STA 303: Design of Experiments
Section 001, Fall 2022

Class Meetings: M & W 6:00-7:20
Zoom link posted on top of Canvas Module page for remote classes as announced or necessitated
Instructor: Adam Shrager
Email – shragera@tcnj.edu
Office Hours –Wednesday 4pm – 5:45 pm. Additional times as announced and as requested. Room P-204.

Description: The course will introduce students to problems and techniques inherent to the design of experiments. Design of experiments refers to the process of planning an experiment so that appropriate data will be collected that can be analyzed by statistical methods, resulting in valid and objective conclusions. This course will cover the two aspects to any experimental problem, the design itself and the analysis of the resulting data. There are broad applications across numerous disciplines in the sciences and the humanities. Statistical software packages are essential to the course and will be used throughout.

Purpose of the Course: Experiments are performed by investigators in virtually all fields of inquiry, usually to discover something about a particular process or system. An experiment can be defined as a series of tests in which purposeful changes are made to input variables of a process or system so that we may observe and identify the reasons for any changes that may be witnessed in the output response. Statistical design of experiments refers to the process of planning the experiment so that appropriate data that can be analyzed by statistical methods will be collected, resulting in valid and objective conclusions. The statistical approach to experimental design is necessary if we wish to draw meaningful conclusions from the data. Indeed, when the problem involves data that are subject to experimental errors, statistical methodology is the only objective approach to analysis. This course will cover the two primary aspects to any experimental problem: the design of the experiment itself and the statistical analysis of the resulting data.

STA 303 will equip students with skills in designing and analyzing experiments that they can utilize and build on in flexible ways at both graduate school and in future employment. It will emphasize real data and authentic applications, and will present data in a context that is both meaningful to students and indicative of the field of science underlying the data. The course will encourage synthesis of theory, methods and application, and will include extensive experience with statistical computing. There will be frequent opportunities to develop communication skills through in-class presentations of project work. Students will also see how the design of experiments fits into the broader process of research and decision making.

Technology: All course topics and learning outcomes will be integrated with technology. Those who enroll in the course are expected to have access to a laptop computer and will sometimes be asked to bring the computer to class. Students will be exposed to at least two distinct statistical software packages.

Learning Outcomes: On completion of this course students should have achieved the following learning goals:

(i) A clear understanding of the theoretical development of statistical techniques for design and analysis.
(ii) The selection of appropriate techniques in given contexts.
(iii) The skills to design experiments and apply correct statistical procedures to a wide variety of real-life problems.
(iv) The ability to clearly compare and contrast the advantages and disadvantages of the different experimental approaches.
(v) The practice of assessing the reasonableness of analytic results.
(vi) The ability to provide correct interpretations of results and graphical output, and to recommend appropriate decisions.
(vii) The possession of strong computing skills and familiarity with statistical software for analysis of experiments.
(viii) The possession of skills directed to the communication of statistical results to a variety of audiences.

Expectations: All students are expected to…

Attend all class meetings and participate in in-class activities.

Read the portions of the text as assigned.

Make serious attempts at all of the assigned weekly problem sets and in preparation for exams.

Use the resource of their fellow students and their instructor to seek answers to questions that arise in class, in the readings, and on the homework

Textbook and Required Class Materials

TEXTBOOK: Design and Analysis of Experiments **(10th Edition)** by Douglas C Mongomery. Wiley Publishing, 2020

Calculator & Computer: Each student is expected to have access to a graphing calculator, which will be accessed occasionally. Each student will also need access to Microsoft Excel or similar spreadsheet program (Google sheets will work with a simple add-on), as well as specific statistical software (R).

Classroom Policies

Attendance: ***All students are expected to attend all classes***. It is assumed that any information given out during class has been delivered to all students. A student who is absent for a test **will not** be permitted to make up the test unless some arrangement has been made with me in advance. Approval for missing a test will be rare and based on truly exceptional circumstances. In the case of illness, a doctor's note will be required. Please view TCNJ's attendance policy **http://www.tcnj.edu/~recreg/policies/attendance.html**

Academic Honesty: Please make sure you are familiar with TCNJ's academic honesty policy. Any suspected violation of this policy will be confronted in strict accordance with the policy. **http://www.tcnj.edu/~academic/policy/integrity.html**

Students with Disabilities: See TCNJ's Americans with Disabilities Act (ADA) policy available on the web: http://www.tcnj.edu/~affirm/ada.html .

Graded Assignments

Exams (20%, 20%, 10% each): Three in-class exams will be given on or about **September 26, October 19, and November 16.** Your lowest exam grade will count 10% towards your final course grade. The other two exams will count 20% each towards your course grade. All work on the exams must be independent. Make-up exams will not be considered.

