San José State University
Computer Science Department
CS/BIOL 123A Bioinformatics I, Sec 01, Spring 2019

Course and Contact Information

Instructor:	Leonard Wesley
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Office Hours:	Thursdays 2:00PM – 4:00PM, Except on 2/21, 3/21, 4/25 when office hours will be from 12noon to 1:30PM
Class Days/Time:	Tuesdays and Thursdays 10:30AM – 11:45AM
Classroom:	DH 450
Prerequisites:	CS 23, and BIOL 115 or CHEM 130A; or CS 46B and a molecular biology course. Allowed Declared Majors: Computer Science, MS Bioinformatics, and Biology

Catalog Course Description:
Introduction to the main public domain tools, databases and methods in bioinformatics. Analysis of algorithms behind the most successful tools, such as the 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.

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

1. SLO-1 BIOINFORMATICS DBs: Describe the structure of bioinformatics-related DBs and how they function to analyze sequence and related biological data. Navigate through various DBs to research and answer questions of interest, identify genes, and analyze complex genomes.

2. SLO-2 ALIGNMENT: Describe and use pairwise and multiple sequence alignment algorithms to conduct local, global, and semiglobal alignments. Understand and use BLAST and advanced DB searching.

3. SLO-3 PHYLOGONY: Build, understand, and use molecular phylogenetic trees. Understand and answer questions about evolution using molecular phylogenetic trees.

4. SLO-4 PROTEINS & FUNCTIONAL GENOMICS: Understand protein analysis, proteomics, and functional genomics.

5. SLO-5 NGS: Describe, understand, and analyze state-of-the-art technologies such as next-generation-sequencing (NGS) and genome assembly.

Required Texts/Readings:

Textbook

Bioinformatics and Functional Genomics   Edition: 3rd Year 2015
Author: Pevsner
ISBN 13: 978-1-118-58178-0   Price ranges from $39(Paperback) to $73(e-Book)

Other Readings

Introduction To Bioinformatics by Arthur M Lesk, 4th Edition, Oxford University Press, 2014, ISBN-13: 978-0-19-965156-6

Bioinformatics: A Prectical Guide To The Analysis of Genes and Proteins by Andreas D. Baxevanisnad B.F. Francis Oullette, 3rd Edition, Wiley Interscience, 2005, ISBN-10: 0-471-47878-4 (cloth)

Computational Resources:
Students are required to make sure that they have access to sufficient UNIX, Windows, or Mac based computational resources (e.g., computers and software) to carryout assignments in the course. An attempt to offer the course in a classroom with sufficient computation resources will be made by the department to support classroom instruction and demonstrations. However, students should be prepared to bring their portable laptops to class.

Course Requirements and Assignments:
Students will be assigned videos or related multi-media or electronic copies of course subject matter for reading and review. In situations where assignments involve programming, an alternative and equivalent non-programming assignment will be provided for non-computer science and non-software engineering students that lack the programming background and prefer not to complete and submit programming assignments.

Students will be expected and required to read the assigned material and complete all homework or programming tasks prior to the indicated next class meeting. In class instruction will, at times, consist of a short unannounced quizzes at the start of selected classes to test comprehension of assigned material. For "In-Class Exercise" classes, the class will be divided into groups of 2-4 students to work on the assigned in-class exercises.

Course Logistics:

Students should expect to spend approximately nine (9) hours per week (on average) completing the assigned course work. This includes viewing videos, homework, in-class lecture and in-class exercise time. The amount of time that a student actually spends depends on their individual skills and the time allocated to the course. The nine (9) hours per week estimate is based on the previous experiences of the instructor and students. So please plan and schedule accordingly.

Previously, students have asked for special exception to policies and procedures for this course. An example includes asking the instructor for extra assignments or work to help improve a student's grade. Even if such a request is reasonable in the view of the instructor, no exception will be given to a student unless it can be made available to the entire class, AND does not constitute significant extra work on the part of students, instructors, graders and so forth. Students should have no concern that other students will receive special exceptions that will not be available to them to pursue.

NOTE: University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading." However, attendance will be required in order to complete and submit many in-class exercises, quizzes, and exams.

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.

Quizzes and Exams:

There will be three quizzes, one midterm and a final exam all of which will count toward the final grad as specified in the "Grades" section below. During quizzes and exams, communication with other individuals via any means is strictly prohibited without the express permission of the instructor. Violations will be met with the full impact of SJSU's academic integrity policy and procedures.

Projects:

Several life science related project topics will be described near the start of the course. Projects will involve applying the skills and knowledge learned in the course to the project. Teams of 3-4 students will be formed to work on a selected project topic. Teams will be required to submit a project proposal before starting on a project, and submit a project report along with working code at the end of the course. Individual student scores on a project will be determined by the content and quality of the contribution of each student toward the project. The score on the course project and project presentation will count toward the final grad (percentage wise) as specified in the "Grades" section below.

