Biostatistics - Syllabus

Primary Instructor:	Giacomo Fiorin
Email:	giacomo.fiorin@temple.edu
Phone:	215-204-4213
Office location:	Science Education and Research Center, room 704D
Office hours:	Tuesdays 3:30-5:00, Wednesdays 2:30-4:00
Adjunct Instructor:	Christopher MacDermaid
Email:	macdercm@temple.edu
Phone: f	215-204-4215
Office location:	Science Education and Research Center, room 701D
Office hours:	Mondays 1:00-4:00

Outside the office hours of both instructors, please email both instructors to schedule an appointment.

Class Hours and Location

Lectures and tests in class are held Tuesdays and Thursdays between 12:30-1:50, in the **Science Education and Research Center (SERC), room 108A**.

Tuesday classes are typically lectures covering theory and examples, while most Thursday classes are recitations of exercise, activities in class or in the computer lab. Activities in the computer lab will be conducted at the Tuttleman Learning Center, or alternative resource depending on availability.

Homework

Homework will be assigned throughout the semester with frequency at most weekly. Assignment scores will contribute to the final grade, each carrying 20 points maximum. Bonus points beyond 20 will be awarded for the most difficult tasks in each assignment.

Assignments may be turned in electronically via Blackboard, or on paper in class. Assignments turned in within one day late carry a penalty of 5 points. Assignments turned in more than one day late will count as zero. Exemptions may be requested, no later than one day before the due date: the final grade will be prorated. A maximum of 2 exemptions are allowed through the semester.

Exams and Final Scores

The course is organized in three sections, separated by two midterm exams. The first and second midterms are non-cumulative tests in classroom (including both problems and multiple-choice quizzes), and carry a maximum of 100 points each. The final exam will be cumulative, focusing largely on material from the first two sections, and will carry up to 150 points. Absence from an exam without proper justification, or plagiarism will result in a zero score for that exam. Tests carry the option to earn bonus points for the most difficult questions (i.e. the maximum score may be higher than 100% on a given test).

The highest number of points that the final score will be compared against for grading purposes is the number of assignments times 20 points, 200 points from the two midterms, and 150 points from the final.

In percentages, these are 30% from the assignments, 20% from each midterm, and 30% from the final.

If the score on the final is significantly different from the average score of the two midterms, the higher number will be used to calculate the final grade, with a 30% contribution from the assignments.

Students of the *graduate course (5312)* and students who have signed the *Honors Contract* early in the semester have the option of carrying out a short project involving statistical analysis, and to illustrate it (as a short paper or a presentation) as a final evaluation alternative to the test in class. Approval by the instructor of the content of the project is required.

Software

Several activities will be conducted in one of the computer labs at Tuttleman Learning Center (dates will be communicated in advance) or another computer lab depending on availability.

During the first part of the semester, it will be illustrated how to use a regular spreadsheet program (MS Excel or OpenOffice Calc) for statistical analysis.

During the second and third month, more specialized statistical software such as JMP is required: JMP is installed on the computers at TLC and the Tech Center, and can be downloaded from the webpage *download.temple.edu* using one's own AccessNet ID. Other statistical packages useful to this purpose are e.g. SAS, SPSS, R and Matlab. Students already proficient in one of these programs or in a programming language should let known their skills in advance for suggestions on how to complete final projects (for graduates and/or Honors).

To typeset assignments, each student can make use of any software of their choice, provided that the file submitted is in Adobe PDF, MS Office, or OpenDocument format. Electronic data will be screened for plagiarism.

Textbook

The reference textbook for the Fall 2014 class is:

B. Rosner.
"*Fundamentals of Biostatistics*", 7th edition, Brooks/Cole, 2010.
(ISBN 978-0-538-73349-6)

Note: this textbook is available in "US" and "international" editions. The differences between the two editions are certain minor paragraphs, and a few additional problems in the US edition.
I will only cover material or assign problems that are present in both editions. Editions prior to 7th contain the same basic material, but are not officially supported.

Other optional readings are:

G. Norman and D. Streiner. *"Biostatistics: the bare essentials"*, 3rd edition, BC Decker Inc, 2008.
(ISBN 978-1-55009-347-6)

H. Motulsky. *"Intuitive Biostatistics: a non-mathematical guide to statistical thinking"*, Oxford University Press, USA, 2010.
(ISBN 978-0-19-973006-3)

Wikipedia (with the proverbial grain of salt!)

Calendar

Exam dates are marked in boldface. Items in *italics* are only applicable to the graduate course (5312) or when taking the course as Honors level.

	Subject	**Chapters of Rosner textbook**
Aug 26, Aug 28	Types of data and how to visualize them: communicating data to other people clearly and without bias. *Critical examination of a scientific paper.*	1
Sep 2, Sep 4	Descriptive statistics: median, mean, standard deviation, etc. *Definition of higher-order statistical moments (skewness, kurtosis), standard deviation of derived data (chain rule).*	2
Sep 9, Sep 11	Elements of probability theory. Relationships between events. From frequency to probability. *Frequentist vs. Bayesian definition of probability.*	3
Sep 16, Sep 18	Discrete probability distributions: dice rolls, binomial, Poisson. *Relationship with continuous distributions (probability mass functions vs. probability density functions). Numeric integrals.*	4
Sep 23, Sep 25	Continuous probability distributions: normal distribution, *z*-score. Normal approximation to the binomial distribution. *Tests of normality. Asymmetric probability distributions: log-normal, power-law. Examples from ecology and social sciences.*	5
Sep 30, Oct 2	Estimation of quantities from sampled data: central limit theorem, standard error of the mean, confidence intervals. *Estimation using exact distributions (without normal approximation).*	6
Oct 7, Oct 9	**Review and Midterm Exam 1**	
Oct 14, Oct 16	One-sample hypothesis testing. Significance, Type I and Type II errors, power, sample size estimation. *Hypothesis testing for discrete probability distributions.*	7
Oct 21, Oct 23	Two-samples inference and hypothesis testing: Student's *t*-distribution, *t*-test, pooled and split variances, paired *t*-test. *Test for equal variances.*	8
Oct 28, Oct 30	Multisample hypothesis testing: one-way ANOVA F-test, sums of squares, post-hoc comparisons, Fisher's LSD and Bonferroni correction. *Linear contrasts, two-way ANOVA.*	12

Nov 4, Nov 6	Regression and correlation: least squares, inference, correlation coefficient. *Analysis of covariance (ANCOVA).*	12 + 11
Nov 11, Nov 13	**Practice and Midterm Exam 2**	
Nov 18, Nov 20	Non-parametric statistics for nominal data: Poisson distribution, chi-square test, contingency tables. *Fisher's exact test. Assignment of final projects.*	10
Nov 25, Nov 27	Break	
Dec 2, Dec 4	Non-parametric statistics for ordinal data: Wilcoxon rank-sum test (aka Mann-Whitney U), sign test, Wilcoxon signed-rank test. *Application of rank and sign tests to skewed parametric data.* *Reexamination of the scientific paper from Week 1.*	9
Dec 11	**Final Exam** ***Projects due***	