

BIOL/CS/SE 123A: BIOINFORMATICS I

San José State University

Computer Science Department

Section 01, Fall 2019

COURSE AND CONTACT INFORMATION

Instructor: Wendy Lee Ph.D.

Office Location: MacQuarrie Hall (MH 413)

Email: wendy.lee@sjsu.edu

Office Hours: Mon 12:00 pm – 1:00 pm, Wed 2:30 pm – 3:30 pm

Class Days/Time: Monday & Wednesday 9:00 am – 10:15 am

Classroom: Science Building (SCI 311)

Prerequisites: Biol 30 and Biol 31, or CS 46A and CS 46B

COURSE FORMAT

- Class time will be spent either in “lecture” mode or in “lab” mode, explained in “Class Protocol” in this document.
- You are required to bring your wireless laptop to each class.
- Exams will be in-class, hand-written, closed-book.
- Course materials such as syllabus, handouts, notes, hands-on exercise, project instructions, etc. can be found on Canvas Learning Management System course login website at <https://sjsu.instructure.com>. You are responsible for regularly checking with the Canvas messaging system to learn of any updates.

COURSE DESCRIPTION

Introduction to the main public domain tools, databases and methods in bioinformatics. Analysis of algorithms behind the most successful tools, such as local and global sequence alignment packages, and the underlying methods used in fragment assembly packages. Solution of complex biological questions requiring modification of standard code.

COURSE LEARNING OUTCOME (CLO)

Upon successful completion of this course, students will be familiar with the following concepts and will be able to apply them in appropriate situations:

1. Pairwise and multiple sequence alignments.
2. Computation and interpretation of sequence homology.
3. Phylogenetic trees, and the algorithms that compute them (UPGMA, Neighbor-Joining).
4. Public DNA and protein databases, and how to use them.
5. Preprocessing and variant calling using next-generation DNA sequencing data.

REQUIRED TEXTS/READINGS

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

Other Readings: Additional course readings, examples, exercises, etc. will be assigned and will be provided by the instructor.

COURSE REQUIREMENTS AND ASSIGNMENTS

1. **Problem Sets (20%):** Four homework assignments. The purpose of the assignments is to develop your understanding of the material and your skills in problem-solving. Homework is only accepted in hardcopy. Only a subset of the assigned problems on any given problem set will be graded. Assignments are due in the beginning of the lecture on the following dates:
 - September 4, 2019: Homework 1
 - September 18, 2019: Homework 2
 - October 14, 2019: Homework 3
 - November 6, 2019: Homework 4

2. **Term-Project (25%):** Information on the term project can be found in the course website in Canvas. It is a group project. Each group consists of two students. Here are the key deliverables and due dates:
 - a. **Team Formation:** September 23, 2019.
 - b. **Project proposal:** October 2, 2019.
 - c. **Progress Report:** November 4, 2019.
 - d. **Final Project:** Dec 2, 2019.
 - e. **Presentation:** Each group gives a 10-minute, in-class presentation on Dec 2 or Dec 4, 2019, during class time.
3. **Term Exams (30%):**

Exam One (15%): October 7, 2019.
Exam Two (15%): November 18, 2019.

Exam One and Exam Two are each one hour and fifteen minutes long. All exams are in-class, closed-book and comprehensive. Make-up exams will be given only at the instructor's discretion. Note: If you fall behind, you will likely do poorly on the exams as well.
4. **Final Exam (25%):** A cumulative Final Exam will be given on Friday, December 13, 2019, from 8:15 am to 9:30 am. If there is a time conflict, please inform the instructor at least two weeks in advance for rescheduling.

GRADING INFORMATION

Grading calculation will be based on the following:

- Four Assignments/Problem Sets (20%)
- Term Project (25%)
- Term Exam One (15%)
- Term Exam Two (15%)
- Final Examination (25%)

Incomplete work: Points will be deducted for incomplete question responses and solutions that are partially functional. Consult individual assignment for details of point allocation for each problem.

Late assignments: No late homework will be accepted. However, under exceptional circumstances, one problem set per student might be accepted late. It will need to be handed in prior to the following class meeting and will

be graded with 30% off. Such an extension should be requested from the instructor.

Makeup Exams: You must submit only your own work on exams. Makeup exams will only be given in cases of illness (documented by a doctor) or in cases of documentable, extreme emergency.

