

**STA 270 Applied Statistics**  
**Department of Mathematics and Statistics**  
**College of Engineering, Forestry and Natural Sciences**  
**Northern Arizona University**

**Semesters Offered:** All semesters    **Credit Hours:** 3

**Course Prerequisite:** MAT 102X with a grade of C or better or Math Placement 46 or International Student Group SAS.

**General Information:** STA 270 is a three-credit course meeting 150 minutes each week. It serves to fulfill a requirement in the Science/Applied Science distribution block in the University Liberal Studies program. It supports the mission of the program to prepare students to live responsible, productive, and creative lives as citizens of a dramatically changing world through the study of statistical methodology and its application. Essential skills featured in this course are critical thinking, quantitative reasoning, and scientific reasoning.

**Catalog Description:** STA 270 Applied Statistics (3). Graphical and quantitative description of data; binomial, normal and  $t$  distributions; one- and two-sample hypothesis tests and confidence intervals; simple linear regression and correlation.

**Course Description:** Statistics is the discipline that seeks to quantify uncertainty in decision making based on data collection and analysis. Whether you are interpreting the latest poll concerning candidates in the next presidential election, or seeking to determine whether two species of salamander are differently adapted to the climate of the Colorado plateau, statistics is the key.

Knowledge of statistics is important in understanding newspaper and magazine accounts of the latest public opinion polls and the results of the latest medical studies. The day has arrived when H.G. Wells prediction has come true: “Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.” To be able to critically read and understand statistical information is necessary in the modern world.

Statistical thinking is the cornerstone of much of scientific inquiry. Florence Nightingale (nurse and statistician) said, “Statistics...the most important science in the whole world: for upon it depends the practical application of every other science and of every art; the one science essential to all political and social administration, all education, all organization based upon experience, for it only gives the results of our experience.” It is by proper design of scientific studies and the application of statistical techniques that scientific theories are evaluated and science is advanced.

In STA 270 Applied Statistics we will explore how one may use data to draw appropriate conclusions in the face of uncertainty and how statistical methodology is a fundamental tool for understanding what is going on in the world around us. We will

develop and discuss data gathering, and data analysis tools to address both societal questions and the evaluation of scientific hypotheses.

### **Student Learning Outcomes**

Upon completion of this course, students will be able to:

1. Understand and explain simple statistical methods commonly used in reporting polling data and scientific research studies using correct statistical notation and appropriate language. (critical thinking, quantitative reasoning , environmental consciousness)
2. Construct informative graphical and numerical summaries of data appropriate for the type of data and the context in which the data was collected. (quantitative reasoning, use of technology, environmental consciousness)
3. Interpret the meaning of graphical and numerical summaries of data in written terms appropriate to the context in which the data was collected. (quantitative reasoning, environmental consciousness)
4. Recognize and properly carry out parameter estimation (including confidence interval calculations) and hypothesis testing procedures by hand, with the aid of a statistical calculator, or using a statistical software program. (quantitative reasoning, use of technology)
5. Understand the formalism of parameter estimation and hypothesis testing and how it relates to, supports, and advances the scientific method. (quantitative reasoning, scientific inquiry).
6. Properly apply the formalism of parameter estimation and hypothesis testing to scientific inquiry by appropriate statistical analysis of collected data. (quantitative reasoning, scientific inquiry, environmental consciousness)
7. Understand the limitations of the statistical methodology learned in the course, and be able to recognize problems in which the statistical methods learned are not appropriate. (critical thinking)

**Course Structure and Approach:** This course will provide the student with opportunities to learn about the methodology of statistics through lectures, discussions, individual and group projects, and computer laboratory activities according to instructor design. Readings in the textbook will provide basic information to assist student learning.

**Current Text and Coverage:** *Statistics: The Exploration and Analysis of Data*, 6<sup>th</sup> edition, by Peck and Devore. Material will be drawn from chapters 1 through 11 of the text. Additional topics may be selected from chapters 12 and 13 of the text.

**Calculator:** A calculator will be needed to complete homework problems and for use in examinations. An excellent choice for this course is the TI-83 statistical calculator. [Note: In some sections (as indicated in the class schedule) the TI-83 will be required.]

