BIA 654 - Experimental Design

School of Business
Spring 2019

Instructor: Professor Chihoon Lee, Ph.D.
Contact Info: clee4@stevens.edu
Office Hours: Tuesday 1:30 pm–3:30 pm
Course Web Address: We will use *Canvas*.

COURSE DESCRIPTION

This course is about the power of statistical experiments with applications to Business Analytics. We will learn fundamental topics in experimental and data collection strategies in order to reduce firms' costs, increase productivity, and improve their quality of services or products. Specific topics to cover include testing differences among several variables, factorial experiments, fractional factorial designs, case studies with applications to business and management.

LEARNING OBJECTIVES

After successful completion of this course, students will be able to:

i) Design various statistical experiments;
ii) Analyze the survey or experimental data;
iii) Document and present the research analyses and finding to help make management and business recommendations.

PREREQUISITE(S)

I will assume you have basic knowledge of introductory statistics at the level of MGT 620 or equivalent. It is strongly advised for you to review such basics. Useful website resources with selected statistical topics are provided at the end of this document.

FORMAT AND STRUCTURE

The course will employ lectures, in-class individual or group assignments, individual weekly homework assignments, and team projects. In the team projects, students will analyze a real industrial problem, formulate a model, collect data (e.g., via survey design), solve the problem using one or more of the design techniques discussed in class, and interpret the solution for management.

COURSE MATERIALS

1. Lecture slides and homework assignments will be self-contained.
2. **Required Textbook: Testing 1-2-3 Experimental Design with Applications in Marketing and Service Operations, Ledolter and Swersey, Stanford Business Books, 2007 (can buy at Stevens Bookstore)**
3. Other Readings: Additional reading materials (e.g., journal articles, case studies) will be posted in Canvas.

STATISTICAL PACKAGE SOFTWARE

- We will use **SAS-JMP (called 'Jump')** in this class; it provides easy-to-use, yet very powerful platform.
- As Stevens student, 6-month license is $29.95 from http://onthehub.com/
- Be sure to choose the right platform: Windows or Mac.

GRADING PROCEDURES

Grades will be based on:

Homework 30%
-- You are encouraged to work with other students on assignments. You should complete the assignments prior to class.
Midterm Exam 30%
-- There will be in-class pencil & paper style midterm exam. Each individual must take it individually.
Final Exam: Project Report 20% **and Presentation** 20%
-- Each team of size 2-4 students will a) identify a research topic, b) apply experimental and/or survey design, c) interpret the results, and d) report the research findings. Each team will write a management report and make a brief presentation describing the research question and hypotheses, methods, results, and implications.

GRADING SCHEMES

$94 \leq A \leq 100$, $90 \leq A- < 94$

$87 \leq B+ < 90$, $83 \leq B < 87$, $80 \leq B- < 83$, etc.

GENERAL COMMENTS

- All Exam work is to be independent, although you can reference your notes and assignments (no laptop or phone use), you should not work with other students on the Midterm Exam.

- However, class discussion is clearly encouraged while working and practicing the Homework problems.

- All late submissions of homework assignments will receive a 10% grade reduction per day, and no credit for submissions past one-week deadline, without prior instructor permission.

ACADEMIC INTEGRITY

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound by the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

The following statement is printed in the Stevens Graduate Catalog and applies to all students taking Stevens courses, on and off campus.
"Academic Improprieties
The term academic impropriety is meant to include, but is not limited to, cheating on homework, during in-class or take home examinations and plagiarism. The Institute has adopted a procedure to deal with such actions. An instructor of a graduate course may elect to formally charge a student with committing an academic impropriety to the Dean of Graduate Academics or to adjudicate the issue personally." Consequences of academic impropriety are severe, ranging from receiving an "F" in a course, to a warning from the Dean of the Graduate School, which becomes a part of the permanent student record, to expulsion.

Reference: https://www.stevens.edu/provost/graduate-academics/handbook/academic-standing.html#PDG

Ethics Pledge

Consistent with the above statements, all homework exercises, tests and exams that are designated as individual assignments MUST contain the following signed statement before they can be accepted for grading.

_____

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination. I further pledge that I have not copied any material from a book, article, the Internet or any other source except where I have expressly cited the source.

Signature _____ Date: _____

Please note that assignments in this class may be submitted to www.turnitin.com, a web-based anti-plagiarism system, for an evaluation of their originality.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. Student Counseling and Disability Services works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, and psychiatric disorders in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from SCDS staff. The

SCDS staff will facilitate the provision of accommodations on a case-by-case basis. These academic accommodations are provided at no cost to the student.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the office of Student Counseling, Psychological & Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/sit/counseling/disability-services. If you have any questions please contact:

Lauren Poleyeff, Psy.M., LCSW - Diability Services Coordinator and Staff Clinician in Student Counseling and Disability Services at Stevens Institute of Technology at lpoleyef@stevens.edu or by phone (201) 216-8728.

Resource for Basic Statistical Topics

As noted earlier, I will assume you have basic knowledge of introductory statistics. For your review, access the following website:
http://www.statisticslectures.com/topics/statistics/
Free statistics lectures are available in short video-based format.
In particular, the following selected topics are relevant to our course.

Unit I - Descriptive Statistics

- Frequency Distributions and Cumulative Frequency Distributions
- Arithmetic Mean for Samples and Populations
- Central Tendency: Mean, Median, and Mode
- Variance and Standard Deviation of a Population
- Variance and Standard Deviation of a Sample
- Skewness
- The Normal Curve and Empirical Rule
- Z-Scores (part one)
- Z-Scores (part two)

Unit II – Probability

- The Basics of Probability
- Addition Rule (Probability "or"), Multiplication Rule (Probability "and")
- Discrete and Continuous Random Variables, Discrete Probability Distributions
- Probability Histograms, Mean and Expected Value of Discrete Random Variables
- Variance and Standard Deviation of Discrete Random Variables
- Binomial Distribution
- Mean and Standard Deviation of Binomial Random Variables

Unit IV - Inferential Statistics

- Parameters, Statistics, and Sampling Error
- Distribution of the Sample Mean
- The Central Limit Theorem
- Sample Proportions
- Confidence Intervals about the Mean, Population Standard Deviation Known
- Student's t-Distribution
- Confidence Intervals about the Mean, Population Standard Deviation Unknown
- Confidence Intervals for Population Proportions
- Null and Alternative Hypotheses
- Type I and Type II Errors
- One-Tailed and Two-Tailed Tests
- Independent and Dependent Samples
- One Sample z-Test
- One Sample z-Test for Proportions

Tentative Plan

Class	Lecture and Activities
Class 1	**Overview, Principles, Planning and Conducting Research**
Class 2	**Review of Basic Statistical Concepts**
Class 3	**Inferential Statistics, Analysis of Variance (ANOVA)**
Class 4	**ANOVA – Cont'd**
Class 5	**Testing Differences Among Several Means –Completely Randomized Designs, Block Designs**
Class 6	**Two-Level Factorial Designs**
Class 7	**Two-Level Factorial Designs – Cont'd**
Class 8	***Midterm Exam***
Class 9	**Two-Level Fractional Factorial Designs**
Class 10	**Three or More Levels Design**
Class 11	**Survey Research and Design Methods**
Class 12	**Survey Design and Analysis – Cont'd**
Class 13	**Case Studies**
Class 14	***Project Presentations and Reviews***