Problem Sets & Class Participation (20%): Problem sets will cover the concepts taught in the class. Most assignment submissions will be electronically submitted to Canvas. **No late assignments will be accepted**. You are encouraged to work with others on your problem sets, except when noted, but each student must submit their assignment independently. If you work with someone else. You must simply write: I WORKED WITH _____ on the top of your assignment. Again, working in study groups is encouraged.

There will be SIX graded problem sets distributed. Your best FIVE problem set grades will count toward your final course grade. Essentially, this means you can drop your lowest grade…or skip one assignment. (** Please note that Problem Set 5 is a group project and is required for everyone – It may be weighed heavier than the others and it can not be skipped**)

Problem Sets will be graded on completeness, accuracy, and effort. I will not appreciate submitted work that is not college-quality. Assignments graded 1(worst) -5 (best) will be returned to you roughly a week after you submit them, and discussed in class. You are encouraged and expected to check over your work.

Final Exam (30%): The final exam for this course will be a comprehensive exam. See TCNJs Final Exam policy at http://www.tcnj.edu/~academic/policy/finalevaluations.htm

Extra Credit. My grading policy is generous and is designed for students to succeed. There will be absolutely no extra credit issued or assigned. Don't ask, unless you enjoy rejection and awkward moments.

IF NECESSARY:

Online Proctoring of Exams
The Committee on Academic Programs has submitted its final recommendation on Online Proctoring for Fall 2020 to the Steering Committee. The recommendation includes suggested language for a required syllabus statement if a faculty member will use online proctoring during the fall semester.

Recording of Class Sessions
If I will be recording any class sessions during the semester, you will be informed in advance. All concerns relating to privacy issues will be respected.

Use of Cameras during Class Sessions and Meetings

Your participation in this course matters and is valued. This course may utilize live Zoom sessions. If you do not have access to the necessary equipment for this course, TCNJ can provide it for you for the semester. Please contact care@tcnj.edu to help you secure the needed technology free of charge. This is a confidential process. However, if you need assistance in this process, please let me know. Also, the Accessibility Resource Center (ARC) is available to help facilitate the removal of barriers and to ensure reasonable accommodations if needed. For more information about ARC, please visit: https://arc.tcnj.edu/.

Accessibility and Accommodations

Students who experience barriers in this course are encouraged to contact the instructor as early in the semester as possible. The Accessibility Resource Center (ARC) is available to facilitate the removal of barriers and to ensure reasonable accommodations. For more information about ARC, please visit: https://arc.tcnj.edu/.

Access to IT support

If you have technology issues or needs during the semester, please contact the IT Helpdesk at 609-771-2660 or helpdesk@tcnj.edu.

STAT 303: Sec 1, Fall 2022

Date	Day	Topics
W, 8/31	1	Chapter 1: Introduction to Experimental Design
Tu, 9/6	2	Chapter 1: Statistical Techniques in Experimentation
W, 9/7	3	Chapter 2: Sampling & Sampling Distributions ***PS#1 Due***
M, 9/12	4	Chapter 2: Review of Inference
W, 9/14	5	Chapter 2: Inference about the difference in means
M, 9/19	6	Chapter 2: Inference about the difference in means: paired data ***PS#2 Due***
W, 9/21	7	Chapter 2: Inference about variances. TEST REVIEW.
M, 9/26	8	**TEST 1 – Experimentation & Inference**
W, 9/28	9	Chapter 3: Single Factor Experiment & intro to ANOVA
M, 10/3	10	Chapter 3: ANOVA and Applications to Regression
W, 10/5	11	Chapter 3: Regression Approach to ANOVA ***PS#3 Due***
W,10/12	12	Chapter 4: Intro to Block Design & Types of block designs
M, 10/17	13	Chapter 4: Statistical Analysis of block designs. TEST REVIEW.
W,10/19	14	**TEST 2 – Single Factor ANOVA & Block Design**
M,10/24	15	Chapter 5: Intro to Factorial Designs
W,10/26	16	Chapter 5: The General Factorial Design
M,10/31	17	Chapter 6: The 2^k Factorial Design
W,11/2	18	Chapter 7: Blocking and Confounding in the 2^k factorial design ***PS#4 Due***
M,11/7	19	Chapters 5-7: In-class lab, create, analyze, and interpret factorial design
W,11/9	20	Chapters 5-7: In-class lab, create, analyze, and interpret factorial design
M,11/14	21	Chapters 5-7: Present experiments (***PS#5***). TEST REVIEW.
W,11/16	22	**TEST 3 – Factorial Designs**
M,11/21	23	Chapter 10: Fitting Regression Models
M,11/28	24	Chapter 10: Fitting Regression Models
W,11/30	25	Chapter 13: Experiments with Random Factors ***PS#6 Due***
M, 12/5	26	Chapter 14: Nested and Split-Pair Designs
W, 12/7	27	FINAL EXAM REVIEW