Reading, Homework, Programming, In-Class Exercises, Participation Assignments

Graded reading, homework, programming, and class participation and brief course feedback assignments will be given almost weekly, and will count toward the final grade. There will be 4 In-class Exercise sessions. These will typically involve forming teams of 2-3 students that work on assigned programming or non-programming-like exercises in the classroom. They provide an opportunity to get started on homework assignments that are to be submitted on a designated due date. Participation is mandatory, and scores will count toward final grade.

Any questions or concerns about scores/marks that students receive on assignments must be presented to the instructor within two weeks from the date grading of the assignments is completed and presented/released to the class.

Tentative course calendar of assignment due dates & exam dates:
(Please note that course calendar below, and its content is "subject to change with fair notice")

Week and Class Mtg #	Thur	Tue	Module # & Name	TOPIC	Assignment See Canvas For Module & Weekly Assignment Details and Due Dates
Week 1 Class Mtgs 1 & 2	1/24	1/29	#1 Biology Basics	1/24: Intro To Course: -Topics, learning objectives, course logistics, Instructor background - Greensheet 1/29: - Intro to molecular biology, DNA, RNA, and the central dogma. - DNA Replication, Transcription, and Translation	Learning Module #1 Week #1
Week 2 Class Mtgs 3 & 4	1/31	2/5	#1 Bioinformatics DBs	1/31: - Entrez Gene 2/5: - Ensembl	Learning Module #1 Week #2 February 12th Last Day To Drop Classes Project Team Formation By Instructor
Week 3 Class Mtgs 5 & 6	2/7	2/12	#1 Biology Basics DBs	2/7 - UCSC 2/12: - **In-Class Exercise 1** Topics Covered 1/24 – 2/12	Learning Module #1 Week 3

Week 4 Class Mtgs 7 & 8	2/14	2/19	#2 Alignment	2/14: - Pairwise Sequence Alignment 2/19: - Pairwise Sequence Alignment	Learning Module #2 Week 4 Project Proposals Due 2/19
Week 5 Class Mtgs 9 & 10	2/21	2/26	#2 Alignment	2/21: - **Quiz 1 (~35 mins): Covers Topics Week 1 thru Week 4** - Multiple Alignment 2/26: - Multiple Alignment	Learning Module #2 Week 5
Week 6 Class Mtgs 11 & 12	2/28	3/5	#2 Alignment #3 Phylogenetic Trees	2/28: - Multiple Alignment 3/5: - Molecular phylogenetic trees	Learning Module #2 & Learning Module #3 Week 6
Week 7 Class Mtgs 13 & 14	3/7	3/12	#3 Phylogenetic Trees	3/7: - **In-Class Exercise 2** Topics Covered 2/14 – 3/5 3/12: - **Midterm (Full period): Covers Topics Week 1 thru Week 6**	Learning Module #3 Week 7
Week 8 Class Mtgs 15 & 16	3/14	3/19	#3 Phylogenetic Trees	3/14: - Molecular phylogenetic trees 3/19: - Molecular phylogenetic trees	Learning Module #3 Week 8

Week 9 Class Mtgs 17 & 18	3/21	3/26	#4 Proteins & Functional Genomics	3/21: - Proteins & Proteomics 3/26: - **Quiz 2 (~35 mins): Covers Topics Week 7 thru Week 8** - Proteins & Proteomics	Module #4 Week 9
Week 10 Class Mtgs 19	3/28	4/2	#4 Proteins & Functional Genomics	3/28: - Functional Genomics 4/2: - **SPRING BREAK**	Module #4 Week 10
Week 11 Class Mtgs 20	4/4	4/9	#4 Proteins & Functional Genomics	4/4: - **SPRING BREAK** 4/9: - **In-Class Exercise 3** Topics Covered 3/12 – 3/28	Module #4 Week 11
Week 12 Class Mtgs 21 & 22	4/11	4/16	#4 Proteins & Functional Genomics	4/11: - Functional Genomics 4/16: - **Quiz 3 (~35 mins): Covers Topics Week 9 thru Week 11** - Functional Genomics	Module #4 Week 12
Week 13 Class Mtgs 23 & 24	4/18	4/23	#5 NGS	4/18: - Sequencing Technologies 4/23: - **In-Class Exercise 4** (Work on Team Projects, Q&A)	Module #5 Week 13
Week 14 Class Mtgs 25 & 26	4/25	4/30	#5 NGS	4/25: - Sequencing Technologies 4/30: - Genome Assembly	Module #5 Week 14

Week 15 Class Mtgs 27 & 28	5/2	5/7	#5 NGS	5/2: - Genome Assembly 5/7: - Genome Assembly	Module #5 Week 15
Week 16 Class Mtgs 29	5/9		#5 NGS	5/9: - Finish Genome Assembly - Review for Final Exam	Module #5 Week 16
			Final Project Code and Project Report Due To Canvas **May 21, 2019 By 11:59PM** **Final Exam** **Thursday May 16, 2019 from 9:45AM to 12:00noon in DH 450**		

