Stat 205: Elementary Statistics for the Biological and Life Sciences
Fall 2011
Tuesday/Thursday 11:00 a.m.–12:15 p.m. in Health Sciences Building 114

- **Instructor**: Dr. Tim Hanson
  Office: LeConte 219C (777-3859)
  email: hansont@stat.sc.edu
  Website: http://www.stat.sc.edu/∼hansont/stat205/stat205_fall2011.html
  Office hours: Tuesday & Thursday 9–10:30am, and by appointment

- **Description**: 3 credits; prerequisite is Math 111 or higher. This course gives students in biology, ecology, public health, pharmacy, nursing and other life sciences a non-calculus based introduction to the application of modern statistical methods including descriptive and inferential statistics. Statistics is a *foundational research tool* within the biological and life sciences. Topics include descriptive statistics, probability, and inference for statistical models including: one and two sample problems for continuous and discrete data, 2×2 tables (independence; comparing odds ratios, relative risks, and differences in proportions; diagnostic testing), one-way ANOVA, linear and logistic regression, and survival analysis.

- **Learning objectives**: After completion of the course, the successful student will be able to (a) understand and interpret common graphical displays and summary statistics from data, (b) apply the rules of probability to solve basic problems, (c) understand aspects of one and two sample problems, including confidence intervals, hypothesis testing, sample size calculation, power, and checking assumptions, (d) understand basic ideas underlying one-way analysis of variance, (e) understand aspects of the simple linear regression model: least squares estimation, the normal-errors model, confidence interval and hypothesis tests for slope β_1, (f) understand the logistic regression model and its use for analyzing Bernoulli outcomes with a continuous predictor, (g) understand aspects of 2×2 contingency tables: relative risk, odds ratio, difference in proportions, case-control studies, independence, sensitivity, specificity, and prevalence, predictive values positive and negative, Simpson's paradox and the Cochran-Mantel-Haenszel test, (h) have a basic understanding of related ideas including receiver operator characteristic (ROC) curves, disease rates, incidence versus prevalence, and survival curves, and (i) be able to carry out common statistical methods in the computing package R.

- **Required textbook**: *Statistics for the Life Sciences*, 4*th* Ed., by Samuels, M.L., Witmer, J.A., and Schaffner, A. Addison Wesley, 2011.

- My **expectations** for you: *Read* the sections of the text to be covered prior to the class session. *Attend* class and arrive on time. Note that regular attendance is required. Do assigned homework *after every lecture*. *Ask questions* to clarify concepts.

- **Computing**: Statistical analyses will be carried out via R, free software for statistical computing and graphics. If you have your own Windows-based machine or a Macintosh, you can install R now from `http://cran.r-project.org/`. You will also need a scientific calculator for exams.

- **Homework**: Homework assignments will be posted on the course website each week, except exam weeks. *I cannot overstress how important these assignments are to learning the material.*

- **Exams**: Two in-class exams will be given. Make-up exams will be considered *only in extreme circumstances* and documentation is required. Contact me *ahead of time* if you think your situation merits a makeup. The final exam takes place Friday, December 9 at 5:30 p.m.

- **Grading**: Each of the three exams is worth 15%, your homework is worth 45%, attendance is 10%. Grades: 90%-100% A, 85%-89% B+, 80%-84% B, 75%-79% C+, 70%-74% C, 65%-69% D+, 60%-64% D, under 60% F.

Date	Topics	Sections
Thur., Aug. 18	Course expectations, statistics, evidence, random sampling, introduction to R	1.1, 1.3, & notes
Tues., Aug. 23	Variables, frequency distributions	2.1, 2.2
Thur., Aug. 25	Measures of center, boxplots	2.3, 2.4
Tues., Aug. 30	Relationships among variables, dispersion	2.5, 2.6
Thur., Sep. 1	Statistical inference, roadmap, R examples	2.8, 2.9
Tues., Sep. 6	Probability trees, probability rules	3.2, 3.3
Thur., Sep. 8	Densities, random variable, mean & variance	3.4, 3.5
Tues., Sep. 13	Binomial & normal distributions	3.6, 4.1, 4.2
Thur., Sep. 15	Normal distribution (continued)	4.2, 4.3, 4.4
Tues., Sep. 20	Sampling distribution of $\bar{y}$, review for Exam I	5.1, 5.2
Thur., Sep. 22	Exam I	
Tues., Sep. 27	Estimation, $SE_{\bar{y}}$, CI for μ, study design: sample size determination	6.2, 6.3, 6.4
Thur., Sep. 29	CI for $\mu_1 - \mu_2$	6.6, 6.7
Tues., Oct. 4	Two-sample hypothesis tests: permutation & t tests	7.1, 7.2
Thur., Oct. 6	Test vs. CI, Type I & II errors, power, association vs. causation	7.3, 7.4, 7.9
Tues., Oct. 11	One-sided tests, sample size planning	7.5, 7.7
Thur., Oct. 13	Assumptions, Wilcoxin–Mann–Whitney test	7.8, 7.10
Tues., Oct. 18	Paired observations	8.1, 8.2, 8.3, 8.4
Thur., Oct. 20	FALL BREAK – NO CLASS	
Tues., Oct. 25	CI for p, review for Exam II	9.1, 9.2
Thur., Oct. 27	EXAM II	
Tues., Nov. 1	χ^2 tests for independence	10.2, 10.3, 10.4
Thur., Nov. 3	Difference in proportions, relative risk, odds ratios, case-control studies	10.7, 10.9
Tues., Nov. 8	Stratified 2×2 tables, Cochran-Mantel-Haenszel statistic, Simpson's paradox	Notes
Thur., Nov. 10	Analysis of variance	11.2, 11.3, 11.4, 11.5
Tues., Nov. 15	Linear regression	12.1, 12.2
Thur., Nov. 17	Linear regression	12.3, 12.4
Tues., Nov. 22	Logistic regression	12.8 and notes
Thur., Nov. 24	THANKSGIVING – NO CLASS	
Tues., Nov. 29	Survival analysis	Notes
Thur., Dec. 1	Sensitivity, specificity, ROC curves	Notes