

**San José State University**  
**Computer Science Department**  
**CS/BIOL 123A Bioinformatics I, Sec 01, Fall 2015**

**Course and Contact Information**

<b>Instructor:</b>	Leonard Wesley
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<b>Office Hours:</b>	Tuesdays and Thursdays 10:30AM – 12noon
<b>Class Days/Time:</b>	Tuesdays and Thursdays 9:00AM – 10:15AM
<b>Classroom:</b>	DH 450
<b>Prerequisites:</b>	CS 23, and BIOL 115 or CHEM 130A; or CS 46B and a molecular biology course. Allowed Declared Majors: Computer Science, Biology

**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 conduct pairwise alignment (local, global, and semiglobal)
2. SLO 2 identify homology and similarity between sequences
3. SLO 3 conduct multiple sequence alignment
4. SLO 4 conduct genomic-based database searches
5. SLO 5 build and analyze phylogenetic trees

**Course Learning Outcomes (CLO)**

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

1. CLO 1: use dynamic programming for pairwise alignment, to understand how multiple sequence alignment algorithms work
2. CLO 2: understand the Fitch-Margoliash, UPGMA, and neighbor-joining phylogenetic tree algorithms

3. CLO 3: understand the types and use of various databases for DNA and protein related sequence analysis.

## Required Texts/Readings

### Textbook

*Understanding Bioinformatics* by Marketa Zvelebil and Jeremy Baum, Garland Science 2008, ISBN-13: 978-0-8153-4024 (pbk)

### Other Readings

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

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

### Other equipment / material requirements

Students should make sure that they have access to sufficient computational resources, e.g., relatively recent laptops or workstation and OSs that will allow the completion of in-class and out-of-class homework and exercises.

### Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in [University Policy S12-3](http://www.sjsu.edu/senate/docs/S12-3.pdf) at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

HW: Several (3+) homework assignments  
IN-CLASS EXERCISE: Several (3+) exercises to be completed in and/or out of the classroom.  
EXAMS: Three exams lowest score dropped and final exam  
PROJECT & PRESENTATION: One final project report and presentation

NOTE that [University policy F69-24](http://www.sjsu.edu/senate/docs/F69-24.pdf) 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.”

### Grading Policy

Quizzes (1 of 7 lowest scores dropped)	(25 pts each) x 8 quizzes =	200 pts
Exams (lowest of 3 scores dropped)	(125 pts each) x 2 exams =	250 pts
In-Class Exercise Submissions	(CR/NC 10 pt each) x ~10 =	100 pts
Homework	(10 pts each) x 7 HW Assignments =	70 pts
Project Report and Presentation		180 pts

Final Exam

300 pts

Total Course Points

= 1,100 pts Total

\* The instructor reserves the right to adjust the above point distribution by  $\pm 5\%$  if there are exam or quiz questions, as well as homework that are deemed, by the instructor or department, as overly difficult or easy. Notice of any adjustment to the point distribution will be announced in class or via email no more than 1 week from when the instructor or department recognizes an adjustment is warranted.

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](http://www.sjsu.edu/senate/docs/F13-1.pdf) at <http://www.sjsu.edu/senate/docs/F13-1.pdf> for more details.

### **Classroom Protocol**

DH450 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 exercise, 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 assigned lecture video. 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, lecture, and video materials.

### **University Policies**

#### **General Expectations, Rights and Responsibilities of the Student**

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU’s policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See [University Policy S90–5](http://www.sjsu.edu/senate/docs/S90-5.pdf) at <http://www.sjsu.edu/senate/docs/S90-5.pdf>. More detailed information on a variety of related topics is available in the [SJSU catalog](http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html), at <http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html>. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

## **Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at [http://www.sjsu.edu/provost/services/academic\\_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

## **Consent for Recording of Class and Public Sharing of Instructor Material**

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course and the following items to be included in the syllabus:

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
  - It is suggested that the greensheet include the instructor's process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
  - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

## **Academic integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2.pdf) at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

## **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at [http://www.sjsu.edu/president/docs/directives/PD\\_1997-03.pdf](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

# CS/BIOL 123A Bioinformatics I, Fall 2015, Course Schedule

## Course Schedule

Week #	Tue	Thur	SUBJECT/TOPIC	Text Book Chapter	Video #	Quiz (Q) or Exam (E)	HW Assign. #
1	No Class	8/20	Course Overview -and- Introduction To Molecular Cell Biology & Bioinformatics (Terminology, Structure of DNA & RNA)	1.1	1 Post By 8/22		1
2	8/25	8/27	Introduction To Molecular Cell Biology & Bioinformatics (DNA, RNA, and Proteins: The Central Dogma -and- Gene Structure and Control -and- The Tree of Life & Evolution)	1.2, 1.3, 1.4	1	8/25 Practice Q 8/27 -Q	2
3	9/1	9/3	Protein Structure (Primary & Secondary, Protein Folding)	2.1, 2.3	2	9/1 - Q	3
4	9/8	9/10	Bioinformatics Databases (Type, Structure, and Use of Bioinformatics Databases)	3.1, 3.2	3	9/10 - Q	
5	9/15	9/17	Bioinformatics Databases (Genomic, Proteomic, Annotation, Sequence, Structure, Exp. Studies, Microarray...) NCBI, EMBL-EBI, PDB, DDBJ	3.3	3	9/17 - E	4
6	9/22	9/24	Sequence Alignment (Pairwise Sequence Alignment, Substitution Matrices)	4.1, 4.2, 4.3, 5.1	4	9/24 - Q	
7	9/29	10/1	Sequence Alignment (Substitution Matrices cont., Insertion Gaps, Local vs Global Alignment, Multiple Alignments)	5.1, 4.4, 4.5, 4.6	4		
8	10/6	10/8	Sequence Alignment (Searching DBs Nucleic & Protein DBs)	4.6, 4.7, 4.8, 4.9	4	10/8 - Q	5
9	10/13	10/15	Sequence Alignment (Indexing, Significance of Alignment Scores, Aligning Complete Genomes)	5.3, 5.4, 5.5	5	10/15 - Q	
10	10/20	10/22	Sequence Alignment (Aligning Complete Genomes)	10/22 - 5.5	5	10/22 - E	6
11	10/27	10/29	Phylogenetic Analysis (Terminology & Basics, Consequences of Molecular Evolution)	7.1, 7.2	7	10/29 - Q	
12	11/3	11/5	Phylogenetic Analysis (Phylogenetic Tree Reconstruction)	7.3	7	11/5 - Q	7
13	11/10	11/12	Phylogenetic Analysis	11/19 - 8.1	8	11/12 - Q	

Week #	Tue	Thur	SUBJECT/TOPIC	Text Book Chapter	Video #	Quiz (Q) or Exam (E)	HW Assign. #
			(Building Phylogenetic Trees)				
14	11/17	11/19	Phylogenetic Analysis (Building Phylogenetic Trees)	8.1 – 8.3	8	<b>11/19</b> - E	8
15	11/24	No Class	Phylogenetic Analysis (Building Phylogenetic Trees)	8.3	8		
16	12/1	12/3	Project Presentations				
17	12/8	No Class	Review for Final Exam				
Final Exam Thursday December 10, 2015 7:15AM to 9:30AM in Room DH 450							

#### Grading Percentage Breakdown

Percentage of Total Pts	Pts	Letter Grade
96.66% and above	> 1,063	A+
93.33% - 96.65%	1,026 – 1,062	A
90% - 93.32%	990 – 1,025	A-
86.66% - 89.99%	953 - 989	B+
83.33% - 86.65%	916 - 952	B
80% - 83.32%	880 - 915	B-