SCHEDULE FOOTNOTES:
NONE AS OF JANUARY 2019

Grades *

WRITTEN HOMEWORK (10 at 10 points each)	100 pts
QUIZZES (3 at 50pts each)	150 pts
MIDTERM	100 pts
IN-CLASS EXERCISES (4 at 50pts each)	200 pts
WEEKLY COURSE FEEDBACK (15 at 5pts each)	70 pts
PROGRAMMING ASSIGNMENTS OR ALTERNATIVES	
(5 @ 40pts each)	200 pts
FINAL EXAM	200 pts
FINAL PROJECT REPORT	200 pts

Total Course Points   = 1,220 pts Total

* The total points for each category might change depending on the number of project teams and assignments. The instructor reserves the right to adjust, with sufficient advanced notice,

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

Classroom Protocol:

DH 450 is a dual purpose room. It can be a regular lecture room or a computer laboratory. Please note that "or" in the last sentence is exclusive. In other words, DH450 is never a lecture room AND a computer lab at the same time.

Lecture Mode: This is when DH450 is used as a regular lecture room. Students are expected to listen and follow the Lecture. DH450 can be a noisy room because of the large number of workstations and the server. Be considerate to your classmates and follow the Lecture. Do not use the computer (workstation) during lectures, and do not talk to your classmates during lectures. Do not open your laptops, or check email, web-chat, tweet, web-surf on the internet, and so forth. If you cannot follow these simple rules, please do not enroll in this class.

Lab Mode: This is when DH450 is used as a computer lab for in-class exercises, Canvas exams, and related assignments that involve the use of computers. Use the computers and share your ideas and solutions with your classmates except during exams or when otherwise instructed. For in-class exercises, the results of your work for that class session will need to be uploaded to an appropriate Canvas assignment for review and possible grading. We shall alternate between the two modes. A typical class will begin with a short lecture (Lecture Mode) to describe the in-class exercise that will reinforce the assignment. This will be followed by a hands-on (Lab Mode). There will be a number of in-class exercises or hands-on-exercises. The purpose of the in-class exercises and hands-on exercises is to develop your understanding of the course lectures, homework assignments, videos, and e-materials.

Grading Percentage Breakdown (NOTE: Ranges might change if point totals change)

Percentage of Total Pts	Pts	Letter Grade
96.66% and above	≥ 1,179	A+
93.33% - 96.65%	≥ 1,139- 1,178	A
90% - 93.32%	≥ 1,098 – 1,138	A-
86.66% - 89.99%	≥ 1,057 – 1,097	B+
83.33% - 86.65%	≥ 1,017 – 1,056	B
80% - 83.32%	≥ 976 – 1,016	B-
76.66% - 79.99%	≥ 935 – 975	C+
73.33% - 76.65%	≥ 895 - 934	C
70% - 73.32%	≥ 854 – 894	C-
66.66% - 69.99%	≥ 813– 853	D+
63.33% - 66.65%	≥ 773 – 812	D
60% - 63.32%	≥ 732 - 772	D-
Below 60%	**< 732**	**F**

HOW TO CALCULATE/ESTIMATE YOUR GRADE:

If students would like to calculate their numeric grade percentage, the formula is as follows: Numeric CS 123A Grade Percentage =

$$\frac{Total\ points\ from\ assignments}{Total\ course\ points} \times 100\%$$

There is no guarantee that grades will be curved. If so, it will be done at the end of the semester. The instructor is already aware that graduate students need to maintain an overall GPA of B or better. Just because a student NEEDS a particular grade doesn't mean that the instructor will automatically GIVE the student that grade. Students must EARN a passing grade based on submitted and evaluated course work.

Extra credit options, if available:

There are no extra credit assignments in this course except for completing designated "Advanced" assignments. However, homework assignments and exams might, at the discretion of the instructor, contain extra credit options.

Penalty for late or missed work:

Late assignments will receive a 25% deduction for every 24hr period the submission is late. There will be partial credit for assignments.

Receiving An Incomplete (I) Grade:

Receiving a grade of Incomplete (I) is not automatic. Students must complete at least 80% of course assignments by the end of the semester to be eligible to receive a grade of incomplete. Students must also provide documentation to support the reason for the request to receive an Incomplete grade. The instructor has the final decision to give an Incomplete grade. If the instructor agrees to give a student an Incomplete grade, the instructor will enter the remaining work to be completed as part of the PeopleSoft grade submission process.

Grade Change Policy:

It is a university policy that course grade changes must be made within one semester from the end of the course. Requests for exceptions to this policy must be accompanied with a documented and compelling reason.

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/. Make sure to review these policies and resources