C O U R S E S Y L L A B U S

Quantitative Bioinformatics (BIOL-337/STAT-337/STAT-437)
Spring Semester, 2014; Tuesdays and Thursdays 6.00 – 7.15pm in IES Building, Room 110
Prerequisites: Some exposure to basic statistical/biostatistical methods (e.g. as in BIOL/STAT335 or equivalent) as well as differential and integral calculus (MATH 131-132/161-162); or permission of the instructor
Text: Deonier, Richard C., Simon Tavaré and Michael S. Waterman, *Computational Genome Analysis: An Introduction*, 2005, New York: Springer, ISBN: 0-387-98785-1.

Instructor: Timothy E. O'Brien, Ph.D. **Email**: tobrie1@luc.edu
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Office Hours: Tuesdays and Thursdays 1.00-2.00pm and 5.00-5:30pm, and by appointment
Course Web Page: **http://webpages.math.luc.edu/~tobrien/courses/bioinf/course-homepage.htm**

Course Overview

Predicting which conditions and diseases will develop in animals and humans based on its gene and protein characteristics must involve drawing conclusions from well-designed studies. As such, meaningful decisions hinge upon the correct use of statistical hypothesis testing, prediction and estimation. The most likely conclusions are also drawn from probabilistic/ stochastic arguments, and so a well-chosen experimental design removes any biases and allows researchers to generalize from small studies to the larger population.

This course explores recently developed mathematical, probabilistic and statistical methods currently used in the fields of bioinformatics and DNA microarray and protein array data analysis. These include stochastic processes, (hidden and traditional) Markov chains, microarray and other techniques. Our focus in this course is on the application of these techniques and on meaningful interpretation of results. Students will be required to analyze real-life data sets using the Minitab, R and SAS statistical packages. Grading will be based on homework assignments, two quizzes, a midterm and a final exam, and a course project/paper.

Homework and Exams

Homework assignments (in groups for undergraduates) will be given every week or two, graded and returned to students in a timely manner to give students needed feedback. Two 50-minute quizzes will be given during the semester: on Tuesday February 11th and Tuesday April 15th. The 75-minute midterm exam is scheduled for Tuesday March 18th; the (comprehensive) final exam will take place on Thursday, May 1st @6pm.

Grading Scheme

Homework and R assignments	15%
Two Quizzes (@ 12.5% each)	25%
Midterm Exam (Tuesday, March 18th)	20%
Final Exam (Thursday, May 1st)	25%
Participation	5%
Class Paper	10%

Final course (letter) grades will be awarded according to the following grading scheme:

[92.5 , 100] = A, [90.0 , 92.5) = A-, [87.5 , 90.0) = B+, [82.5 , 87.5) = B, [80.0 , 82.5) = B-, [77.5 , 80.0) = C+, [72.5 , 77.5) = C, [70.0 , 72.5) = C-, [67.5 , 70.0) = D+, [60.0 , 67.5) = D, [0.0 , 60.0) = F

Participation

Students are expected to actively participate in class discussion. To the extent possible, students should read the lecture material before class so as to best benefit from the class lecture and discussion.

Computing

Students will develop the ability to analyze data sets using the Minitab, R and SAS software packages, although no previous exposure to these packages is needed. Students will need to download R onto their personal computers to complete some exercises; students are also required to have & use a calculator.

Academic Honesty

With the exception of UG group homework assignments, it is presumed & required that students do their own work on the homework assignments and all exams. Discussing homework problems with others is encouraged; however, submitting work as your own which is copied or paraphrased from someone else is not permitted. Neither discussing nor copying related to exam questions is permitted. Cheating includes, but is not limited to, illegal collaboration, copying, using materials not permitted on tests, and assisting others on tests. Anyone found cheating will not be permitted to withdraw and will receive an "F" grade for the course. Your academic dean will be informed and a statement will be placed in your permanent file.

Tentative Semester Schedule (Text Chapters) – this schedule is subject to change including exam dates

Tuesday	Thursday
1/14 – Introduction; Molecular Biology Overview (1)	1/16 – Molecular Biology Overview (1)
1/21 – Words (2)	1/23 – Words (2)
1/28 – Words (2)	1/30 – Words (2), Word Distributions (3)
2/04 – Word Distributions (3)	2/06 – Word Distributions (3)
2/11 – Word Distributions (3); Quiz 1	2/13 – DNA Physical Map (4)
2/18 – DNA Physical Map (4)	2/20 – Sequence Alignment (6)
2/25 – Sequence Alignment (6)	2/27 – Rapid Alignment Methods (7)
3/04 – *No class – Spring Break*	3/06 – *No class – Spring Break*
3/11 – Rapid Alignment Methods (7)	3/13 – DNA Sequence Assembly (8)
3/18 – Midterm Exam	3/20 – DNA Sequence Assembly (8)
3/25 – Signals in DNA (9)	3/27 – Signals in DNA (9)
4/01 – Signals in DNA (9)	4/03 – Similarity, Distance & Clustering (10)
4/08 – Similarity, Distance & Clustering (10)	4/10 – Gene Expression (11)
4/15 – Gene Expression (11); Quiz 2	4/17 – No Class: Easter Holiday
4/22 – Gene Expression (11)	4/24 – Gene Expression (11)

Note #1: The midterm exam will be 75 minutes in length and the final will be two hours in length; the final exam will be comprehensive.
Note #2: The last day that a student may withdraw without a penalty grade of "WF" is Monday, March 24th.