STA 115: Statistics - Program Cover Document

I. Basic Course Information

A: STA 115 – Statistics

B. The course will be scheduled for two lecture periods in a computer lab. Introductory Statistics will often be the only statistics course taken by students not majoring in the discipline. It is a requirement, for example, for nursing majors and sociology majors. This course also satisfies the quantitative reasoning general education requirement for liberal arts majors. There is no prerequisite for the course.

In recent years the NSF funded numerous projects to reform the teaching of introductory statistics courses such as this one. The transformed course follows the recommendation of this reform movement and requires the instructor to teach more data analysis and to teach less probability. The focus of our transformed STA 115 course is on concepts, reasoning and thinking instead of simply on computational skills.

II. Learning Goals

Students on this course should develop statistical "thinking". Therefore the three main objectives of this course are for students:

1. To realize that variation is all around us and that it is present in everything we do,
2. To develop probabilistic thinking,
3. To recognize that our response to situations where variation occurs should be at least partially determined by careful statistical/probabilistic reasoning.

It is the interplay between mathematical models and experimental data, theory and observations that makes statistics such a unique subject. Students, who most likely expect statistics to be just another math course, will be instructed very clearly about how statistical thinking is based on probabilistic arguments and not deductive arguments like mathematics. The instructor should emphasize the special nature of statistics by clearly distinguishing actual data from mathematical models throughout the course.

The course will address the following questions:

1. How to collect data effectively.
2. How to summarize and interpret data.
3. What a confidence interval is.
4. How to interpret the result of a hypothesis test.
5. What the limitations are of statistical inference.

The course will attempt to build strong positive attitudes towards statistics and reinforce students' use of statistics in the real world by

1. relying heavily on real data,
2. emphasizing statistical concepts,
3. relying on computers to automate computations and graphics,
4. treating formal derivatives as secondary.

As a result of this course students should begin to appreciate the prevalence of statistics in every-day life, and how much more cautious we should be in using statistical statements and interpretations.

III. Student Assessment

Students' content knowledge will be tested through a combination of quizzes and examinations. It is critical that students' understanding of ideas, data analysis skills and their ability to interpret results be tested throughout the course. Simply memorizing formulae and theories and being able to perform manual computations should have no relevance in the assessment.

Regular individual or group homework assignments will aid students to understand concepts discussed in class and will help them to become familiar with applications of these concepts in different situations. Computer or instructor-graded homework assignments will provide valuable feedback to the students as well as information for the instructor on the progress of students.

Students may be asked to critically read media articles that incorporate statistics and participate subsequently in class discussions at the discretion of the instructor.

IV. Learning Activities

The instructor should foster active learning in and out of the classroom through:

1. group problem solving and discussion,
2. demonstrations based on class-generated data,
3. written or oral projects,
4. lab explorations (using statistical software such as Data Desk, Minitab, Fathom etc.) that illustrate and develop deep understanding of concepts through a combination of simulations, problems and examples.

The instructor should use the multimedia capabilities provided by the lab setting to present material using real data, computer simulations, videos etc. Teaching and demonstrating the capabilities of the chosen statistical software package should form an integral part of the lectures.

Departmental course syllabus- STA 115: Statistics

I. Basic course information

A. Purpose statement

This course aims at providing students with a basic understanding and appreciation for descriptive statistics (describing data) and inferential statistics (drawing conclusions from data). Emphasis is on the practice of statistics rather than on mathematical proofs.

B. Course description

STA 115 is a one semester introductory statistics course that is a requirement for nursing and sociology majors. It is designed to also satisfy the quantitative reasoning requirement for liberal arts majors. The course introduces the basic ideas of descriptive and inferential statistics using a problem-solving approach based on investigation of real data. The motivation for this course is not the mathematical theory of statistics but rather the everyday practice of statistics. Therefore the non-mathematical nature of statistics should be emphasized whenever possible and attention to the prevalence of statistics should be achieved by showing examples from areas of different human endeavors.

II. Learning goals

A. Content goals

- Develop an understanding of important concepts such as mean and variability.
- Understand the variability of sample statistics and the usefulness of the normal distribution as a model for data.
- Understand the importance of considering how a sample was selected in evaluating inferences based on that sample.
- Understand what a confidence interval is and be able to interpret the result of a hypothesis test in both one sample and two sample cases.
- Become aware of the limitations of statistical inference.

B. Performance goals

At the end of the course, students should be able to

- Critically analyze data sets and statistical calculations.
- Use statistical thinking and reasoning.
- Use Data Desk, or appropriate statistical software, to make statistical calculations. (Enter data, generate descriptive statistics, perform hypothesis tests etc.)
- Effectively communicate the results of their statistical work to others not familiar with statistics.
- Critically read and understand statistics presented in the media.

C. Prerequisites

No course prerequisites but as the course requires students to use statistical software and possibly an online Homework, Tutorial and Assessment system, students should have some very basic computer skills: using the internet, saving data to a file, navigating folders and basic word processing skills.

III. Student assessment

A syllabus should clearly describe the schedule for the assessment tools, the criteria that will be used to evaluate student performance, and how the grades will be calculated. The assessment should be directly linked to the learning goals. Feedback must be timely, constructive, and regenerative. Students should be given the opportunity to re-attempt similar tasks after incorporating the instructor's feedback. Different assessment methods in a statistics class that could be used at the instructor's discretion include:

- **a.** Quizzes (including calculations and essay questions explaining their understanding of concepts and principles).
- **b.** Exams (covering a broad range of material).
- **c.** Homework assignments (problems, open-ended computer-based explorations, critiques of statistical ideas or issues in the news).
- **d.** Projects/reports. (group or individual)

IV. Learning Activities

It is generally accepted as a principle in statistics education that students learn best by "doing statistics". It is also generally accepted that statistical concepts are best learned in the context of real data. Therefore, besides traditional lecturing and problem solving sessions, the course will be enhanced by carefully designed sequences of student activities. These activities could include:

a. Simulations that give students an intuitive sense of random variation and of the idea of probability as long-run relative frequency.
b. Exploration of a statistical concept or method through simulation or analysis of real data, guided by a series of questions designed to get students thinking about issues that are currently being studied.
c. Discussion of classroom examples based on real data and case studies.
d. Small student projects that require the student to apply both his/her statistical knowledge and computing skills.