SOSC 5090

Quantitative Methods for Social Science Research

FALL 2022
Wednesday 13:30-16:20
Zoom Meeting ID 977 5691 4363
(Computer Room 4402 will be available for students)

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OFFICE HOURS: by appointment

OVERVIEW:
This course introduces quantitative methods for social science research, and how they are used to assemble, describe, and draw inferences from bodies of numerical data. The course serves as a prerequisite to taking more advanced methodology courses (such as SOSC5340 and above). The course covers two modules. The first is about descriptive statistics and fundamentals of statistical inference. Topics include frequency distribution, probability theory, random variable and probability distributions, estimation, and hypothesis testing, *t*-test and contingency table analysis. The second is about linear regression techniques, which is widely used in social science research. Topics such as Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA) are covered under the framework of linear regression. The course materials are explored through the analyses of real data sets using STATA.

OBJECTIVES AND REQUIREMENTS:
The course aims to develop your skills as both a "consumer" and a "producer" of social research. As a "consumer," you will become a more informed and critical reader of academic work, news accounts and advertising materials that present statistical evidence. As a "producer," you are expected to conduct elementary statistical analysis and make sense of the quantitative results.

You will be assessed through 8 assignments (40% of final grade, 5% for each), a term paper presentation (20% of final grade), and a final term paper (40% of final grade).

● **Assignments** are designed to help you understand the materials presented in lectures. Most assignments involve the use of computer to analyze data sets or samples from national and/or regional representative surveys. Video recordings of STATA tutorials will be uploaded to Canvas to help you learn how to use STATA and how to complete the assignments.

● **Term paper** is designed to help you gain some firsthand research experience. You need to pick a topic of your interest, identify data source, and conduct statistical analysis with techniques you have learned or be learning from the course, and draw conclusions. You are required to present your research in class at week 13 and to submit a final paper on or before December 14, 2022. Details about term paper and assignments will be uploaded to Canvas.

Prerequisites:
Although there is no prerequisite for the course, I assume that you are familiar with the materials in Chapters 1-3 of the Agresti's book (see "textbooks" below) and have some knowledge but imperfect understanding of the materials in Chapters 4-6. If you need a thorough review for basic statistics, a good text I can recommend is Moore, Notz, and Flinger (2021) *The Basic Practice of Statistics (9th edition)*, W. H. Freeman. High school algebra, either remembered or re-learned, will also be necessary to get through the course, though formula derivations are presented only when necessary.

Textbooks:
- ● Required
  Agresti, Alan, 2018. *Statistical Methods for the Social Sciences* (5th edition). Boston: Pearson.

- ● Recommended
  - Hamilton, Lawrence C., 2013. *Statistics with STATA (Version 12)*. Cengage.
  - Treiman, Donald, 2009. *Quantitative Data Analysis: Doing Social Research to Test Ideas*. San Francisco, CA: Jossey-Bass. (Chinese version:《量化数据分析：通过社会研究检验想法》，唐启明著，任强译，社会科学文献出版社，2012.)

The required book will be available at HKUST bookshop for purchase. Recommended books will be available at HKUST library.

Computing and Internet Learning Resources:
You will be doing substantial amount of data analysis with a software package called STATA. Among a number of popular statistical packages, STATA is a fast and efficient package which includes most of procedures of interest to social scientists (http://www.stata.com).

Free learning resource for STATA can be found at
- ・ UCLA Stata Portal (an extensive resource that leads you to many useful links):
  http://statcomp.ats.ucla.edu/stata
  http://www.ats.ucla.edu/stat/stata/sk (Starter Kit section for new users)
- ・ Princeton Stata Tutorial:
  http://data.princeton.edu/stata/
- ・ UNC Carolina Population Center:
  http://www.cpc.unc.edu/services/computer/presentations/statatutorial/

Instruction Format:
The course will be offered online via zoom. There will be real-time online lecturing of the concepts/theoretical ideas, and video recordings of STATA illustrations. Computer Room 4402, with STATA 16 available for use, has been reserved for this course on Wednesdays, 13:30-14:20. TA will be at present in Room 4402 during the lectures to assist the students in running STATA and other course-related issues.

Topic Outline and Tentative Schedule

Lecture	Date	Topic

1	Sept. 7	**Introduction**
		Topics:
		    Social science research; variables and measurement; sampling methods
		Readings:
		    Agresti, Chapters 1-2

2	Sept. 14	**Descriptive Statistics**
		Topics:
		    Tabular and graphical displays of data; measures of central tendency and dispersion; sample statistics and population parameters
		Readings:
		    Agresti, Chapter 3
		
		Assignment 1 due on 14 September 2022.

3	Sept. 21	**Probability Distributions**
		Topics:
		    Discrete and continuous random variables; normal distribution; sampling distribution
		Readings:
		    Agresti, Chapter 4
		
		Assignment 2 due on 21 September 2022.

4 - 6	Sept. 28
	Oct. 5
	Oct. 12
		Statistical Inference I: Basics
		Topics:
		    Central limit theorem; point estimation; confidence interval; choice of sample size
		Readings:
		    Agresti, Chapter 5
		
		Statistical Inference II: Hypotheses Testing
		Topics:
		    Hypotheses testing; t distribution; type I and type II errors
		Readings:
		    Agresti, Chapter 6
		
		Statistical Inference III: Bi-variate Relationship
		Topics:
		    T-test, one-way ANOVA; cross-tabulation; chi-square test of independence

		Readings: Agresti, Chapter 7:1-3, 8:1-3 *Assignment 3 due on 5 October 2022.* *Assignment 4 due on 12 October 2022.*

7	Oct. 19	**Simple Linear Regression**
		Topics:
		      Scatter plot; correlation coefficient; simple linear regression;
		      OLS estimates; goodness of fit
		Readings:
		      Agresti Chapter 9
		
		Assignment 5 due on 19 October 2022.

8	Oct. 26	**Special Topics: How to Write a Research Paper** Readings: TBA

9	Nov. 2	**Multiple Regression I**
		Topics:
		      Causality; statistical control; multiple regression model
		      estimation
		Readings:
		      Agresti, Chapters 10; 11:1-2
		
		Assignment 6 due on 2 November 2022.

10	Nov. 9	**Multiple Regression II**
		Topics:
		      Inference for regression; reporting regression results, variable
		      transformation
		 Readings:
		      Agresti, Chapter 11.4

11	Nov. 16	**Multiple Regression III**
		Topics:
		      Interaction effect with dummy variables, analysis of variance
		      and covariance
		Readings:
		      Agresti, Chapters 12
		
		Assignment 7 due on 16 November 2022.

12	Nov. 23	**Multiple Regression IV**
		Topics:
		      Assumptions of linear models; non-linearity; multi-collinearity,
		      regression diagnostics

		Readings: Agresti, Chapters 13-14
13	Nov. 30	**In-class presentations** *Assignment 8 due on 30 November 2022.*
		The term paper due 14 December 2022 (no later than 12:00 p.m., submitted to Canvas).

Due Dates
Assignment 1: September 14, 2022
Assignment 2: September 21, 2022.
Assignment 3: October 5, 2022.
Assignment 4: October 12, 2022.
Assignment 5: October 19, 2022.
Assignment 6: November 2, 2022.
Assignment 7: November 16, 2022.
Assignment 8: November 30, 2022.
Final paper: December 14, 2022.