

# SOC 6003: Advanced Statistical Analysis

2<sup>nd</sup> term, 2025-26

Mondays 11:30 – 2:15 pm

Sino Building 429

Instructor: Jin Lei

e-mail: [ljin@cuhk.edu.hk](mailto:ljin@cuhk.edu.hk)

Course Assistant: Yang Xingyue

e-mail: [xingyuey@link.cuhk.edu.hk](mailto:xingyuey@link.cuhk.edu.hk)

## Course Outline

### 1 Basic concepts

- 1.1 The research process
- 1.2 Descriptive statistics
- 1.3 Inferential statistics

Knoke et al. 2002. Chapters 1-3; Freund, Wilson & Sa. 2006. Chapter 1: 5-17.

### 2 Multiple regression: Basics

- 2.1 Model specification
- 2.2 Partial effects
- 2.3 Standardized coefficients
- 2.4 Estimation method
- 2.5 Model evaluation

Allison. 1999. Chapters 2, 4 and 5; Freund, Wilson & Sa. 2006. Chapters 2 – 3

### 3 Multiple regression: Techniques

- 3.1 Modelling group differences
- 3.2 Modelling interaction effects
- 3.3 modelling nonlinear effects
- 3.4 Mediation analysis

Allison. 1999. Chapter 8; Kahane. 2001. Chapter 5; MacKinnon. 2008. Chapters 1 – 3; James et al. 2021. Chapter 6

### 4 Multiple regression: Diagnostics

- 4.1 Regression assumptions
- 4.2 Detection of assumption violation
- 4.3 Remedies of assumption violation
- 4.4 Multicollinearity
- 4.5 Robustness to influential cases

Alison. 1998. Chapters 6 – 7; Freund, Wilson & Sa. 2006. Chapters 4 – 5

### 5 Logistic regression

- 5.1 Binary dependent variables
- 5.2 The logic of logistic regressions
- 5.3 Probability, odds, and log odds

- 5.4 Interpreting coefficients
- 5.5 Estimation method
- 5.6 Model evaluation
- 5.7 Extensions: multinomial logistic regression
- 5.8 Extensions: ordinal logistic regression

Pampel. 2000. Chapters 1-3; O'Connell. 2005. Chapter 4

## **6 Poisson regression**

- 6.1 Analyzing count data
- 6.2 Estimation method
- 6.3 Goodness of fit measures

Kleinbaum et al. 1998. Chapter 24: 687-709.

## **7 Fixed and random-effect models**

- 7.1 Pooled data and panel data
- 7.2 Fixed-effect model for linear outcomes: two-period data
- 7.3 Fixed-effect model for linear outcomes: multiple repeated measures
- 7.3 Random-effect model for linear outcomes

Allison 2009. Chapters 1-3; Fitzmaurice et al. 2011. Chapter 14.

## **8 Event history analysis**

- 8.1 Introduction
- 8.2 Hazard rate and survivor function
- 8.3 Kaplan-Meier curves
- 8.4 Discrete-time methods
- 8.5 Cox's proportional hazard model

Yamaguchi. 1991. Chapters 1, 2, 5-6

## Assessment

Assignments 30%, Quiz 30%, Term paper 40%

### Grade descriptors

- A A thorough understanding of the course materials and an outstanding performance on all learning outcomes.
- A- A solid understanding of the course materials and an outstanding performance on almost all learning outcomes.
- B An adequate understanding of the course materials and a substantial performance, on average, on all learning outcomes.
- C A basic understanding of the course materials and a satisfactory performance on the majority of learning outcomes, possibly with a few weaknesses.
- D A partial understanding of the course materials and an inadequate performance on a number of learning outcomes
- F A poor understanding of the course materials and an unsatisfactory performance on a number of learning outcomes.

## Plagiarism

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at <http://www.cuhk.edu.hk/policy/academichonesty/>.

## Generative AI

You can use AI tools to help proofread and copyedit your writing. You cannot ask AI tools to write any parts of assignments. If you use AI tools in any parts of your assignments, you need to declare it clearly. For the term paper, it is mandatory that you submit a statement explaining whether you used any AI tools and how you used them.

