CS612, Algorithms in Bioinformatics – Syllabus

Spring 2016

Instructor: Nurit Haspel (nurit@haspel.umb.edu)

Course Description

This course will introduce students to bioinformatics – the area concerning the development and application of computational methods to address key problems in biology. It will introduce the students to a variety of methods and skills required to conduct research in this highly rising field. The emphasis of the course is structural bioinformatics with focus on various computational methods to simulate, analyze and model protein structure, dynamics and function. Other subjects such as systems biology, genomics and interaction networks will be introduced as well. The course is designed first and foremost for computer scientists but is also open to biology majors with adequate computational/mathematical background, subject to permission from the instructor.

Prerequisites

- CS210 (Intermediate Computing).
- MATH 260 (Linear Algebra).

Or permission from the instructor. Knowledge in biology is not required but is an advantage. This is a graduate course but highly motivated undergraduate students are welcome to register.

Textbook

There is no required textbook. Much of the material is available as papers or online. The following books are recommended:


Topics

- Introduction to biochemistry and molecular biology – molecules, proteins, DNA, RNA.
- Protein sequence alignment and database search.
- Protein structure representation and visualization.
• Structural classification and databases: PDB, SCOP, CATH and others.
• Protein structural prediction – the protein folding problem and the CASP challenge.
• Exploration of protein dynamics – biomolecular simulations, force fields, Molecular Dynamics, Monte Carlo simulations.
• Geometric algorithms for rapid molecular conformational sampling.
• Protein-protein interactions and docking methods, the CAPRI challenge.
• Overview of other topics: systems biology, genomics and metabolic networks.

Other topics may be covered if time permits. The topics are subject to change.

Assignments and Grading
The following grading scheme is subject to change (I will give notice should this happen)
• Homework Assignments – 4-5 written assignments will be given (40-50% total)
• Term project – 30% of your final grade
• Final presentation of projects – 20-30% of your final grade

The homework assignments are individual. The projects may be done in groups of 2-3 students.

Final Grade
Your final grade will be calculated using the following table. The minimum standard for passing the course is a percentage score of 60%. Remember that as a graduate course, you cannot get a passing grade less than a 'C' Keeping this in mind, your grade for the course will be calculated using the following table. Assume your final percentage score for the course is P:

<table>
<thead>
<tr>
<th>P</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 90</td>
<td>A</td>
</tr>
<tr>
<td>85 &lt; P ≤ 90</td>
<td>A-</td>
</tr>
<tr>
<td>80 &lt; P ≤ 85</td>
<td>B+</td>
</tr>
<tr>
<td>75 &lt; P ≤ 80</td>
<td>B</td>
</tr>
<tr>
<td>70 &lt; P ≤ 75</td>
<td>B-</td>
</tr>
<tr>
<td>65 &lt; P ≤ 70</td>
<td>C+</td>
</tr>
<tr>
<td>60 &lt; P ≤ 65</td>
<td>C</td>
</tr>
<tr>
<td>P ≤ 60</td>
<td>F</td>
</tr>
</tbody>
</table>

Accommodations
Section 504 of the Americans with Disabilities Act of 1990 offers guidelines for curriculum modifications and adaptations for students with documented disabilities. If applicable, students may obtain adaptation recommendations from the Ross Center for Disability Services, M-1-401, (617-287-7430). The student must present these recommendations and discuss them with each professor within a reasonable period, preferably by the end of Drop/Add period.


**Student Conduct**

Students are required to adhere to the University Policy on Academic Standards and Cheating, to the University Statement on Plagiarism and the Documentation of Written Work, and to the Code of Student Conduct as delineated in the catalog of Undergraduate Programs, pp. 44-45, and 48-52. The Code is available online at:

[www.umb.edu/student_services/student_rights/code_conduct.html](http://www.umb.edu/student_services/student_rights/code_conduct.html)

**class email**

I may occasionally send out e-mails to the entire class. Mass e-mails will be sent through WISER, to your UMB accounts. Please make sure you read your UMB e-mails regularly. You are responsible for it.

**Homepage**

The course home page is [http://www.cs.umb.edu/~nurith/cs612](http://www.cs.umb.edu/~nurith/cs612). All material for this course will be available from the site.