**Computer Lab:** The use of technology for data display, manipulation and calculation is a vital part of modern statistical analysis. So that you may become familiar with statistical software, one or more class sessions will be held in the Department's computer lab (222 AMB) where you will learn how to use a statistical software package [e.g., JMP]. The use of statistical software will be required to complete technology assignments and may also be used in completing other homework as indicated by your instructor. The course carries a fee for the use of the Department of Mathematics and Statistics computer lab.

### **Course Outline; Possible Timeline**

1. Descriptive Statistics – 8 days  
The nature of statistics; population vs. sample; data collection; frequency distributions; graphical techniques for summarizing single variable and bivariate data; numerical measures of average, variation, and correlation; linear regression as a descriptive tool.
2. Probability – 5 days  
The nature of probability; binomial and normal distributions; sampling distributions; the central limit theorem.
3. Inferential Statistics – One Population – 14 days  
The nature of inference; the  $t$  distribution; point estimation and confidence intervals for a population mean; point estimation and confidence intervals for a population proportion. The nature of hypothesis tests; hypothesis tests concerning a population mean; and hypothesis tests concerning a population proportion.
4. Inferential Statistics – Two Populations – 7 days  
Confidence intervals and hypothesis tests concerning two population means; independent samples; paired samples. Confidence intervals and hypothesis tests concerning two population proportions.
5. Additional Topics – 4 days  
Additional material concerning either (a) linear regression including inference about the fitted line, or (b) the chi-square distribution, goodness of fit tests, and contingency tables.
6. Exams and computer laboratory activities – 4-6 days

### **Assessment of Student Learning Outcomes**

Student progress toward achieving course objectives will be measured in a variety of ways:

- Student understanding of basic concepts and ability to properly apply statistical techniques will be evaluated by some or all of the following: regular homework assignments (at least weekly); quizzes; objective testing throughout the semester; and a comprehensive final examination.
- Student ability to properly use technology (graphing calculators or statistical software) as an aid to statistical calculation will be evaluated by special technology exercises, and in some sections individual projects.
- Student understanding of and ability to correctly interpret and explain statistical procedures will be evaluated through class discussion, small group activities and test questions requiring short written responses.

Assessment will include a minimum of three in-class exams and a comprehensive final examination worth at least 25% of the overall grade. In addition, individual sections will use two or more of the following items: (a) collected traditional homework assignments, (b) collected homework requiring the use of statistical software; (c) quizzes; and (d) group or individual projects requiring the collection of data, data analysis (using statistical software) and a written report.

### **Learning Portfolio**

For those sections in which individual or group projects are used, project reports will become part of the student's learning portfolio.

### **Assignments, Examinations, Grading, and Other Policies**

Hourly examinations and the comprehensive final exam. The emphasis in this course is on gaining a conceptual understanding and skill in the use of proper statistical procedures, not on memorization of formulas. Thus you will be allowed to bring a formula sheet with you for each exam. Examinations will consist of word problems requiring you to apply correct statistical procedures and interpret the results in the context of the problem. This will require the understanding of statistical terminology and the ability to convey results using correct technical English. For some problems, output from statistical software may be provided and you will be required to interpret the output in an appropriate manner. A portion (less than 20%) of each examination may consist of multiple choice or true/false questions used to assess understanding of fundamental concepts, definitions and principles of statistics.

Homework assignments. Regular written homework assignments will be made requiring you to apply the statistical techniques discussed in class to solving problems. This will require familiarity and understanding of the mechanics of statistical techniques, their conceptual basis, the use of appropriate technology (statistical calculator or software), and the ability to interpret results using everyday language.

Make-up policy. Activities done in class and counted toward your grade as quizzes cannot be made up in the case of non-institutionally recognized absences. No late work

will be accepted except in case of excused documented absences with prior notification and approval.

University policies. Students are responsible for the following policies; Safe Environment, Students with Disabilities, Institutional Review Board, Academic Integrity, and academic Contact Hour. A copy of these policies may be downloaded from the web site: <http://jan.ucc.nau.edu/academicadmin/plcystmt.html>.

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