## References

- Allison, P.D. 1998. *Multiple Regression: A Primer*. Newbury Park, CA: Sage.
- Allison, P.D. 2009. *Fixed Effects Regression Models*. Los Angeles: Sage.
- Fitzmaurice, GM., NM. Laird, and JH. Ware. 2011. *Applied Longitudinal Analysis*. Hoboken, N.J: Wiley. (Online access)
- Freund, R.J., Wilson, W.J., and Sa, P. 2006. *Regression Analysis: Statistical Modeling of a Response Variable*, 2<sup>nd</sup> edition. Burlington, MA: Academic Press. (Online access)
- James, Gareth, Daniela Witten, Trevor Hastie, and Robert Tibshirani. 2021. *An Introduction to Statistical Learning: With Applications in R*. Springer Texts in Statistics. Springer. (Online access)
- Kahane, L.H. 2001. *Regression Basics*. CA: Sage.
- Kleinbaum, D.G., Kupper, L.L., Muller, K.E., and Nizam, A. 1998. *Applied Regression Analysis and Other Multivariable Methods*, 3<sup>rd</sup> edition. Duxbury Press.
- Knock, D, GW. Bohrnstedt, and AP Mee. 2002. *Statistics for Social Data Analysis*. Itasca, Ill: Wadsworth Publishing.
- MacKinnon, D.P. 2008. *Introduction to Statistical Mediation Analysis*. New York: Lawrence Erlbaum Associates. (Online access)
- O’Connell, AA. 2005. *Logistic Regression Models for Ordinal Response Variables*. 1 edition. Thousand Oaks, Calif: SAGE Publications.
- Pampel, FC. 2000. *Logistic Regression: A Primer*. Thousand Oaks, CA: Sage.
- Wickham, Hadley, Mine Çetinkaya-Rundel, and Garrett Grolemund. 2023. *R for Data*

*Science: Import, Tidy, Transform, Visualize, and Model Data*. O'Reilly Media, Inc.  
(Online access)

Yamaguchi, K. 1991. *Event History Analysis*. Newbury Park, CA: Sage Publications.

Some books are available online through the UL; other books are on reserve at the UL.

## Class schedule

Date		Topics	Assignments due
January	5	1. Basic concepts	
	12	2. Multiple regression: Basics	R tutorial
	19	2. Multiple regression: Basics	
	26	3. Multiple regression: Techniques	Exercise 1
February	2	3. Multiple regression: Techniques	R tutorial
	9	4. Multiple regression: Diagnostics	Exercise 2
	16	Holiday	
	23	5. Logistic regression	
March	2	5. Multinomial and ordinal logistic regressions	Exercise 3
	9	6. Poisson regression	
	16	7. Fixed and random-effect models	Exercise 4
	23	7. Fixed and random-effect models	
	30	8. Event history analysis	
April	6	Holiday	
	13	Quiz	
	27		<b>Term paper</b>

## **Term Paper**

Due: Apr. 27, 2026

Students are required to conduct a statistical analysis and write a research paper similar to the format of articles published in the *American Sociological Review (ASR)*. You are encouraged to read a few *ASR* articles in order to familiar yourself with conducting statistical analyses and writing quantitative research papers. You have to choose your own data for this exercise. The structure of the paper and the length of each section depend on the nature of the research topic. The following format provides a rough guideline for your reference.

- 1. Introduction** (1 to 2 pages): Motivate your readers
  - What is your research question?
  - Is the question important either in terms of theoretical significance or policy implications?
  - What is the nature of your study: A replication or a test of new theories?
- 2. Literature review** (2 pages): Discuss the conceptual framework
  - Review at least 5 articles related to your research topic.
  - Identify research tradition(s) as the starting point of your own research.
  - What are the unanswered questions in previous research?
  - Does your research extend analyses of previous studies?
- 3. Model and hypotheses** (1 page): Focus your study on specific issues
  - Construct your own model based on previous research evidence and your own speculations. A model is simply a set of statements describing how theoretical concepts are linked together (include path diagrams if appropriate).
  - Formally state the hypotheses that you are going to test in the paper.
- 4. Data and variables** (1 page)
  - Describe data source: when it was collected, method of data collection, no. of cases ...
  - Define each variable used in the analysis (discuss measurement issues, e.g. scale, coding ...)
  - What are the concepts that these variables are supposed to measure? Give justification.
- 5. Method** (1 to 2 pages)
  - Describe the method of analysis.
  - Is the method appropriate?
  - Are there any methodological issues that we need to pay attention to (i.e. outliers, linearity, and multicollinearity)? Describe the steps that you have taken to check and correct these potential problems?
- 6. Findings** (2 pages)
  - Report the results from your analysis. Report descriptive statistics first and then the results from your statistical models.
- 7. Summary and conclusion** (1 to 2 pages)
  - Briefly summarize key findings.
  - Discuss implications of the findings to your model and theory.
  - Are there any unanswered questions?
  - Discuss implications for future research or policy recommendation?