San José State University

Computer Science Department
Computer Science 223: Bioinformatics, Section1, Spring 2019

Course and Contact Information

Instructor:	Philip Heller
Office Location:	MacQuarrie Hall 211
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Office Hours:	Thursdays 9:30-11:30
Class Days/Time:	M/W 3:00 – 4:15
Classroom:	MacQuarrie Hall 223
Prerequisites:	CS 123A or CS 155

Course Format

Some class meetings, to be announced in advance, will be software labs. Students are required to bring a wifi-enabled computer to these sessions.

Course Description (Required)

Catalog description: The course investigates the main algorithms for solving computational problems in bioinformatics. Methods will include Hidden Markov Models for gene prediction and protein profiling, and Genetic Algorithms for biological sequence analysis and structure prediction. Students will be given programming projects

This section will emphasize the BLAST algorithm, Hidden Markov Models, Metagenomics, and CRISPR technology.

Course Learning Outcomes (CLO) (Required)

Upon successful completion of this course, students will be able to:

1. Describe the molecules and processes of molecular biology: DNA, RNA, proteins, transcription, translation, and evolution.
2. Perform BLAST analysis, with publicly hosted, local, and custom databases.
3. Create and apply Hidden Markov Models for DNA and protein sequence analysis.
4. Perform metagenomic analysis.
5. Understand the role of CRISPR sequences as microbial immune systems and as modern gene-editing technology.

Required Texts/Readings

Textbook

"Understanding Bioinformatics" by Marketa Zvelebil and Jeremy Baum, 1st edition, Garland Science, 2008, ISBN 0-815-34024-9.

Other technology requirements / equipment / material

Homework assignments, class project, and some class sessions require a wifi-capable computer.

Course Requirements and Assignments

Homework Assignments: There will be approximately 6 homework assignments. Programming may be in any language the student prefers. Homework is only accepted in hardcopy. No late homework will be accepted except by prior arrangement with the instructor or in cases of documented emergency. Homework is due at the end of class on the due date.

Term Project: Students will do a term project in teams of 1 or 2. Projects must include a substantial programming component.

Exams: Two in-class midterm exams (15% each) and one final exam (25%). Missed exams cannot be made up except for reasons of illness as certified by a doctor, or documentable extreme emergency. Makeup exams may be oral.

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

Final Examination or Evaluation

There will be a final examination on Monday May 20 at 12:15 PM.

Grading Information (Required)

Determination of Grades

Homework: 25%
Midterm 1: 15%
Midterm 2: 15%
Project: 20%
Final: 25%

At least	Letter Grade
97%	A+
93%	A
90%	A-
87%	B+
83%	B
80%	B-

77%	C+
72%	C
70%	C-
67%	D+
62%	D
60%	D-
<60%	F

Classroom Protocol

Students are expected to arrive on time and to be attentive and respectful. Use of any electronic device for any purpose not related to the course material is not allowed.

University Policies (Required)

Per University Policy S16-9 *(http://www.sjsu.edu/senate/docs/S16-9.pdf)*, relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

CS 223 Spring 2019 Course Schedule

This agenda is approximate. Topics and exam dates will be announced

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	1/28	Intro to course. History of Bioinformatics.
1	1/30	Molecular Biology background.
2	2/4	Molecular Biology background. Evolution.
2	2/6	Sequencing technology. Assembly and deBruijn graphs.
3	2/11	Sequence alignment. Pairwise alignment algorithms.
3	2/13	Multiple sequence alignment. Phylogenetic algorithms: WPGMA and UPGMA.
4	2/18	Phylogenetic algorithms: Neighbor-Joining.
4	2/20	Hidden Markov Models.
5	2/25	Hidden Markov Models.
5	2/27	Profile Hidden Markov Models.
6	3/4	Midterm 1 review.
6	3/6	Midterm 1.
7	3/11	BLAST.
7	3/13	BLASTable databases.
8	3/18	Metagenomics.
8	3/20	Metagenomics.
9	3/25	CRISPR.
9	3/27	CRISPR.
10	4/1	Spring Break.
10	4/3	Spring Break.
11	4/8	Bioinformatic Deep Learning.
11	4/11	Bioinformatic Deep Learning.
12	4/15	Review for Midterm 2.
12	4/17	Midterm 2
13	4/22	Project presentations.

Week	Date	Topics, Readings, Assignments, Deadlines
13	4/24	Project presentations.
14	4/29	Project presentations.
14	5/1	Project presentations.
15	5/6	Project presentations.
15	5/8	Project presentations.
16	5/13	Review for final exam.
Final Exam	5/20	12:15 PM MacQuarrie Hall 223