San José State University
Computer Science Department
CS 223 Bioinformatics, Sec 01, Spring 2016

Course and Contact Information

Instructor:	Leonard Wesley
Office Location:	MH 212
Telephone:	408.924.5287
Email:	Leonard.Wesley@sjsu.edu
Office Hours:	Tuesdays and Thursdays 1:00PM – 2:00PM
Class Days/Time:	Tuesdays and Thursdays 7:30PM – 8:45PM
Classroom:	DH 450
Prerequisites:	Graduate standing or instructor consent.

Course Description

The course investigates the main algorithm.for solving computational problems in bioinformatics. Methods will include Hidden Markov Model. for gene prediction and protein profiling. and Genetic Algorithm, for biological sequence analysis and structure prediction. Students will be given programming projects.

Expanded Course Description

Students will experience hands-on application and problem-solving oriented introduction to Python script programming, and the analysis and management of bioengineering and biological data.

Learning Outcomes

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

1. SLO1 Develop and implement computational solutions using Python basic language constructs, programming techniques, and methodologies.
2. SLO2 Use basic features of Python programming for bioinformatics as well as other life science related tasks.
3. SLO3 Develop basic Python programming skills to be the “glue” between existing applications in order to develop sophisticated computational solutions.

Course Learning Outcomes (CLO)

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

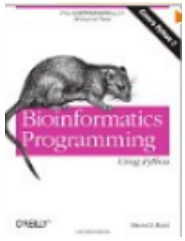
1. CLO1 Implement dynamic programming algorithms to support the analysis of biological related data.
2. CLO2 Understand commonly used Python algorithms and modules related to implementing algorithms such as hidden Markov models, simulated annealing, energy surface characterization, generating correlation data, and other related genetic algorithms as time permits.
3. CLO3 Implement the data structures that support the algorithms to retrieve and manipulate biological data from genomic and proteomic databases.
4. CLO4 Carry out preliminary computation-based bioinformatics research and analyses using acquired Python skills. Generate short preliminary research presentations based on the results of research investigations.

Required Texts/Readings

Textbook

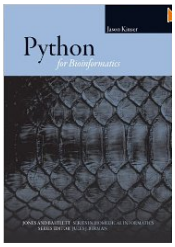
There is no required textbook. Instructional material related to the Python script languages will be provided has either handouts or the web-based location of the required material will be provided. Additional required reading material will be distributed to the class as appropriate.

Other Readings



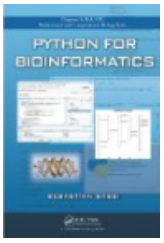
Bioinformatics Programming Using Python: Practical Programming for Biological Data. Mitchell L. Model (Paperback) O'Reilly Press. 2010 ISBN 978-0-596-15450-9

Approx. $43.03 Amazon.com



Python for Bioinformatics: Jason Kinser (Paperback) Jones and Bartlett Press, 2009, ISBN 13-978-0-7637-5186-9

Approx. $33.92 Amazon.com



Python for Bioinformatics Sebastian Bassi (Paperback) CRC Press (Chapman & Hall Book) . 2010 ISBN 978-1-58488-929-8

Approx. $65.03 Amazon.com

Think Python: Allen Downey (Paperback) O'Reilly Press 2012 ISBN 10: 144933072X; ISBN-13: 978-1449330729 Free Download from

greenteapress.com/thinkpython/thinkpython.pdf

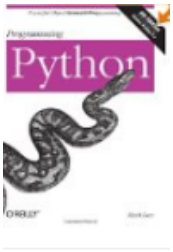
Kindle Edition $17.27

Bioinformatics Programming In Python: Ruediger-Marcus Flaig Wiley-VCH Verlag GmbH & Co. KGaA Press (Chapman & Hall Book) . 2008

Approx. $66.13 Amazon.com

Learning Python: Mark Lutz (Paperback) O'Reilly Press 2009
ISBN 978-0-596-15806-4

