COMP 383/483 Computational Biology

- Instructor: Dr. Heather Wheeler hwheeler1@luc.edu
- Prerequisites: BIOL 388/488 and COMP 231/271
- Synchronous Sessions: Tues/Thurs 3:00 – 4:40 PM CST/CDT via Zoom
- TA: Elyse Geoffroy egeoffroy@luc.edu
- Office Hours: Second half+ of class sessions or by appointment

Objectives:

- Design and implement advanced data structures/algorithms for computational biology
- Analyze primary literature in bioinformatics and computational biology
- Increase proficiency in Python scripting and command line tools used in the field
- Develop a software solution to meet a real need in the life sciences

Course Materials: There is no specific text for this course. Rather, we will be using free online materials and the scientific literature. Students must have access to a computer (Mac, Windows, or Linux operating system) with administrative rights, i.e. can install software. Computers must have a minimum of 8 GB of RAM and a reliable internet connection. For synchronous sessions, the student needs a device with a microphone and a large enough screen to view shared code. A webcam is helpful for interacting with classmates and instructor, but not required.

Discussions, Office Hours & Seeking Help: To meet at a time other than scheduled class time, you must email the instructor or TA to schedule a day and time in advance. Note that each synchronous session will have ample time at the end to work on assignments and ask questions. Another route to get assistance is to ask questions via email, **please cc: instructor and TA**. We will do our best to respond to emails within 24 hours. There are many online forums where you can post your questions or search for questions and answers. When you encounter a problem, error message, etc., you can always try and **Google it!**

Student Accommodations: Any student requesting accommodations is required to register with Student Accessibility Center (SAC). Students will provide the instructor with an accommodation notification from SAC, preferably within the first two weeks of class. Students are encouraged to meet with the instructor individually in order to discuss their accommodations. All information will remain confidential. For more information or further assistance, please call 773.508.3700 or visit https://www.luc.edu/sac/.

Academic Integrity: Plagiarism and cheating will not be tolerated and will be reported to the college. See http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml. STUDENTS FOUND TO PRESENT SOMEONE ELSE'S WORK AS THEIR OWN WILL **RECEIVE ZERO POINTS FOR THE ASSIGNMENT**. ANY STUDENT WHO REPEATS SUCH AN ACTION WILL RECEIVE A FAILING GRADE (F) FOR THE COURSE.

The Unix, Python, and R programming assignments and mini-project at the beginning of the semester will be done independently (although you can get help from each other in class). Cheating includes submitting as your own work something that has been written by another person (classmate, tutor, website, etc.). **You must comment your code in your own words** to demonstrate that you understand it. You will often be asked questions about how your code works and your comments will help you explain. Our goal is for you to better understand strategies and algorithms used in bioinformatics, not for you to simply solve the problems

without understanding your code. **Inability to explain how your code works will result in a reduced grade.**

After the first half of the course, the rest of the course will be spent working on a group project. As part of a group, you are expected to contribute to the same degree as your teammates. **"Coasting" or letting your teammates carry you is plagiarism; you are taking credit for contributions that you did not make.** This is on-par with presenting someone else's idea/work as your own without proper citation. Plagiarism and cheating of any form will not be tolerated. A student suspected of such behavior will be assessed on an individual basis and action taken per the instructor's evaluation of the seriousness of the behavior. Repeat offenders will earn an F for the course. **As a contributing member of a group, it is your responsibility to ensure that all members are contributing.** Issues that cannot be resolved within the group should be reported to the instructor.

Grading: Your grade will comprise several assignments as listed below.

Assignment	Points
Unix Command Line Exercises	2
ROSALIND 1-5	3
ROSALIND 6-10	5
ROSALIND 11-13	5
ROSALIND 14-15	5
ROSALIND 16-21	5
R Plotting Exercises	5
Mini-Project	15
Initial Group Project Presentation	10
5-minute Group Progress Presentations (3 points each, 2 total)	6
GitHub Repo Checks (2 points each, 3 total)	6
Application Note Rough Draft	3
Final Presentation	10
Final Project (code)	15
Final Application Note	10

105 points are available. Your final grade will simply be the sum of all of the points you have earned over the course of the semester. The minimum points (pts) needed for each grade are listed in the table below. Points are rounded to the nearest tenth.

