Stevens Institute of Technology
Howe School of Technology Management
Syllabus

BIA 654 – Experimental Design

Overview

Course Description and Objectives: This course covers fundamental topics in statistical research methods utilizing a variety of experimental and survey research designs and data collection strategies. Research is performed for a variety of purposes: to explore, to describe or classify, to establish relationships or to establish causality. Over the years, researchers have developed a variety of research strategies to accomplish these purposes. These strategies include the designed experiment, survey designs, quasi-experiments, case studies, longitudinal, and observational designs, as well as various statistical analysis and evaluation techniques and methods.

This course develops students’ ability to analyze a real-world problem and develop statistical formulations that are amenable to solution using various statistical analysis and design techniques. Specifically this course covers an introduction to experimental and survey design and analysis concepts and models used in business and management decision-making including hypothesis development, operational definitions, reliability and validity, measurement and variables, as well as various design methods, such as sampling, randomization, and counterbalancing.

Specific topics covered and addressed in experimental and survey design include: planning and conducting research, research strategies and control of variables, overview of experimental and survey design, fundamental assumptions in analysis of variance (ANOVA), factorial designs, multiple comparison tests, randomized block designs, and analysis of covariance, quasi- and non-experimental designs, and case studies and longitudinal research, all with applications to business and management.

At the end of the course, students/teams will present a project, which consists of designing an experiment or survey, collecting and analyzing data, while addressing appropriate research hypotheses and questions utilizing suitable statistical methods and analyses.

The ability to translate practical problems into representations that are amenable to analysis requires critical thinking and imagination and is an essential skill for analysts wishing to develop creative solutions in practice. While the emphasis is on statistical modeling rather than statistical algorithms, the analytical techniques learned in this course are essential building blocks for the analysis of problems across business intelligence and data analytics with

Semester: Fall 2014
Day of Week/Time: Wednesdays

Instructor name and contact information
Professor Thomas F. Brantle, Ph.D. P.M.P.
Moodle Email
thomas.brantle@stevens.edu
(732) 872-7742

Office Hours: By Appointment
Class Website: Moodle

Revised: 8/12/2014
application to business, finance, economics, and management. This course is therefore an essential foundation for the study of other subject areas in the BI&A curriculum.

While the emphasis is on statistical modeling rather than statistical algorithms, the analytical techniques learned in this course are essential building blocks for the analysis of problems across business intelligence and data analytics with application to business, finance, economics, and management. This course is therefore an essential foundation for the study of other subject areas in the BI&A curriculum.

Prerequisites: MGT 620 – Statistical Models or Equivalent

Additional Objectives

Additional learning objectives include the development of:

Written and oral communications skills: the individual and team assignments will be used to assess written and presentation skills, additionally the final presentations will be video-recorded and used to assess presentation skills.

Ethical Understanding: discussion of ethical issues in the application of experimental design and statistics in general to business and management is integrated throughout the course.

Team skills: The final project for the course will involve student teams; an online survey instrument will be used to measure individual contributions to team performance.

Learning Goals

After taking this course, the student will be able to:
- use a statistical software to analyze various statistical experimental and survey research designs
- visualize experimental, survey, quasi-experimental, and observational data and communicate results
- recognize patterns, classify information, and forecast events
- think critically about data and research findings
- present and document research analyses and findings
- read and execute statistical experimental and survey design analysis techniques not covered in class
- help make management and business recommendations based on results from statistical research experimental and survey design analysis

Pedagogy

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

The MS in Business Intelligence and Analytics is a 36 credit degree (12 courses), that is divided into six subject areas that conceptually comprise the field of BI&A. Each course combines relevant theories and techniques with applied exercises to illustrate practical industry applications of data analytics. Students also complete an industry-oriented capstone course where they apply the principles, and methods they have learned to real problems in the application domain of their choice.

Obtain the skills to collect, analyze, and interpret data in the following areas:

- Strategic data planning and management
- Databases/Data warehousing
- Data mining/Machine learning
- Network analysis/Social networking
- Risk, modeling, and optimization
- BI&A by industry (e.g., pharmaceutical or financial)

Textbook, Course Notes and Statistical Software

Textbook:

Supplemental Readings:
Various additional supplemental readings and course materials will be assigned and distributed throughout the semester

Optional:

Software:
Excel and SAS (preferred), or SPSS, or Project R

Course Notes and Assessments/Assignments: Available and posted on Moodle.

