Course Outline

Contents

- Course Details
- Course Summary
- Assumed Knowledge
- Student Learning Outcomes
- Teaching Strategies
- Teaching Rationale
- Student Conduct
- Assessment
- Course Schedule
- Resources for Students
- Course Evaluation and Development

Course Details

Course Code	BINF2010
Course Title	Introduction to Bioinformatics
Convenor	Bruno Gaeta (/users/z8670378)
Admin	Bruno Gaeta (/users/z8670378)
Classes	**Lectures** : lectures will be delivered online using Microsoft Teams Labs: labs will also be held online, as self-directed exercises with assistance provided using Zoom. Timetable for all classes (/BINF2010/20T3/timetable)
Consultations	by appointment
Units of Credit	6
Course Website	https://moodle.telt.unsw.edu.au/course/view.php?id=53623 (http://cse.unsw.edu.au/~bi2010/20T3/)
Handbook Entry	http://www.handbook.unsw.edu.au/undergraduate/courses/current/BINF2010.html (http://www.handbook.unsw.edu.au/undergraduate/courses/current/BINF2010.html)

Course Summary

The course surveys the major areas of bioinformatics, exploring the history of bioinformatics in relation to advances in computing hardware and software; the biological problems currently being addressed using bioinformatics; and future applications of bioinformatics. Major topics include genomics; genome sequencing projects; proteomics; structural genomics; systems biology; phylogeny; medical informatics; and commercial

applications of bioinformatics. The general nature of the data, computational problems and the approaches employed will be discussed in each case. Bioinformatics will be discussed both as a scientific discipline and as an engineering discipline. The course will also explore the role of bioinformatics in the biotechnology and pharmaceutical industries and ethical issues associated with biological data. Lectures are supplemented by practical exposure to bioinformatics web sites and to commonly used bioinformatics software.

Assumed Knowledge

- The course assumes familiarity with fundamental concepts in molecular biology as covered in the prerequisite courses BABS1201 or DPST1051
- Some knowledge of basic probabilities and statistics (HSC level) is also assumed

Student Learning Outcomes

After completing this course, students will:

L01. Define bioinformatics and provide examples of common uses in analysing genome, protein and expression data and in modelling biological systems

L02. Describe some common application areas of bioinformatics and the techniques used therein (genome annotation, rational drug design, medical genomics etc) and describe and explain some common bioinformatics algorithms and common data types used in these applications

L03. Explain the use of and perform common bioinformatics procedures using commonly available software and websites, including: retrieving relevant sequences and structures from databases; identifying ORFs in a DNA sequence; identifying the function of an unknown sequence by similarity searching; identifying the function of an unknown sequence by pattern searches or based on physicochemical properties; creating a multiple sequence alignment and a phylogenetic tree;

L04. Use the UNIX command line and write simple shell scripts to perform basic file management tasks and launch bioinformatics programs

L05. Discuss the impact of bioinformatics on modern biology and relevant ethical and social issues

L06. Identify and discuss some engineering challenges common in bioinformatics

L07. Use R to visualise complex data and analyse transcriptomics data

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

Graduate Capability	**Acquired in**
Scholars capable of independent and collaborative enquiry, rigorous in their analysis, critique and reflection, and able to innovate by applying their knowledge and skills to the solution of novel as well as routine problems	Lectures and labs
Professionals capable of ethical, self- directed practice and independent lifelong learning	Lectures and discussions
Global citizens who are culturally adept and capable of respecting diversity and acting in a socially just and responsible way	Lectures and discussions

Teaching Strategies

- Lectures are structured to emphasise the bioinformatics analysis process. Each lecture module starts with a discussion of the biology context, followed by a discussion of bioinformatics approaches, then of relevant computer science algorithms. Guest lecturers provide illustrations of applications in industry and current research.
- Computer laboratory work and assignments that demonstrate the use of software and interpretation of outputs.

Teaching Rationale

Lectures and labs are structured to emphasise the interdisciplinary nature of bioinformatics, starting with a biological problem that is solved using mathematical and computational representations and methods. Labs, case studies discussed by guest lecturers and assignments allow students to apply the concepts discussed in the lectures.

