Biology 4401: Experimental Design & Statistical Methods
Fall 2014

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Course description: This course is an introduction to the basic methods for designing experiments,
                        analyzing data, and drawing inferences. Mathematical concepts and theory
                        underlying statistical methods commonly applied in the biological sciences will
                        be covered, including fundamentals of discrete and continuous distributions,
                        random and fixed variables, hypothesis testing, regression and analysis of
                        variance techniques. Parametric and non-parametric approaches for data analysis
                        are included. The computer program MINITAB provides the analytical tool for
                        putting statistical theory into practice using a variety of data sets. Group problem
                        solving exercises will be an important part of this course, and administered using
                        Learning Catalytics. In addition, students are required to examine critically the
                        application and use of statistical analysis in the scientific literature.

Textbook: "*Introductory Statistics,*" by Prem S. Mann (8th Ed.), J. Wiley & Sons
                (*Note to students: earlier editions are satisfactory*)

Grading: Homework assignments   20%
                Midterm Exams (3 @10% each)   30%
                Final Exam   20%
                Student Critique on Applied Statistics   10%
                In-class work (group problems)   20%

                Homework assignments are to be completed and submitted prior to posted deadlines!
                Any assignments submitted after the deadline will be assessed a 25% penalty, and no
                homework will be accepted after graded assignments have been returned.

                Midterm exams will be based on lecture material. Formula sheets and calculators are **not**
                allowed unless specifically indicated by the instructor. Statistical tables required for
                answering questions will be provided.

                The final exam is a comprehensive take-home exam.

                Instructions for preparing the Critique paper (**due Nov. 21**) will be posted to the course
                web site (T-Square).

MINITAB: The use of the statistical software MINITAB is strongly encouraged for this course.
                There are multiple methods for accessing MINITAB. First, it is bundled with the
                textbook if purchased new. Second, it can be purchased separately as an on-line
                download (but 30 day trials are free!). Third, it is available on the School of Biology
                computer cluster located in Room 206, Cherry Emerson (Biology) Building. Fourth, the
                software is available through mycloud.gatech.edu (this will be how you to access the
                software during class problem sets). Note, MINITAB is PC-only software. If you own a
                Mac, you will need to either install an operating system which allows PC programs to
                run, or take advantage of running MINITAB in the "cloud." Instructions for accessing
                MINITAB via mycloud.gatech.edu will be found on T-square.

Learning Catalytics: In-class problem solving sets will be administered using the web site
learningcatalytics.com. Students can access this web site from the classroom using any
internet-enabled device, including laptops, notebooks (e.g. iPads), and "smartphones."
Although you will be allowed to work in groups, each student will need to create their
own account. A semester-length account will cost ~$12.

SYLLABUS

DATE	TOPIC	TEXT CHAPTERS
Aug 19	Introduction to course	
Aug 21	Descriptive Statistics	1-3
Aug 26	Intro to Probability Distributions	4-5
Aug 28	Binomial & Poisson Distributions	4-5
Sep 2	Density Functions & Intro to Normal Distribution	6
Sep 4	The Normal (Gaussian) Distribution	6
Sep 9	The Standard Normal (z) Distribution	7
Sep 11	Sampling Distributions	7
Sep 16	Probability Statements: What do They Really Mean?	-
Sep 18	**MIDTERM EXAM 1**	**1-7**
Sep 23	Applications of sampling distributions	8
Sep 25	Central Limit Theorem	8
Sept 30	Hypothesis Testing	9
Oct 2	Type I & Type II Errors & Power	-
Oct 7	One-sample tests of hypotheses	9
Oct 9	Sign test and Ranked Sign test	15*
Oct 14	**Fall Break, No Classes**	
Oct 16	Two sample tests of hypotheses	10
Oct 21	**MIDTERM EXAM 2**	**8, 9, 15**
Oct 23	Two sample tests	10
Oct 28	Wilcoxon signed-rank test & rank sum test	15
Oct 30	Goodness of fit and Chi Square tests	11
Oct 31	**Deadline for Critique Paper Approval**	
Nov 4	Tests for multiple samples (ANOVA)	12
Nov 6	Analysis of variance	12, 15
Nov 11	Mean separation techniques in ANOVA	12
Nov 13	Introduction to linear regression	13
Nov 18	Linear regression	
Nov 20	Linear regression with non-parametric applications	13, 15

Nov 21   **Critique Paper Due**

Nov 25   **MIDTERM EXAM 3**   10, 11, 12, 13, 15
Nov 27   **Thanksgiving Break, No classes**

Dec 2   Multiple Regression: Adding variables to a linear model   14*
Dec 4   Two-way ANOVA and ANCOVA models   -
             Take-Home Final Released to Class

Dec 10   **Final Exam (Take Home) Due @ 5:00 pm**   **ALL**
             (hard copy ONLY)

*Note: Chapters 14 & 15 are not included in the textbook but are available as a free download from the
       publisher