FACULTY of ENGINEERING

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING,

BINF1001

BIOINFORMATICS 1

SESSION 2, 2011

Course staff

Course Convener:

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Lecturers

MB- Mike Bain (mike@cse.unsw.edu.au)
SD – Sven Delaney (s.delaney@unsw.edu.au)
RG – Renate Griffith (R.Griffith@unsw.edu.au)
GT – Guy Tsafnat, Centre for Health Informatics
TT – Torsten Thomas (t.thomas@unsw.edu.au)
MW - Marc Wilkins (marc.wilkins@unsw.edu.au)

Course details

This course is worth 6 units of credit and includes 2 hours of lectures and 3 hours of practicals/tutorials per week.

Course aims and learning outcomes

To provide an overview of the field of bioinformatics and its impact on modern biology, together with its industrial and computing context.

By the end of this course you should be able to:

- Define bioinformatics and provide examples of common uses in analysing genome, protein and expression data and in modelling biological systems
- Provide examples of the impact of bioinformatics on biological research (eg the Human Genome project, computer-assisted drug design, systems biology)
- Outline the fundamentals of biology that underlie bioinformatics, including: basic cell structure and physiology; inheritance; basic principles of chemistry/structure of nucleic acids and proteins; the central dogma; evolution and the diversity of life;
- Identify and describe common bioinformatics data types including sequences, structures, and expression data; outline how these data are obtained
- 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;
- Discuss the industrial and commercial context of bioinformatics including biotech and pharmaceutical industries, health informatics, software industry and models of software licensing

Teaching approach and 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.
- Lectures are supplemented by computer laboratory work and assignments that demonstrate the use of software and interpretation of outputs, and programming assignments that require students to implement algorithms discussed in lectures and tutorials
- Group tutorial work assess teamwork and communication skills

UNSW graduate attributes especially developed in the course include:

- *The skills involved in scholarly enquiry* – students need to research, compare and evaluate different bioinformatics methods as part of the practical work and sequence annotation assignment
- *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 requires 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 final examination especially requires students to reflect and provide a critical synthesis of the course contents
- *A respect for ethical practice and social responsibility* – the Human Genome tutorial involves discussion and reflection on ethical considerations of the Human Genome Project
- *The skills of effective communication* – written communication is assessed principally through laboratory reports, sequence annotation assignment and the midsession and final examinations.

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 website: http://www.cse.unsw.edu.au/~bi1001
- See on the next page for instructions for login on the course website

Course evaluation and development

This course will be evaluated through the online CATEI 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. Action from feedback from previous years has led to a stronger integration between the computer science and biology components of the course, adoption of a reference textbook, change in assessment weight for the midsession exam, reinforcement of the biology component, and coordination between practicals and lectures. Feedback from last year on one section of the course has led to a change of lecturer for that section.

Assessment

- Sequence annotation assignment 20%
  Each student will be assigned a DNA sequence to annotate by choosing and using a range of bioinformatics tools. Students are expected to submit a web report on the sequence discussing their results and the process they used to obtain them. This exercise assesses the ability to evaluate and use bioinformatics tools and interpret their output, as well as written communication and web design skills
- Laboratory and tutorial work 20%
  Marks from short reports on laboratory work and presentations and participation in tutorials
- Biology quizzes 5%
  Online quizzes on biology. These ensure that students understand enough biology to understand bioinformatics lectures
- Midsession exam 15%
  A one hour exam in the middle of session
- Final exam 40%
  A formal exam in the exam period

Course schedule

Lectures are held on Mondays and Wednesdays in Mathews 104 (K-F23-104). The Tuesday 2-5 slot is either a tutorial (location TBA) (shown in *italics*) or a laboratory (shown in **bold**) in the Bugle lab (overflow in Moog lab). Note that labs and tutorials are not held every week.

IMPORTANT: Students without a CSE computer account ***must*** contact the CSE student office before week 3 to set up and activate their account.

Wk	Starting	Lec 1 Mon 11-12 Mat 104	**Lab Tue 2-5** *Tutorial Tue 2-4*	Lec 2 Wed 12-1 Mat 104
1	18/07	-	-	-
2	25/07	Biology (SD)	-	Biology (SD)
3	1/08	What is bioinformatics (BG)	**Bioinformatics websites (BG)**	What is bioinformatics (BG)
4	8/08	Sequence analysis (MW)	-	Sequence analysis (BG)
5	15/08	Phylogeny (BG)	**Sequence analysis (BG)**	DNA sequencing (TT)
6	22/08	Environmental genomics (TT)	**Phylogeny (BG)**	String alignment (MB)
7	29/08	String alignment (MB)	*Human Genome (BG)*	Health informatics (GT)
Break	5/09			
8	12/09	Microarrays (MB)	*Midsession exam*	Microarrays (MB)
9	19/09	Microarrays (MB)	**Microarrays (MB)**	Systems biology (MB)
10	26/09	Proteomics (MW)	-	Proteomics (MW)
11	3/10	Proteomics (MW)	**Proteomics (MW)**	Structural bioinformatics (BG)
12	10/10	Structural bioinformatics (BG)	**Structural bioinformatics (BG)**	Bioinformatics in drug design (RG)
13	17/10	Bioinformatics as engineering (BG)	*Revision/consultation*	Bioinformatics as engineering (BG)

IMPORTANT NOTE: GETTING STARTED WITH THE COURSE WEBSITE

You need a CSE account in order to log in the course website. Students who do not have a CSE account MUST contact the CSE student office before week 3 to obtain an account. The CSE Lab Help Desk (ground floor Mech Eng building) can provide assistance in activating the account. Once your account is activated you can use your login and password to log onto the course website. The first time you log in you will need an enrolment key for the course. This enrolment key is TINDALL

Academic honesty and plagiarism

What is Plagiarism?
Plagiarism is the presentation of the thoughts or work of another as one's own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students 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 items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.

Other matters
Please refer to the "yellow form" for important information and policies regarding the use of CSE facilities, OHS, special consideration and supplementary assessment, accessibility etc. The form is available online at:
http://www.cse.unsw.edu.au/~studentoffice/policies/yellowform.html