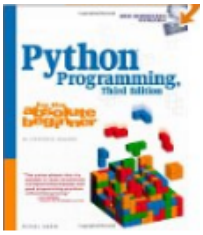
Approx. $32.85 Amazon.com



Programming Python: Mark Lutz (Paperback) O'Reilly Press 2011

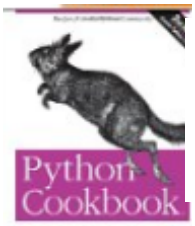
ISBN 978-0-596-15810-1

Approx. $38.26 Amazon.com



Python Programming for the Absolute Beginner 3rd Edition: Michael Dawnson O'Reilly Press 2009
ISBN 978-1-4354-5500-9
ISBN -10: 1-4354-5500-2
eISBN-10: 1-4354-5601-7

Approx. $20.87 Amazon.com



Python Cookbook: Alex Martell, Anna Ravenscroft (Paperback) O'Reilly Press 2011

ISBN 978-0-596-00797-3

Approx. $30.13 Amazon.com

Python for Data Analysis: Wes McKinney (Paperback) O'Reilly Press 2015

ISBN 978-1-449-31979-3

Approx. $23.18 Amazon.com

Beginning Python: From Novice to Professional: Magnus Lie Hetland , Faller Verlag, New York 2008
ISBN 978-1-59059-982-2
eISBN-13 978-1-4302-0634-7

Approx. $26.81 Amazon.com

Developing Bioinformatics Computer Skills, Cynthia Gibas and Per Jambeck, O'Reilly & associates. (A goc book for beginners)

Introduction to Computational Biology: Maps, Sequences and Genomes, Michael S. Waterman, CRC Pres (A statistical oriented view of bioinformatics)

Bioinfromatics: A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxecvanis and B.F. Francis Ouellette, John Wiley & Sons 2nd Ed. (Includes contributions from several authors providing a wide perspective)

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

Students will be assigned a video and or related multi-media or electronic copies of Python programming, programming in general, or literature related to developing computational solutions on a weekly basis. 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 consist of a short quiz at the start of elected classes to test comprehension of assigned material. Then the class will be divided into groups of 3-4 students to work on in-class programming exercises over two 75 minute class periods of supervision. Exceptions might be if a guest lecture or other relevant course-related activity is scheduled.

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.

Quizzes and Exams:

There will be programming quizzes assigned almost every week and four exams during the semester. The lowest quiz score and lowest exam score will be excluded from final course grade calculation. Because some quiz and exam scores will be dropped, there will not be any make up quizzes or exams.
Scores on quizzes and exams will count toward the final grad (percentage wise) as specified in the "Grades" section below. Programming quizzes and exams will cover the material presented in class or assigned in any and all previous weeks of the course unless specified otherwise.

Projects:
Several bioinformatics-related and biomedical-related engineering projects will be offered near the start of the course. Teams of 3-4 students will be formed to work on assigned projects. Teams will be required to submit a project proposal before starting on a project, and give a project presentation at the end of the course. Individual student scores on a programming project will be determined by the content and quality of the contribution of each student toward the project.
Students will be required to give a final project presentation. Scores on final programming project, and project presentation will count toward the final grad (percentage wise) as specified in the "Grades" section below.

NOTE that 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."

Grading Policy

Quizzes (1 of 5 lowest scores dropped)	(10 pts each) x 4 quizzes =	40 pts
Exams	(50 pts each) x 2 exams =	100 pts
In-Class Exercise Submissions	(CR/NC 1 pt each) x ~10 =	10 pts
Final Programming Proj. & Presentation		200 pts
Total Course Points	=	350 pts Total*

* The instructor reserves the right to adjust the above point distribution by ±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. The total points might change if and when the number or type of assignments change.

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

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 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, 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 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 at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop 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 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, 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 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 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 at 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 (AEC) at http://www.sjsu.edu/aec to establish a record of their disability.

