

Bioinformatics II Section 03

CS 123B

Spring 2024 3 Unit(s) 01/24/2024 to 05/13/2024 Modified 01/21/2024

Contact Information

Instructor: Wendy Lee Ph.D.

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Office Hours: Tuesday/Wednesday 2:00-3:00 PM by appointment only:

<https://calendly.com/wendy-lee-sjsu/spring-2024-office-hours>

Class Schedule: Tuesday/Thursday 9:00 AM - 10:15 AM @ MH 225

Course Information

Course Description and Requisites

Advanced Bioinformatics algorithms, tools, databases. Biological background; protein structure/function; sequencing technology; sequence identification; transcriptomics; metagenomics; CRISPR. Possible additional topics: functional genomics; protein networks; drug discovery; pathway analysis; immunoinformatics; analysis pipelines; machine learning applications. Project applying advanced approaches to real-world problems.

Prerequisite(s): CS/BIOL/SE 123A. Allowed Majors: Computer Science, Data Science, Software Engineering, Biology, Chemistry or MS Bioinformatics.

Letter Graded

Classroom Protocols

Students are expected to adhere to the Student Conduct Code found on the [SJSU Student Conduct website \(http://www.sjsu.edu/studentconduct/\)](http://www.sjsu.edu/studentconduct/). Additionally, students should regularly attend lectures and labs (if applicable), treat instructors and peers with respect, and refrain from the use of cell phones during any classroom activities.

- **Dual Role of MH 225:** Lecture/Lab MH 225 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 MH 225 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.
- **Lab Mode:** This is when MH 225 is used as a computer lab. Use your laptop computer. 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 do not disturb classmates and the instructor during class.
- Students are responsible for knowing all materials covered in class lectures, readings, assignments, and other course-related work.
- Laptops, tablets, and other devices should only be used for course-related purposes.

Program Information

Diversity Statement - At SJSU, it is important to create a safe learning environment where we can explore, learn, and grow together. We strive to build a diverse, equitable, inclusive culture that values, encourages, and supports students from all backgrounds and experiences.

Course Learning Outcomes (CLOs)

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. Genome sequencing technologies and applications.
2. Obtain publicly available data from NCBI SRA database.
3. Pre-processing raw sequencing reads and aligning them to a reference genome.
4. DNA variant calling for genotyping and cancer/disease detection.
5. Differential gene expression analysis using RNA-seq.
6. Metagenomics analysis using 16S and shotgun sequencing.
7. Bioinformatics analytical pipeline development.

Course Materials

Course readings, examples, exercises, etc. will be assigned and will be provided by the instructor.

Technology Requirements

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. [SJSU has a free equipment loan program available for students \(http://www.sjsu.edu/equipmentcheckout\)](http://www.sjsu.edu/equipmentcheckout). Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor as soon as possible or at the latest one week before the test date to determine an alternative. See [Learn Anywhere website \(https://www.sjsu.edu/learnanywhere/equipment/index.php\)](https://www.sjsu.edu/learnanywhere/equipment/index.php) for current Wi-Fi options on campus.

Course Requirements and Assignments

1. **Quizzes (10%):** Quizzes will take place on Tuesday at the beginning of class to assess students' knowledge of the course materials from the week before. A unique password will be provided for each quiz during lecture. Each quiz will expire at the end of Wednesday of that week. ***No make up quizzes will be given.***
2. **Hands-on Lab Report (20%):** The purpose of the hands-on lab is to develop your understanding of the material and your skills in problem-solving. Hands-on lab reports are only accepted in Canvas. You must submit lab report on time to receive full credit.
3. **Midterms (30%): MT1 (15%) will be on March 14th and MT2 (15%) will be on April 25th.** No make-up exam will be given if a student misses the midterm exam submission deadline (unless you have a legitimate excuse or other personal emergencies and can provide documented evidence).
4. **Term Project & Presentation (20%):** The term project is a group project. Each group consists of 2 students. Here are the key deliverables and due dates:
 - Team Formation: February 22, 2024.
 - Project proposal: March 19, 2024.
 - Progress Report: April 15, 2024.
 - Final Project Due: May 7, 2022.
 - Presentation: Each group gives a 10-minute, in-class presentation on May 7 or May 9, 2024, during class time.
5. **Final Exam (20%):** Final Exam is on May 17 (Friday) 7:15 AM to 9:30 AM. It is a comprehensive test, including topics covered at the beginning and throughout the course.

Grading Information

Grading calculation will be based on the following:

- 10% Quizzes
- 20% Hands-on Lab Reports
- 30% Midterm
- 20% Term Project
- 20% Final Exam

Incomplete work: points will be deducted for incomplete question responses and solutions that are partially functional. Consult individual assignments 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 per day of being late. Such an extension should be requested from the instructor.

Exams and any assignments: You must submit your own work. Copying and any other form of cheating will not be tolerated and will result in a failing grade (F) for the course, as well as disciplinary consequences.

Makeup Exams: Makeup exams will only be given in cases of illness (documented by a doctor) or in cases of documentable, extreme emergencies.

Grade Scale:

Grade	Percentage
A plus	97.0 to 100%
A	93.0 to 96.99%
A minus	90.0 to 92.99%
B plus	87.0 to 89.99%
B	82.0 to 86.99%
B minus	80.0 to 81.99
C plus	77.0 to 79.99%
C	72.0 to 76.99%
C minus	70.0 to 71.99%
D plus	67.0 to 69.99%
D	62.0 to 66.99
D minus	60.0 to 61.99%
F	<60.0

Per [University Policy S16-9 \(PDF\)](http://www.sjsu.edu/senate/docs/S16-9.pdf) (<http://www.sjsu.edu/senate/docs/S16-9.pdf>), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on the [Syllabus Information](https://www.sjsu.edu/curriculum/courses/syllabus-info.php) (<https://www.sjsu.edu/curriculum/courses/syllabus-info.php>) web page. Make sure to visit this page to review and be aware of these university policies and resources.

Course Schedule

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

Week	Date	Topics
1	1/25	Syllabus. Introductions. Course Expectations.
2	1/30, 2/1	Sequencing technologies and applications. Set up galaxy account.
3	2/6, 2/8	Obtain data from SRA and perform data pre-processing & QC
4	2/13, 2/15	Mapping raw sequencing data to a reference genome
5	2/20, 2/22	DNA variant calling overview
6	3/5, 3/7	DNA variant calling for cancer detection.
7	3/12, 3/14	Midterm #1 Review Midterm #1
8	3/19, 3/21	RNA sequencing (RNA-seq) overview. Spliced-aware mapping and read quantification
9	3/26, 3/28	Differential gene expression analysis & data visualization
10	4/2, 4/4	Spring Break - No Class

11	4/9, 4/11	Introduction to Google Cloud Platform Create and Config Google Cloud VM Instance and Storage
12	4/16, 4/18	Building Bioinformatics Pipelines
13	4/23, 4/25	Midterm #2 Review Midterm #2
14	4/30, 5/2	16S rDNA sequencing for taxonomic classification PCoA Analysis and data visualization for metagenomics data
15	5/7, 5/9	Term Project Due + In-class Presentation
17	5/17 (Fri)	Final Exam: 7:15 AM-9:30 AM