BCH 571 (CRN 90313)

Bioinformatics for Life Scientists

Fall 2018

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Lectures: Tuesdays, 2:15-3:15pm, Neuman Room (Medical Center Room 1-6823)

Labs: Thursdays, 2:00-5:00pm, Neuman Room (Medical Center Room 1-6823)

Credit hours: 4

Texts: Required:

Python for Biologists: A complete programming course for beginners
Martin Jones

An Introduction to Bioinformatics Algorithms
Neil Jones and Pavel Pevzner

Grading:
- Lab projects and participation (60%)
- Final project (written paper of 3-6 pages, a program with example input and expected output, and an oral presentation to class; 40%)

Course Description:
This course will teach scripting in Python and also algorithm design for bioinformatics. It expects no prior knowledge in programming. The class will meet twice a week – once for a traditional lecture and once for a laboratory session.

Course Aims:
The primary aim of this course is for each student to be able to write data-handling programs in Python. At the end of the course, all students will be able to write programs. The secondary aim for the course is for students to understand approaches to tackling more complex tasks, such as algorithm design and estimating algorithm complexity.

Academic Integrity:
Academic integrity is a core value of the University of Rochester. Students who violate the University of Rochester University Policy on Academic Honesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since academic dishonesty harms the individual, other students, and the integrity of the University, policies on academic dishonesty are strictly enforced. For further information on the University of Rochester Policy on Academic Honesty, please visit the following websites: http://www.rochester.edu/GradBulletin/PDFbulletin/Regulations.pdf
https://www.rochester.edu/college/honesty/assets/files/Academic_Honesty.pdf

Accommodations for Students with Disabilities:
Students needing academic adjustments or accommodations because of a documented disability must contact the Disability Resource Coordinator for the school in which they are enrolled:
http://www.rochester.edu/disability/access-coordinators.html

Schedule Overview:

1. Thinking about scripting and programming. What is a script and what is a program? What are some of the common languages and why would you choose one or another?
2. Fundamentals of Python. How is it installed? How is it accessed?
3. Programming in Python.
4. How do you use Python libraries to do more complicated tasks?
5. How do you use Python to control and interface existing programs and make analysis pipelines?
6. Algorithms. What is an algorithm? What is complexity?
7. Dynamic programming algorithms. Sequence alignment.
8. Pattern matching. Blast.
9. Hidden Markov Models.
10. Student presentations.

Detailed Schedule:

Classes begins Thursday,8/30/18
Thanksgiving Break – no class Thursday, 11/22/18
Last day of classes Tuesday, 12/11/18

8/30 – Lecture – What is programming and scripting? Why Python? How information flows in programs. The basic syntax in Python. How to manipulate text and files.
9/4 – Lecture – How to Install Python. How to install pycharm. How to write Python.
9/6 – Lab – Install Python. Using the Unix command line. Hello World. Text and File Handling (read chapters 1-3 of Jones)
9/11 – Lecture – Control Loops and Functions. What are the components of a computer and some history. How to think about program cost (e.g. file reading and storage).
9/13 – Lab – Write programs with loops and control structure. (read chapters 4-6 of Jones)
9/18 – Lecture – Computer architecture and using code libraries (Biopython).
9/20 – Lab –Biopython.
9/25 – Lecture –Dictionaries.
9/27 – Lab –Dictionaries (read chapter 8 of Jones)
10/2 – Lecture – Regular expressions and objects.
10/4 – Lab – Regular expressions (read chapter 7 of Jones.
10/9 – Lecture – Tuples and sets.
10/11- Lab – Tuples and sets.
10/16 – Lecture – Interfacing with programs and R.
10/18 – Lab – Interfacing with programs and R. (read chapter 9 of Jones)
10/23 – Lecture – Introduction to algorithms and algorithmic thinking.
10/25 – Lab – First algorithms. (read chapter 2 of Jones and Pevzner)
10/30 – Lecture – Greedy algorithms.
11/2 – Lab – Greedy algorithms. (read chapter 5 of Jones and Pevzner)
11/6 – Lecture – Dynamic programming algorithms.
11/8 – Lab – Dynamic programming algorithms. (read chapter 6 of Jones and Pevzner)
11/13 – Lecture – Hidden Markov Models.
11/15 – Lab – Hidden Markov Models. (read chapter 11 of Jones and Pevzner)
11/20 – Lecture – Using the Unix command line.
11/27 – Lecture – Interacting with Git and the importance of version control.
11/29 – Lab – Unix command line and Git.
12/4 – No class.
12/6 – Student Presentations
12/11 –Student Presentations