Math 115: Quantitative Biology **2021**
Modeling Life, Garfinkel/Shentsov/Guo and
Handbook of Biological Statistics, McDonald (http://www.biostathandbook.com/)
Dr. Roland Minton, Trexler 270-C, 375-2358,
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Course Objectives: *Learn mathematical and statistical concepts that have been helpful to biologists.* Mathematics is a problem-solving discipline, and the ideas that have been developed are essential to understanding our world. The focus here will be on concepts and simple applications of those concepts to biological situations.

Intended Learning Outcomes: At the end of the course, successful students will be able to
- Use calculus concepts to model and solve problems
- Apply basic modeling techniques to epidemiology and other applications
- Identify which of several statistical models is most relevant for a given problem
- Research and analyze a real world problem quantitatively

Attendance Policy: Attendance and attention in class is essential! Work hard in class and you will have little need for studying the night before a test. You are responsible for everything done in class, through attendance and sharing class notes with classmates. If you miss a class, e-mail or call me before class is over and explain why. With the first unexplained absence, you and your advisor and the registrar will be warned that another unexplained absence will result in removal from the course. **If you have two unexplained absences, you will be dropped from the course.**

Equipment: We will use R extensively for statistical analysis of data sets. We will use Mathematica for some messy calculations. Both are available for free. You should have a graphing calculator available for graphing and for basic calculations. Instructions will be given on the use of R, including how to download it.

Study Problems: Problems from the books and handouts will give you problems to practice on. Similar problems will be on the tests. Work as many of these problems as you can and ask questions about those you are not sure about!

Quizzes and Worksheets: There will be regular (usually twice a week) online quizzes to be completed on Inquire. Check Inquire regularly to see the schedule. There will be activities to be completed in-class on most days. These worksheets will be handed in and graded on a scale of 0 to 3 based on effort.

Homework and Project: There will be assignments to be completed and turned in that go beyond basic math problems. Due dates will be clearly marked on assignment sheets. You will have class time to work on these problems and ask questions – use this time wisely! In class, you may ask questions and talk through ideas. However, **do not copy** someone else's work! The final project will be in groups and result in a paper and presentation.

Tests: There will be two tests, one on modeling and one on statistics. Test dates are Friday 10/8 and Monday 11/22. The final exam is Tuesday, 12/14 at 8:30.

Make-ups: In case of sickness or scheduling conflicts, get in touch with me ASAP. Make-ups are easiest to plan in advance and will not be given unless scheduled in a timely fashion.

I expect you to spend at least 12 hours of work each week inside and outside of class.

Grading:

Quizzes: 10%   Worksheets, MCSP, Participation: 10%

Homework: 20%   Project: 20%

Tests: 20% each

Grades may be curved up based on extenuating circumstances, including improvement as the semester goes on.

A: 93-100 A-: 90-92
B+: 87-89 B : 83-86 B-: 80-82
C+: 77-79 C: 73-76 C-: 70-72
D+: 67-69 D: 63-67   D-: 60-62
F: 59 and below

Community: Welcome back to Roanoke College! We will follow mask/distancing guidelines established by the college, out of respect for the health of others. As the pandemic allows, we will work together and get to know each other. Please take the time to get to know your fellow students. They can be a great resource for you! Utilize office hours and all opportunities to ask questions and get help from me. Get involved with campus activities! If you are interested in sports and sports analytics (*Moneyball*) ask me for information on Stat Crew.

Co-Curricular: During the course of the semester, you must "attend" at least one co-curricular event approved by the MCSP department. Write a two-paragraph reflection paper, giving a brief summary of the talk and expanding on some aspect of particular interest to you. Reports are due within a week of the talk. One report must be turned in before fall break.

Academic Integrity: The college policy is fully supported. Tests are closed notes, closed book unless noted. Electronic devices other than computers are not allowed in test situations, and computers may only be used for computation purposes in Mathematica.

Math 115 Schedule

Date	Sections	Topics	Study Problems
W 9/1	1.1	Feedback	
F 9/3	1.2,3	Functions, States	p23 #2
M 9/6	1.4	Modeling Change	p43 #1,3,6,8,10
W 9/8		Epidemiology	
F 9/10		COVID models	Homework #1
M 9/13	1.5	Graphical	p53 #4
W 9/15	1.6	Trajectories	p62 #2,3,4
F 9/17	2.1,2	Derivatives	p79 #1,2,3,5
M 9/20	2.5	Derivative Functions	p98 #1,4,5,6
W 9/22	2.6	Integration	p108 #2b,3b,4
F 9/24	3.1,2	Equilibrium	p131 #2,3,4,7
M 9/27	3.3,4	Three Dimensions	p147 #5,6,7
W 9/29	3.5	Basins of Attraction	p155 #3,4,6
F 10/1	4.1	Oscillations	p181 #2,5,6
M 10/4	5.1,2	Chaos	p238 #1,5.2.5
W 10/6		Review	
F 10/8		Test #1	
M 10/11	5.5		
W 10/13		R introduction	
F 10/15		Project introduction	

FALL BREAK

Math 115 Schedule

Date	Sections	Topics	Problems
M 10/25		Hypothesis testing	
W 10/27		2-sample t-test	
F 10/29		Paired t-test	
M 11/1		ANOVA	
W 11/3		ANOVA	
F 11/5		Chi-square	
M 11/8		Chi-square	
W 11/10		Linear regression	
F 11/12		Linear regression	
M 11/15		Logistic regression	
W 11/17		Transformations	
F 11/19		Review	
M 11/22		Test #2	
M 11/29		Hardy-Weinberg	
W 12/1		Mark and Recapture	
F 12/3		Correlation	
M 12/6		Project work	
W 12/8		Project work	
F 12/10		Review	
T 12/14	Exam 8:30-11:30		

Math 115 Information Sheet

Name:

Email:

Cell phone:

Major(s):

Hometown:

List the math/stat course(s) you took last year.

How hard do you expect Math 115 to be? How interesting?

Why is math important?

What are some of the co-curricular or other campus activities you would like to participate in this year?