A ≥ 93 pts	B+ ≥ 87 pts	B- ≥ 80pts	C ≥ 73pts	D+ ≥ 67pts	F < 63pts
A- ≥ 90 pts	B ≥ 83 pts	C+ ≥ 77pts	C- ≥ 70pts	D ≥ 63pts	

Late/Missed Assignment Policy: Due dates and times for each assignment will be posted on ROSALIND or Sakai. LATE ASSIGNMENTS ARE TYPICALLY NOT ACCEPTED. Extra points are built into the course for this reason. Exceptions may be made at the discretion of the instructor. Please communicate with me if you are unable to keep up with your coursework and we will find solutions together.

***Additional Requirements for Students Enrolled in COMP 483*:** Students enrolled in the graduate level course have additional responsibilities and one additional assignment.

- Each group will include just one student enrolled at the graduate level and this person will serve as the team leader. The team leader is responsible for integrating the team's

design plans, comments, etc. into a Design Document (due 3/16). A template will be provided via Sakai. This document will be worth 7 points towards the team leader's Final Project. The team leader's Final Project grade will still only total 35 points. Thus, it will be calculated as follows:

- Final Presentation: 10pts*0.8=8pts
- Final Project (code): 15pts*0.8=12pts
- Final Application Note: 10pts*0.8=8pts
- Design Document: 7pts

Class Conduct: One important aspect of your education is learning to respect the rights of others. Please respect others by (1) allowing all classmates the right to voice their questions or opinions without fear of ridicule and (2) not making objectionable (e.g., gendered, racial, or ethnic) comments.

Diversity and Inclusion Statement: Science strives to be objective. However, science is historically built on a small subset of privileged voices and thus includes both explicit and implicit biases. My goal is that students from all backgrounds and perspectives are well served by this course. The diversity students bring to computational biology should be viewed as a resource, strength and benefit as we pursue knowledge in the service of humanity. I intend to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, religion or no religion, and culture. Your suggestions for improving inclusion are encouraged and appreciated.

Privacy Statement: Assuring privacy among faculty and students engaged in online instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring during synchronous Zoom sessions will be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered.

Intellectual Property: All lectures, videos, slides and other instructional materials in this course are the intellectual property of the instructor. As a result, they may not be distributed or shared in any manner, either on paper or virtually without the instructor's written permission. Lectures may not be recorded without the instructor's written consent; all synchronous Zoom sessions will be available for students to view in Sakai. Note that Zoom Breakout Rooms will not be recorded. Recognizing that your work, too, is your intellectual property, the instructor will not share or distribute your work in any form without your written permission.

Statement of Intent: By remaining in this course, students are agreeing to accept this syllabus as a contract and to abide by the guidelines outlined in the document.

Course Schedule

Week	Date	Topics	**DUE at start of class** (unless otherwise noted)
1	19-Jan	Course Introduction, Command Line and SSH	
	21-Jan	Python and Biopython Review, Strings	UNIX Command Line Exercises
2	26-Jan	Splicing, k-mers, Sets	ROSALIND 1-5
	28-Jan	Dynamic Programming	
3	2-Feb	Genome Assembly Algorithms	ROSALIND 6-10
	4-Feb	Genome Assembly and Mapping Software	
4	9-Feb	Transcriptomics	ROSALIND 11-13
	11-Feb	***No class: BREAK 1***	
5	16-Feb	FASTQ and Assembly Quality	ROSALIND 14-15
	18-Feb	GitHub and Mini-project Introduction	
6	23-Feb	Programming BLAST	ROSALIND 16-21
	25-Feb	Data Visualization in R	
7	2-Mar	Group Project Introduction, Mini-project Workday	R Plotting Exercises
	4-Mar	Assign Groups, Mini-project Workday	Mini-project due 10:00PM
8	9-Mar	***No class: BREAK 2***	
	11-Mar	Discuss Design Doc & Repo, Group Work	
9	16-Mar	Group Work	Design Doc **[483 only]** due 10:00PM
	18-Mar	Group Work	Repo Check #1
10	23-Mar	Initial Group Presentations	Initial Group Presentation
	25-Mar	Initial Group Presentations	Initial Group Presentation
11	30-Mar	Group Work	
	1-Apr	Group Work, 5-min Group Progress Presentations	5-min Group Progress Presentation
12	6-Apr	Group Work	
	8-Apr	Cross-team hacking	Repo Check #2
13	13-Apr	Group Work	
	15-Apr	Group Work, 5-min Group Progress Presentations	5-min Group Progress Presentation, Rough Draft App Note
14	20-Apr	Group Work	
	22-Apr	Group Work	Repo Check #3
15	27-Apr	**Final Presentations**	Final Presentation
	29-Apr	**Final Presentations**	Final Presentation
Finals	6-May		Final Project code, Final App Note

Schedule is subject to change at discretion of the instructor; changes will be published to Sakai.