Assignments and Evaluation

- Homework 15%
  - You are encouraged to work with other students on assignments. You should read the materials and complete the assignments prior to class.
- Project 25%
  - Each individual or team will a) identify a research topic, b) apply experimental and/or survey design, c) interpret the results, and d) report the research findings. Each individual/team will write a management report and make a brief presentation describing the research questions and hypotheses, methods, results, and implications.
- Midterm Exam 25%
  - There will be a take-home Midterm Exam. Each individual must take the exam individually.
• Final Exam 35%
  — There will be a take-home Final Exam. Each individual must take the exam individually.

Grading:
  • 95 ≤ A ≤ 100
  • 90 ≤ A− < 95
  • 87 ≤ B+ < 90
  • 83 ≤ B < 87
  • 80 ≤ B− < 83
  • Etc.

General Comments:
All Exam work is to be independent, although you can reference your notes and textbooks on all exams and assignments, you should not work with other students on the Midterm Exam and the Final Exam. However class discussion is clearly encouraged while working and practicing the Homework problems. All late submissions (assignments) will receive a 10% grade reduction per day, no credit for submissions past one week deadline, without prior instructor permission.
# Schedule*

BIA654 – Experimental Design  
Fall 2014 Semester  
Prof. Tom Brantle, Ph.D., P.M.P.

<table>
<thead>
<tr>
<th>Class</th>
<th>Dates</th>
<th>Lecture and Activities</th>
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<tbody>
<tr>
<td>Class 1</td>
<td>August 27</td>
<td>Planning and Conducting Research</td>
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<tr>
<td>Class 2</td>
<td>September 3</td>
<td>Sampling, Data Collection and Descriptive Statistics</td>
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<td>Class 3</td>
<td>September 10</td>
<td>Review of Inferential Statistics</td>
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<tr>
<td>Class 4</td>
<td>September 17</td>
<td>Overview and Basics of Experimental Design</td>
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<td>Class 5</td>
<td>September 24</td>
<td>Analysis of Variance (ANOVA)</td>
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<td>Class 6</td>
<td>October 1</td>
<td>ANOVA and Multiple Comparisons</td>
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<td>Class 7</td>
<td>October 8</td>
<td>Factorial Designs – Cont’d</td>
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<tr>
<td>Class 8</td>
<td>October 15</td>
<td>Randomized Block and Analysis of Covariance</td>
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<td>Class 9</td>
<td>October 22</td>
<td>Midterm Exam</td>
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<td>Class 10</td>
<td>October 29</td>
<td>Quasi- and Non-Experimental Designs</td>
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<td>Class 11</td>
<td>November 5</td>
<td>Survey Research and Design</td>
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<td>Class 12</td>
<td>November 12</td>
<td>Survey Design and Analysis – Cont’d</td>
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<tr>
<td>Class 13</td>
<td>November 19</td>
<td>Case Studies and Longitudinal Research</td>
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<td>No Class</td>
<td>November 26</td>
<td>Thanksgiving Recess</td>
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<tr>
<td>Class 14</td>
<td>April 29</td>
<td>Project Presentations and Reviews</td>
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<tr>
<td>Class 15</td>
<td>May 6</td>
<td>Final Exam</td>
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*Subject to revision as necessary and appropriate.*
Ethical Conduct

The following statement is printed in the Stevens Graduate Catalog and applies to all students taking Stevens courses, on and off campus.

“Cheating during in-class tests or take-home examinations or homework is, of course, illegal and immoral. A Graduate Academic Evaluation Board exists to investigate academic improprieties, conduct hearings, and determine any necessary actions. 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.“

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.


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.

Course/Teacher Evaluation

Continuous improvement can only occur with feedback based on comprehensive and appropriate surveys. Your feedback is an important contributor to decisions to modify course content/pedagogy which is why we strive for 100% class participation in the survey.

All course teacher evaluations are conducted on-line. You will receive an e-mail one week prior to the end of the course informing you that the survey site (https://www.stevens.edu/assess) is open along with instructions for accessing the site. Login using your Campus Pipeline (email) ‘CPIPE’ username and password. This is the same username and password you use for WebCT. Simply click on the course that you wish to evaluate and enter the information. All responses are strictly anonymous. We especially encourage you to clarify your position on any of the questions and give explicit feedbacks on your overall evaluations in the section at the end of the formal survey which allows for written comments. We ask that you submit your survey prior to the last class.