BIOL 382 Introductory Biostatistics Syllabus

(last updated 7 January 2016)

Course Description and Expectation

Like any science, Biology is more than a large collection of facts. It is a vibrant, dynamic science that grows through new information found through research. In order to do research using the scientific method, one has to analyze data using inferential statistical methods. The purpose of this course is provide students with an opportunity to become proficient in the analysis of biological data and help students develop criticalthinking skills that will prepare them for careers in scientific research. Whereas any introductory statistics course can help prepare biologists, this one focuses on analytical approaches that tend to be important for biological data.

Learning Outcomes

A student who successfully passes this course will have ability to

- 1. summarize data for different data types
- 2. use appropriate inferential statistics methods to test hypotheses
- 3. use the statistical software, R
- design experimental or observational studies to test a hypothesis
- 5. critically evaluate statistical methods in published articles

Specific Objectives

A student who successfully passes this course will have ability to

- 1. understand the difference between population parameters and sample statistics
- 2. recognize, define, and calculate common descriptive statistics
- 3. understand and calculate probabilities of events
- 4. perform appropriate exploratory data analyses
- 5. calculate and interpret confidence intervals
- 6. perform and interpret results from one and two-sample hypothesis tests
- 7. perform and interpret results from test of independence
- 8. perform and interpret results from ANOVA
- 9. perform and interpret results from linear regression

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Materials Required

- Text: Samuels, M. L., Witmer, J. A., & Andrew. Schaffner. (2012). Statistics for the life sciences, 4th Edition.
 Pearson Education. (Either hard copy or E-Book)
- Calculator (the simpler, the better)
- R software (free download or on computers WKU computer labs)

<u>Optional</u>

- StatCrunch web-based stats software (See preface of text)
- Concepts & Applications of Inferential Statistics: <u>http://vassarstats.net/textbook/</u> (webtext with data analysis modules)
- Personal computer or netbook

Specific topics in BIOL 382 that might not be covered as thoroughly in other introductory statistics courses (but are relevant for biological data)

- Resampling experiments
- Non-parametric statistics
- Categorical data analysis

Biological data are often "messy" and do not lend themselves well to traditional techniques. This course will rely heavily on generating empirical sampling distributions as opposed to using parametric probability distributions (though both will be covered).

Requirements

Prerequisites: BIOL 120-BIOL 121 and BIOL 122-123; MATH 117 or higher (not including MATH 183). In addition to these required prerequisite courses, students should have done well in math courses, found an interest in computational problem solving, and have no fear of mathematics. If any part of the previous sentence is untrue, you should consider dropping this course now and take an alternative "supporting" course. Please be aware that taking BIOL 382 because it is both a 300-level elective and a supporting course, but having little skill or interest in mathematics, means this course will be a struggle, if not torture.

Please be aware also that BIOL 382 is not the same course as PH 383, "Biostatistics in the Health Sciences", and may not count toward credit for WKU Public Health degree programs.

Evaluation (Grading)

Grading will be based on overall performance on quizzes and exams. Homework is assigned, but not graded. The breakdown of quiz and exam weights is made available on the course Blackboard page.

The overall score is converted to a grade using the following expected scale: 0-59.9% = F; 60-69.9% = D, 70-79.9% = C, 80-89.9% = B, 90-100% = A

Exam formats depend on how the course is offered. Check Blackboard for details.

Homework

Problem sets will be assigned to students but will neither be collected nor graded. Rather, the problem sets are opportunities for students to prepare for quizzes. Nevertheless, a wealth of applied experience awaits students who are diligent enough to prepare for quizzes in this course.

When students seek help, they should be prepared to discuss their homework and provide evidence of work.

Other "Supporting" Courses for Biology Majors and Minor

The most current degree requirements for biology require two courses from the following list: BIOL 382, CHEM 222-223, CHEM 314 or CHEM 340-341, CHEM 330, CIS 343, CIS 226 or CS 226 or CS 230, GEOG 316, GEOG 317, GEOG 328, GEOG 416, GEOG 417, MATH 136, MATH 137, MATH 142, MATH 305, MATH 307, PHYS 332-233 or PHYS 265-266, SOCL 302. Thus, there are many options and alternatives to this highly computational course.

The Online Quiz Environment/Format

- Online "Challenge" Quizzes (these are difficult but allow <u>three</u> attempts).
 Scores revealed but answers not revealed until a grace period before corresponding exams.
 - o Multiple choice and input answers
 - o Best score in each quiz counts.
 - ~ 140 points offered; only 100 points count (i.e., multiple opportunities to do well)
 - High correspondence between homework, challenge quizzes, and larger exam problems.
- Concept quizzes (these are based on concepts more so than solving problems, directly; only offered <u>once</u> each)
 - Multiple choice and input answers
 - o 100 points offered; only 100 points count (i.e., only one shot)
 - High correspondence between homework, concept quizzes, and shorter exam problems.