedback are provided to the students

Course Learning Outcomes

- CLO1 : Explain the fundamental biology concepts that provide the context for bioinformatics, including sequence, structure and function as they relate to biological information macromolecules and molecular evolution
- CLO4 : Identify the strengths and limitations of the main approaches used in sequence and structural bioinformatics, functional genomics and systems biology
- CLO7 : Choose and apply computational methods for predicting protein tertiary structure

Final Exam

Assessment Overview

Exam run in the official UNSW exam period assessing weeks 7-10 content. The exam is marked by the lecturers who taught the content, based on correctness, relevance, completeness and clarity of the answers, and demonstration of understanding and integration of the content.

Course Learning Outcomes

- CLO1 : Explain the fundamental biology concepts that provide the context for bioinformatics, including sequence, structure and function as they relate to biological information macromolecules and molecular evolution
- CLO4 : Identify the strengths and limitations of the main approaches used in sequence and structural bioinformatics, functional genomics and systems biology
- CLO5 : Analyse data from high-throughput molecular biology experiments using the R environment

- CLO6 : Interpret and analyze data generated by proteomics experiments using bioinformatics

General Assessment Information

The exact exam platform is still being decided, and will be announced closer to the exam date.

The use of LLMs/ChatGPT is not allowed in exams as it is difficult to distinguish between justifiable use (eg to correct English expression and writing) and use that contravenes the university's plagiarism policy. If an exam is not face to face/invigilated, answers are likely to be processed through plagiarism-detection software which also identifies potential use of LLMs to write answers.

Grading Basis

Standard

Course Schedule

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

Moodle should be consulted for up to date course schedule, class descriptions and assessments. If there is any inconsistency in the description of activities between Moodle and other sources of information, such as course web pages, the description in Moodle applies.

Exact class times and locations are available through http://timetable.unsw.edu.au

Course Resources

Prescribed Resources

Moodle will be used for resources such as lecture slides and recordings (through echo360), lab specs, quizzes and other assessments

Microsoft Teams will be used for communication including announcements and forum-type discussions

Recommended Resources

There is no textbook for this course. Individual lecturers will provide lists of reference books and articles.

Readings and discussion boards will be made available on Moodle.

A number of bioinformatics textbooks are available through the UNSW Library for reference reading. One starting point for assistance is: info.library.unsw.edu.au/web/services/services.html

Course Evaluation and Development

Feedback on this course and on individual lecturers will be gathered through a survey at the end of session, as part of the MyExperience process. Feedback from this survey is the basis for improving the course in subsequent years. In response to feedback from 2023, some of the course content has been updated.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Paul Curmi				Please contact by email or through Teams	No	No
	Peter Humburg				Please contact by email or through Teams	No	No
	Irina Voineagu				Please contact by email or through Teams	No	No
	Sara Ballouz				Please contact by email or through Teams	No	No
	Mark Raftery				Please contact by email or through Teams	No	No
	Fatemeh Vafaee				Please contact by email or through Teams	No	No
Convenor	Raymond Louie				Please contact by email or through Teams	Yes	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be

awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School Contact Information

CSE Help! - on the Ground Floor of K17

- For assistance with coursework assessments.

The Nucleus Student Hub - https://nucleus.unsw.edu.au/en/contact-us

- Course enrolment queries.

Grievance Officer - grievance-officer@cse.unsw.edu.au

- If the course convenor gives an inadequate response to a query or when the courses convenor does not respond to a query about assessment.

Student Reps - stureps@cse.unsw.edu.au

- If some aspect of a course needs urgent improvement. (e.g. Nobody responding to forum queries, cannot understand the lecturer)

You should **never** contact any of the following people directly:

- Vice Chancellor

- Pro-vice Chancellor Education (PVCE)

- Head of School

- CSE administrative staff

- CSE teaching support staff

They will simply bounce the email to one of the above, thereby creating an unnecessary level of indirection and a delay in the response.