

BME 503 – Statistical Methods for BME – Winter 2016

Course Description:	This course will cover descriptive statistics, probability theory, distributions for discrete and continuous variables, hypothesis testing, and analysis of variance, as well as more advanced topics. We will make connections with real problems from engineering, biology, and medicine, and computational tools will be used for examples and assignments.
Class Meetings Times:	Lectures: Tues/Thurs, 12:30-2:00 pm, Cooley G906 Optional Lab: Mondays 11:30-12:30, LBME 1310
Instructors:	<p>Douglas C. Noll, Ph.D. Professor, Biomedical Engineering and Radiology 2109 Gerstacker (734) 764-9194 dnoll@umich.edu Office hours: 2109 Gerstacker, Tuesdays 2-3</p> <p>Kunal Rambhia krambhia@umich.edu Office hours: Mondays 10:30-11:30, LBME 2185</p>
Computational:	You will need access to the “R” software package for HW and projects. R is a freely available statistical package that you will find very useful in your research and other courses (http://www.r-project.org). You probably want to install it on your PC or laptop, and it is also available on CAEN computers.
Recommended Texts:	<p>Primary Course Text - <i>Introduction to the Practice of Statistics</i>, 8th ed. (2014) by Moore. <i>et al.</i> “IPS” in syllabus. Other editions are also ok.</p> <p>This is a pretty good statistics text book. Lots of examples and exercises. The lecture materials were partially drawn from this book and will follow the general approach. This book is recommended, though not required. I strongly recommend that every student have a good statistics book to use as a reference.</p> <p>Since we make extensive use of R in the class, you might also consider a text that can also serve as a reference for R. There are several text books, e.g. <i>Using R for Introductory Statistics</i>, 2nd ed. (2104) by John Verzani, but also on-line resources, such as http://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf and the on-line manuals for R.</p>
Grading:	50% Homeworks (5% for each of 10 HW's) 20% Projects (10% for each of 2 projects) 30% Exams (15% for each of 2 exams)
Homeworks:	<p>There will approximately weekly homework assignments (10 total) and these form a large portion of your final grade. Here are the rules:</p> <ol style="list-style-type: none"> 1. Hand in HW <u>in class</u> in paper form. If easier, it is ok to label plots, axes, key, etc. by hand for the first assignment only. After the first week, you will need to work out how to do it in R. 2. HW assignments that are not in the GSI's hands when he leaves the classroom will be considered late along with a 10% penalty (unless you have made prior arrangements with the GSI). Once solutions have been

	<p>posted, late HW submissions will not be accepted.</p> <ol style="list-style-type: none"> 3. You may discuss the problems with your classmates (both general concepts and R syntax), but you must do your own solution, from beginning to end. 4. You may not copy any other student's HW at all. You may not look at solutions from a prior year's class. Doing your own assignments is the best way to learn. 5. Any numeric exercises must use R, unless otherwise stated. Learning to use R is one of the objectives of this class. 6. Requests for regrades must be made within 1 week and must include an attachment describing your objections. The entire assignment is submitted for regrading and the final grade could be higher or lower.
Projects	<p>Projects are kind of like the assignments, but a bit more open ended and require more thoughtful discussions. The rules are a bit different as well.</p> <ol style="list-style-type: none"> 1. Projects are to be handed in paper form. Projects should be handed in during class on or before the due date or to the instructor in his office if there is no class scheduled for that day. 2. Late assignments will be penalized. 3. You may choose a partner for the projects, but like HW's you must do your own solution. You must have a different partner for each project. You may not look at prior year student's work (though the projects will be a bit different). Violations of these guidelines will be considered a violation of the Engineering Honor Code. 4. Projects should use R to analyze the data.
Exams	<p>There will be two exams during the term. Each should be considered cumulative – that is, any topic discussed in class up 'til that point is fair game, however, the bulk of the questions will be on the topics in the first and second half of the term, respectively. The mid-term exam will be scheduled in the evening the week before spring break. The final exam will be during the regularly scheduled final exam slot. Guidelines (subject to change):</p> <ol style="list-style-type: none"> 1. Closed book, closed computer, calculators allowed and recommended. 2. Unlike HW's and projects, R will not be used. The exams are intended to test conceptual knowledge rather than implementation. It is certainly possible that topics that are not covered in the HW's will be on the exam. 3. Exams will be two hours in length.
Honor Code:	<p>This class will be governed by the Engineering Honor Code: http://honorcode.engin.umich.edu/ Any violations, including copying HW solutions, will be handed over to the honor council for adjudication.</p>

Preliminary Syllabus

(This is expected to change and updated versions will periodically be posted.)

Dates	Topic (lecture # in parentheses)	Readings & Assignments
1/7	Introduction & policies (1)	Lecture Notes, Syllabus
1/12-14	Introduction to R, Descriptive Statistics, Graphing Methods, Correlation (2-3)	IPS Chapters 1, 2.1-2.3 (2.1-2.2 in 7 th ed.)
1/19-21	Regression, Basic Probability (4-5)	IPS Chapters 2 & 4.1-4.2 HW 1 due 1/21
1/26-28	Random variables, distributions and parameters. Sampling distributions (6-7)	IPS Chapters 4 & 5.1 HW 2 due 1/28
2/2-4	Sampling distributions, confidence intervals. (8-9)	IPS Chapters 5.2 & 6.1 HW 3 due 2/4
2/9-11	Hypothesis testing and inference, power. (10-11)	IPS Chapter 6 HW 4 due 2/11
2/16-18	t-distribution and more hypothesis testing, two-sample tests. (12-13)	IPS Chapter 7 HW 5 due 2/18
2/23	Catch-up/mid-course review (14)	
2/25	(no lecture) Midterm Exam (7-9pm, IOE 1610) on prob, means, vars, conf intervals, hypothesis testing, etc.	IPS Chapters 1, 2, 4-7 Project 1 due 2/25
	Spring Break	
3/8-10	Regression, multiple regression, inference with regression. (15-16)	IPS Chapters 10-11 HW 6 due 3/10
3/15-17	Inference with proportions. (17-18)	IPS Chapters 8-9 HW 7 due 3/17
3/22-24	Two-way tables, chi-squared tests, one-way ANOVA. (19-20)	IPS Chapters 12-13 HW 8 due 3/24
3/29-31	More ANOVAs. (21-22)	IPS Chapter 13 HW 9 due 3/31
4/5-7 4/12	Special topics, possibly including non-parametric statistics, logistic regression, non-normal data and transformations, tests of outliers, bootstrap methods. (23-25)	Readings TBD HW 10 due 4/7
4/14	Catch-up/course review (26)	Project 2 due 4/14
4/21	Final (Thursday, April 21, 4-6pm, loc TBD) on two-sample testing, regression, proportions, two-way tables, χ^2 , 1- and 2-way ANOVAs, non-param stats, other topics, etc.	All topics from the class.