Fall 2011

CS/BIO 471/671: Algorithms for Bioinformatics

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CS/BIO 471/671 – ALGORITHMS FOR BIOINFORMATICS

Fall, 2011

Course Description

Theory-oriented approach to the application of contemporary algorithms to bioinformatics. Graph theory, complexity theory, dynamic programming and optimization techniques are introduced in the context of application toward solving specific computational problems in molecular genetics. 4 credit hours.

Meeting Time and Place

12:15 – 1:20 Monday and Wednesday 050 Rike

Textbooks

J. Setubal and J. Meidanis (1997), *Introduction to Molecular Biology*, Brooks/Cole Publishing, ISBN: 0-534-95262-3

D. Krane and M. Raymer (2003), *Fundamental Concepts of Bioinformatics*, Benjamin Cummings, ISBN: 0-8053-4633-3

Instructors and Office Hours

Dr. Michael Raymer
391 Joshi
775-5110

michael.raymer@wright.edu
http://www.wright.edu/~michael.raymer
Office hours: Mon & Wed, 3:00 – 5:00 pm
or by appointment. See course web page for details.

Dr. Dan Krane
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775-2257

dan.krane@wright.edu
Office hours: Mon & Wed, 9:00 – 10:00 am
or by appointment.

Course Web Page

The course web page will be the primary method for distributing important announcements, course material, class notes, etc. Please check the page often. Login to the campus D2L system using your CATS username and password. The URL is: http://pilot.wright.edu

You can find an archive of the course materials at: http://birg.cs.wright.edu/cs471

Grading

Course grades will be determined as follows:

25% Midterm Exam
40% Final Exam
35% Project/homework assignment(s)

Final grades will be based on the standard university-wide score divisions (i.e. 90%, 80%, 70%, etc.). However, the instructors may choose to curve the final grades depending on the distribution of scores at the end of the term.

Tentative Lecture Schedule

Week 1 – Review: Molecular biology and problem solving methods
- Tools and methods of molecular biology [K]
- Codons, codon bias, proteins and metabolic efficiency [K]
- Sequence alignments and dynamic programming [R]

Week 2 – Paper discussion: Raiford, 2009, JME: *S. cerevisia* metabolic efficiency
- Term project teams assignment

Week 3 – Paper discussion: Heizer, 2011: metabolic efficiency
- Term project planning, first assignment

Week 4 – Sequence alignments and dynamic programming, cont'd
- Molecular evolution – how genomes change over time [K]
- Subproblem optimality and dynamic programming [R]
- BLAST and other search methods [R]

Week 5 – Algorithm complexity, P and NP (Class notes)
- Complexity of algorithms [R]
- Big-O notation [R]
- Complexity classes, P and NP [R]
- Some classic algorithms [R]

MIDTERM EXAM – *Date TBA*

Week 6 – Presentations of Term Project Progress

Week 6 – Sequencing and Comparative Genomics (Ch4. Setubal & Meidanis)
- Sequence annotation [K]
- Synteny [K]
- Models and tools for fragment assembly [R]

Week 7 – Mapping of DNA (Ch. 5, Setubal & Meidanis)
- Genetic mapping [K]
- Restriction site mapping, hybridization mapping [K]
- LOD Scores, QTLs, Sulston scores [K]
- Algorithms for mapping [R]

Week 8 – Phylogenetics (Chs. 4 & 5, Krane & Raymer)
- Trees and distances [K]
- Distance-based and character-based approaches [K]
- Bootstrapping and confidence [K]
- Selective forces and population size [k]

Week 9 – Suffix tries and inverted repeats (Class notes)
- Trees, tries, and PATRICIA trees [R]
- Inverted repeats and microRNA [R]

Week 10 – Project results presentations/discussion

Policies & Notes

Collaboration in learning is encouraged, as discussion of the course contents with other students is an important part of the learning process. However, it is expected that **course assignments will be completed *on an individual basis* unless the assignment states otherwise.**

Students may not, under any circumstances, work together in actual implementation of any course assignment unless the assignment specifically allows group submissions. Do not allow other students to view or copy your code or writing. Code sharing, including code from previous quarters, is strictly disallowed. Copying or significant collaboration on any graded assignment will be considered a violation of university guidelines for academic integrity and reported to the Office of Judicial Affairs. The Code of Student Conduct can be viewed at http://www.wright.edu/students/judicial/conduct.html or a hand copy can be obtained from the Office of Student Judicial Services in W035 Student Union. If you have any questions about these policies, it is your responsibility to discuss them with the instructor of the course or a representative of the Office of Judicial Affairs as soon as possible.

If the same work is turned in by two or more students, all parties will be held equally accountable for violation of academic integrity. In other words, *you are responsible for ensuring that other students do not have access to your work*. If you suspect that your work material has been compromised, notify an instructor immediately.