CS 223 Bioinformatics , Spring 2016, Course Schedule

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")

Mtg #	Tue	Thur	SUBJECT/TOPIC	Assignment
1	No Class	1/28	• Course Intro & Logistics • Intro to Enthought Canopy Python • Videos • Navigating Enthought Canopy • Intro to scripting vs compiler languages • Motivation for Python & Intro to a few basic data types. • Background census	Assignment #1: Review Lecture #1 Video Complete practice quiz at end
2	2/2	2/4	• Assignment #1 Q&A • Practice Quiz #1 On Assignment #1 • In-class programming exercise related to Assignment #1 – Navigating Enthought Canopy, Interactive computation, practice with sequence data types.	Assignment #2: Review Lecture #2 Video Complete practice quiz at end
3	2/9	2/11	• Assignment #2 Q&A • **Quiz #1** • In-class programming exercise related to Assignment #2. Basic language constructs and data types. Strings, lists, tuples, dictionaries. DNA and RNA manipulation tasks will serve as context of in-class exercises	Assignment #3: Review Lecture #3 Video Complete practice quiz at end
4	2/16	2/18	• Assignment #3 Q&A • Quiz #1 On Assignment #3 • Possible Projects • Python Language • In-class programming exercise related to Assignment #3.	Assignment #4: Review Lecture #4 Video Complete practice quiz at end
5	2/23	2/25	• Assignment #4 Q&A • **Exam #1** On material from start of semester • In-class programming exercise related to Assignment #4.	Assignment #5: Review Lecture #5 Video Complete practice quiz at end
6	3/1	3/3	• Assignment #5 Q&A • **Quiz #2** On Assignment #5 • In-class programming exercise related to Assignment #5	Assignment #5: Continue With Review of Lecture

Mtg #	Tue	Thur	SUBJECT/TOPIC	Assignment
				#5 Video Complete practice quiz at end
7	3/8	3/10	• Seminar: Chair Kamel M.D. Stryker Neurovascular • Assignment # Q&A5 • **Quiz #3** On Assignment #5 • In-class programming exercise related to Lecture video #5 and or #6	Assignment #6: Review Lecture #6 Video Complete practice quiz at end
8	3/15	3/17	• Seminar Chard Abunassar, Abbott Vascular • Assignment #6 Q&A • **Quiz #4** • In-class programming exercise related to Lecture # 6 and or #7 • Project info & data provided on Canvas	Assignment #7: Review Lecture #7 Video Complete practice quiz at end
9	3/22	3/25	• Assignment #8 Q&A • Project Discussion • In-class programming exercise related to Assignment #8.	Assignment #8 Review Lecture #8 Video (A Python Review)
			SPRING RECESS 3/28 - 4/1	
10	4/5	4/7	• Assignment #9 Q&A • **Exam #2 (** On Assignment #7 • On Assignments #8 • Project Data & Discussion cont. • Project Report Requirements • In-class programming exercise related to Assignment #8	Assignment #11 TBA
11	4/19	4/21	• Assignment #10 Q&A • **Quiz #5** • Python Language (sklean & SVM cont) • Project Related Exercises and Instruction	Assignment #12 TBA
12	4/26	4/28	• Assignment #11 Q&A • On Clas • ses & Regular expressions • Project Related Exercises and Instruction	N/A
13	5/3	5/5	• Assignment #12 Q&A • In-class programming related to project	N/A
14	5/10	5/12	In-Class Work on Final Project Presentations 11/24	N/A
15			Final Project Presentations	N/A

Mtg #	Tue	Thur	SUBJECT/TOPIC	Assignment
Final Project Report Due Date and Time See Canvas Shell				

Grading Percentage Breakdown

Percentage of Total Pts	Pts	Letter Grade
96.66% and above	> 338	A+
93.33% - 96.65%	315 - 337	A
90% - 93.32%	284 – 314	A-
86.66% - 89.99%	246 – 283	B+
83.33% - 86.65%	205 – 245	B
80% - 83.32%	164 – 204	B-
76.66% - 79.99%	126 – 163	C+
73.33% - 76.65%	92 – 125	C
70% - 73.32%	64 – 91	C-
66.66% - 69.99%	43 – 63	D+
63.33% - 66.65%	27 – 42	D
60% - 63.32%	16 – 26	D-
Below 60%	**< 16**	**F**