Grading Scale:

Point Range	Letter Grade	Point Range	Letter Grade
97.0 – 100	A+	72.0 – 76.99	C
93.0 – 96.99	A	70.0 – 71.99	C-
90.0 – 92.99	A-	67.0 – 69.99	D+
87.0 – 89.99	B+	62.0 – 66.99	D
82.0 – 86.99	B	60.0 – 61.99	D-
80.0 – 81.99	B-	<60.0	F
77.0 – 79.99	C+		

CLASSROOM PROTOCOL

- **Dual Role of SCI311:** Lecture/Lab SCI311 will be used as a dual-purpose room. It can be a regular lecture room, or it can be a computer laboratory for hands-on exercises.
- **Lecture Mode:** This is when SCI311 is used as a regular lecture room. Students are expected to listen and follow the lecture. Be considerate to your classmates and follow the lecture. Do not use the computer and/or talk to your neighbor.
- **Lab Mode:** This is when SCI311 is used as a computer lab. Use the computers. Work collaboratively on problems of the Hands-On and share your ideas and solutions with your classmates.
- We shall alternate between the two modes. A typical class will begin with a lecture (Lecture Mode) followed by a hands-on (Lab Mode).
- Regular class attendance is highly recommended and strongly encouraged.
- Please arrive to class on-time so that you benefit fully from the course experience and you do not disturb classmates and the instructor while class is in session.
- Students are responsible for knowing all materials covered in class lectures, readings, assignments, and other course-related work.
- Please do not use mobile phones during class time. Laptops, tablets and other devices should only be used for course-related purposes.

UNIVERSITY POLICIES

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at <http://www.sjsu.edu/gup/syllabusinfo/>

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COURSE SCHEDULE

The course schedule is subject to change with fair notice. Changes will be announced on Canvas.

Week	Date	Topics
1	8/21	Syllabus. Introductions. Course Expectations. Bioinformatics: historical development, current challenges. <i>Questionnaires, Hands-On #1</i>
2	8/26	Background: Molecular biology. <i>Hands-On #2</i>
2	8/28	Bioinformatics Databases. <i>Hands-On #3</i>
3	9/2	No School: Labor Day
3	9/4	Homework #1 due. Bioinformatics Databases. <i>Hands-On #3</i>
4	9/9	Homework #1 answers. Pairwise alignment. <i>Hands-On #4</i>
4	9/11	Pairwise sequence alignment. <i>Hands-On #5</i>
5	9/16	Pairwise sequence alignment. <i>Hands-On #6</i>
5	9/18	Homework #2 due.
6	9/23	Homework #2 answers. Project team formation due. Multiple sequence alignment.
6	9/25	Multiple sequence alignment. <i>Hands-On #7</i>
7	9/30	Multiple sequence alignment. <i>Hands-On #8</i>
7	10/2	Multiple sequence alignment. Project Proposal Due. Review.
8	10/7	Term Exam #1
8	10/9	Phylogenetic inference. <i>Hands-On #9</i>
9	10/14	Homework #3 due. Exam #1 answers.
9	10/16	Phylogenetic inference. <i>Hands-On #10</i>
10	10/21	Homework #3 answers. Phylogenetic inference. <i>Hands-On #11</i>
10	10/23	Sequence Motifs. <i>Hands-On #12</i>
11	10/28	Sequence Motifs. <i>Hands-On #12</i>
11	10/30	Next Generation Sequencing. <i>Hands-On #13</i>
12	11/4	Project Progress Report due. Next Generation Sequencing. <i>Hands-On #13</i>
12	11/6	Homework #4 due.
13	11/11	No School: Veterans Day
13	11/13	Homework #4 answers. Review.
14	11/18	Term Exam #2

Week	Date	Topics
14	11/20	Next Generation Sequencing. <i>Hands-On #14</i>
15	11/25	Exam #2 answers.
15	11/27	No School: Non-Instructional Day
16	12/2	Final Project due. Project presentations
16	12/4	Project presentations
17	12/13	Final Exam. Friday, December 13, 8:15 am - 9:30 am

Important dates:

9/3/2019: Last Day to Drop a Class without a "W" grade

9/10/2019: Last Day to Add Courses for Fall 2019.

11/15/2019: Last Day to Withdraw for Fall 2019.