Program Cover Document: Applied Statistics for Social Scientists

Prerequisite

There are no prerequisites for this course.

Basic Course Information

Applied Statistics for Social Scientists is a 1 course unit seminar course. It has two 80-minute meetings each week. Applied Statistics for Social Scientists is primarily a freshman/sophomore level course. It is designed to prepare students to take domain-specific methods courses in the social sciences. It will furthermore prepare students to adopt a minor in statistics and progress to 300-level courses in statistical theory or applied statistics.

Course Description

This course provides an introduction to the collection, management, and analysis of social science data with an emphasis on statistical programming and applied inferential analysis. Statistics provide foundational tools to social researchers, and a basic understanding of how these tools are used is necessary to understand academic literature and social policy debates. Data management and statistical skills are furthermore a growing source of employment opportunities for social science majors. Upon satisfactory completion of the course, the student will be prepared to take domain-specific methods courses in the social sciences and further courses in statistical theory or applied statistics, though more mathematics may be needed for some courses.

Learning Objectives

At the conclusion of the course, the student will be able to:

1) Use R to manage data and conduct basic data analysis.
    R skills include but are not limited to: formatting and importing tabular data, recoding variables, examining summary statistics, creating visualizations, and analyzing bivariate relationships using appropriate statistical tools.
2) Articulate the basic concepts of data measurement.
    Concepts include but are not limited to: conceptualization, operationalization, codebooks, variable types, levels of analysis, units of analysis.
3) Articulate the basic concepts related to statistical inference.
    Concepts include but are not limited to: Sampling distributions, central limit theorem, random variables, normal distributions (including z-scores), statistical power, type 1 and type 2 error, confidence levels.
4) Articulate basic statistical concepts and the methodological procedures from common statistical tools as well as the logic underlying these procedures.
    These concepts include, at a minimum:
        Applied probability as it relates to tabular social science data (including concepts related to disjoint and independent events, mutual exclusivity, exhaustiveness and the ability to calculate marginal, conditional, and joint probability), t-test, ANOVA, chi-squared test, confidence intervals, p-value, effect size, correlation, ordinary least squares regression.
5) Determine the appropriateness of a statistical test and assess assumptions.

6) Write a final paper which interprets and translates quantitative evidence to inform scientific inquiry, research, policy, and/or practice.

Learning Activities

Learning activities will consist of a combination of recorded videos, lectures, group work, student presentations, and computer assignments. The specific choice will depend upon the individual instructor. Outside class, students are expected to do a significant amount of individual and group homework to achieve the learning goals.

As the final project is foundational to student assessment, students are expected to intensively engage with and receive feedback on a project throughout the semester. While this could take many forms, examples include in-class activities, peer reviews, guided computer assignments, and other tools from project-based learning.

Student Assessment

Students will receive regular feedback on their progress towards their learning goals through the assignment of homework assignments, quizzes, and examinations. Assessment will include at least one written paper which demonstrates the ability to analyze, interpret, translate, and evaluate the results of bivariate statistical analyses.

Student performance on these assessment instruments and the performance of students in their future, domain-specific methods courses will be used to assess the success of Applied Statistics for Social Scientists in achieving its learning goals. Peer reviews and student evaluations will also be used to evaluate the course.

List of Major Course Topics

Descriptive Statistics

Required Topics

Principles of tabular data, including exhaustiveness and mutual exclusivity
Conceptualization, characterization, and operationalization
Random variables (including variable types)
Measuring and visualizing central tendency and dispersion for quantitative outcomes
Assessing and visualizing typicality and variation for qualitative outcomes
Empirical rule, percentiles, and z-scores (i.e., 68-95 rule)

Optional Topics

History of social statistics
Data management and summary in excel
Professional descriptive statistics tables

Statistical Inference

Required Topics

Sampling theory, including central limit theorem
Hypotheses and inferences
Statistical error, including measurement and types (e.g., 1 + 2)
One-sample statistics for continuous and discrete variables
Confidence levels and statistical power
Confidence intervals

Optional Topics

Sampling, PMF, and CDF for events and count variables
Sampling strategies in the social sciences (including probability and non-probability)

Bivariate Statistics

Required Topics

Visualizations for bivariate relationships
Conditional, joint, and marginal probability in two-way tables
Chi squared test
T-tests
Correlation
Simple ordinary least squares regression

Optional Topics

Proportions tests
ANOVA
Logistic regression
Poisson regression
Ordinal logistic regression
Multinomial logistic regression
Multivariate regression

Tentative* Course Schedule

Date	Topic	Activity	Assignment Due
Monday, January 22nd	History of Social Statistics	Assumptions	
Thursday, January 25th	What are “data”?	Data table	History of Social Statistics
Monday, January 29th	Operationalization	Operationalization	
Thursday, February 1st	Qualitative Variables	Marginal + Joint prob	Checkpoint: Project Proposal
Monday, February 5th	Quantitative variables	68-95 Rule	
Thursday, February 8th	**EXAM 1: Descriptive**		
Monday, February 12th	Research design	Sampling Strategies	
Thursday, February 15th	No Class		Checkpoint: Operationalization
Monday, February 19th	Sampling theory 1	Population Space	
Thursday, February 22nd	Sampling theory 2	CLT	Checkpoint: Population space
Monday, February 26th	Statistical estimates	Confidence intervals	
Thursday, February 29th	Statistical significance	Type 1 + type 2	Checkpoint: Descriptive Table
Monday, March 4th	TBD/Review	TBD/Review	
Thursday, March 7th	**EXAM 2: Sampling and Design**		
Monday, March 11th	No Class	Spring Break! 😊	
Thursday, March 14th	No Class	Spring Break! 😊	
Monday, March 18th	Writing about Statistics	Tactile Visualizations	
Thursday, March 21st	Qualitative and Qualitative	Contingency Tables	Checkpoint: Full Dataset
Monday, March 25th	Chi-squared test	Chisq()	
Thursday, March 28th	Qualitative and Quantitative	Box Plot	Checkpoint: Contingency table
Monday, April 1st	TTest	ttest()	
Thursday, April 4th	ANOVA	Aov()	Checkpoint: Box plot
Monday, April 8th	Quantitative and Quantitative	Scatter Plot	
Thursday, April 11th	Correlation	Corr()	Checkpoint: Scatter plot
Monday, April 15th	Linear regression	Lm()	
Thursday, April 18th	**EXAM 3: Bivariate Statistics**		
Monday, April 22nd	Writing like a Social Scientist	Components of a Report	
Thursday, April 25th	Work on Project		Checkpoint: Repo Package
Monday, April 29th	Peer review	Peer review	
Thursday, May 2nd	Final Project Presentations		Final Project Presentations
Finals Week		Final Exam Policy	Final Projects Due