Student Conduct

The **Student Code of Conduct** (Information (https://student.unsw.edu.au/conduct) , Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them, and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer (mailto:ethics-officer@cse.unsw.edu.au) , Grievance Officer (mailto:grievance-officer@cse.unsw.edu.au) , or one of the student representatives.

Plagiarism is defined as (https://student.unsw.edu.au/plagiarism) using the words or ideas of others and presenting them as your own. UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and 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.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism (https://student.unsw.edu.au/plagiarism)

The pages below describe the policies and procedures in more detail:

- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy Statement (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

COVID-19 FAQs

1. **https://www.covid-19.unsw.edu.au/safe-return-campu... (https://www.covid-19.unsw.edu.au/safe-return-campus-faqs)**
2. **https://edtech.eng.unsw.edu.au/c19mess/comms.html (https://edtech.eng.unsw.edu.au/c19mess/comms.html)**

Assessment

Item	Topics	Due	Marks	Contributes to
Lab quizzes	All topics	Weeks 3,4,8,9,10	25%	L03, L04. L07
Assignment	Shell scripting a bioinformatics pipeline	Week 9	15%	L03, L04
Midterm Exam	Exam covering weeks 1-4	Week 5	20%	L01, L02, L05
Final Exam	Exam covering all course with emphasis on weeks 5-10	Exam period	40%	L01, L02, L06

Course Schedule

Week	Lectures Wed 3-5 (2 hours)	Lectures Fri 9-10	Labs (Fri 10-12)	Assignments
1	Introduction to bioinformatics. Sequence data, evolution and alignment (BG)	Sequence databases, RESTful APIs (BG)	Introduction to UNIX command line (optional) (BG)	-
2	Sequence alignment by dynamic programming (BG)	Database searching and multiple sequence alignment (BG)	Basic sequence analysis using EMBOSS (BG)	Human genome video and quiz

3	Genome informatics: applications and assembly algorithms, annotation and genome databases (BG)	Phylogeny inference and UPGMA algorithm (BG)	Phylogeny and UPGMA (BG)	Week 2 lab quiz due
4	Structural bioinformatics (BG)	Case study: characterising a new protein (BG)	Structural bioinformatics (BG)	Week 3 lab quiz due
5	Midterm exam	Case studies: long read assembly of diploid genomes (Rich Edwards)	Advanced UNIX and shell scripting (optional) (BG)	Week 4 lab quiz due
6	FLEXIBILITY WEEK			
7	Proteomics (Marc Wilkins)	Proteomics (Marc Wilkins)	Proteomics (Marc Wilkins)	
8	Transcriptomics (Mike Bain)	Transcriptomics (Mike Bain)	Transcriptome analysis using R (Mike Bain)	Week 7 lab quiz due
9	Experimental design (Peter Humburg)	Case study: medical application of human genomics and transcriptomics (Fabio Luciani)	Data visualisation using R (Rich Edwards)	Scripting assignment due
10	Bioinformatics in medicinal product development; Case studies in translational medicine (Yunki Yau)	Distributed and application-specific hardware in bioinformatics (BG)	Workflow management using Galaxy (BG)	Weeks 8, 9, 10 lab quizzes due

Resources for Students

- There is no required textbook however a recommended book for this course is “Digital Code of Life – How Bioinformatics is Revolutionizing Science, Medicine and Business” by Glyn Moody. This is quite an entertaining book that discusses the history and context of bioinformatics. This book does not cover the same materials as the course, but provides background information and context on most sections of the course, in a very readable format.
- Lecture slides, discussion forums, announcements and assignment specs will be made available on the course moodle website (accessible through my.unsw)
- Lectures will be delivered and recorded using MS Teams. Assistance in the labs will be provided using Zoom.

Course Evaluation and Development

This course will be evaluated through the online MyExperience process at the end of session. Individual lecturers may also distribute surveys on their own teaching. Feedback from these surveys is taken seriously and you are encouraged to respond. As a result from feedback from 2019, the scripting assignment has been revised to avoid issues with the NCBI BLAST API.

Resource created 10 months ago (Tuesday 01 September 2020, 09:44:05 AM), last modified 9 months ago (Monday 07 September 2020, 12:07:22 PM).

Comments

(/BINF2010/20T3/forums/search?forum_choice=resource/50797) (/BINF2010/20T3/forums/resource/50797)

There are no comments yet.