BIO310: Introduction to Bioinformatics

Syllabus, Spring 2024

This is an undergraduate-level course that aims to introduce students to the field of bioinformatics – the area concerning the development and application of computational methods to address key problems in biology. Upon completion of the course, students are expected to acquire a perspective to design computational solutions to biological problems and hands-on skills to implement them. The lab sections will complement the lectures by providing hands-on experience and by introducing common tools and resources used.

Prerequisites: Formal prerequistes are IF100 and MATH 203. Because the course takes a computational, and quantitative perspective, programming skills are required. Basic biology as well as probability and statistics knowledge are required. Students who are interested in the subject are encouraged to register.

Schedule

Lectures:	Mon 11:40 – 12:30	FENS L030
	Thu 8:40 – 10:30	G029
Computational Labs:	Fri 11:40 - 1:30	FASS G025

Delivery format

- The classes and the labs are physical. Attendance is mandatory. Your active participation is expected and will affect your grade.
- Office hours will be online or physical depending on your needs, will be announced.

Contact Information

Instructors:	Oznur Tastan	`otastan@sabanciuniv.edu`
	Office:	FENS 2058

Teaching Assistants:

Cem Azgari	`mpekey@sabanciuniv.edu`
Veysel Ogulcan Kaya	`vogulcan@sabanciuniv.edu`

Office hours will be announced on SuCourse.

Course Webpage

SuCourse will be used. Please regularly check the SuCourse of the course for lecture notes, homework assignments, discussions, and announcements.

Textbook:

No required textbooks. There will be **required readings** posted on SuCourse. Check

the weekly resources frequently.

Optional textbooks
- - P. Compeau, P. Pevzner. Bioinformatics Algorithms: An Active Learning Approach. Active Learning Publishers, 2nd Ed. Vol. 1 and Vol.2, 2015.
Supplementary website: http://bioinformaticsalgorithms.com
- J. Pevsner, Bioinformatics and Functional Genomics, 3rd Edition, 2015.
- A. Lesk, Introduction to Bioinformatics, 4th edition, Oxford University Press, 2014 (3rd edition also OK). ISBN - 978-0199651566.
- N. Jones and P. Pevzner. An Introduction to Bioinformatics Algorithms (Computational Molecular Biology), MIT Press, 2004.
- P. Baldi, S. Brunak. Bioinformatics: The Machine Learning Approach, Second Edition, MIT Press.
- R. Durbin, S. R. Eddy, A. Krogh, G. Mitchison, Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids, Cambridge University Press.

Grading

- 2 Midterm exams, 25 % each (50 %)
- Homework assignments (there or four) (20%)
- Lab assignments attendance (20 %)
- Paper presentation (5%)
- In class participation (5%)

** The instructor can call for an oral exam in any component of the course including homework and lab assignments.

IMPORTANT: One of the following conditions will result in an automatic fail and an NA grade regardless of other grades. ** **If you are in your last semester and expected to graduate this year, you will need to be extra responsible not to fall in one of these conditions**

1. The average exam grade is below 30 out of 100.
2. The average homework assignment grade is below 30 out of 100 .
3. The average lab assignment grade is less than 30 out of 100.
4. Omitting the paper presentation
5. Omitting an exam without a valid excuse.

*** Not falling in one of these conditions are necessary conditions to pass the course but are not sufficient. If your overall performance are poor, you may fail the course.

Tentative List of Topics

Introduction
Introduction to molecular biology – molecules, proteins, DNA, RNA.

Biological Sequence Analysis

- Genome assembly
- Sequence alignment (local, global, pairwise and multiple, space efficient align-

ment algorithms, profile alignment)
- Sequence similarity search algorithms
- Patterns and profiles

Data analysis and prediction for biology and medicine

- Different data types
- Clustering
- Dimensionality reduction
- Hidden markov models

Functional Interpretation of gene sets
- Gene ontologies
- Gene set enrichment analysis

Network Based Analysis of Biological Data
- Protein-protein interaction networks
- Regulatory networks
- Finding communities in networks
- Network-based biomarker discovery

Structural Biology
- Introduction to protein structure
- Structural motifs and domains

Genomic Variation
- Single and structural variations (if time permits)

Disclaimer

- Students who are registered to the course with time-conflict override accept the responsibility of any inconvenience that might occur due to missed content. No make-up will be available for missed exam/content.
- Academic dishonesty will not be tolerated.
- Students are responsible from following the announcements on SuCourse.

Make up policy: There will be a single make-up exam for both the midterm and the final exams, covering the entire semester, will be given after the final exam date. You can take a make-up only if you have a valid health report approved by the University Health Services.

Late day policy: Each student will have a total of four free late (calendar) days to use for homework assignments. Once these late days are exhausted, any assignments turned in late will be penalized and will incur a reduction of 33% in the final score, for each day (or **part thereof**) it is late. For example, if an assignment is up to < 24 hours late, it incurs a penalty of 33%. Else if it is up to more than 24 hours and less than 48 hours late, it incurs a penalty of 66%. And if it is 72 or more hours late, it will receive no credit. You do not need to tell the TA or me that you are using a late day.

Regrade policy: If you feel an error was made in grading your homework or lab, please get an appointment with your TA and stop by his/her office. Please note that

regrading a homework/lab may cause your grade to go up or down. Important: You may object your homework within 14 days after the grades are announced.

Student conduct: Students are required to adhere to the University Policy on Academic Standards and Cheating. You may discuss programming assignments with classmates. However, you must not share, show or see the code of your classmates. You must write your own code entirely. You may never use, look at, study, or copy any answers from previous semesters of this course or from the internet. All class work should be done independently unless explicitly indicated on the assignment handout.