SOCY 201: Introduction to Statistics for Sociology

Syllabus
Department of Sociology
University of Maryland
Spring 2023

Lecture: 3207 Parren J. Mitchell Art-Sociology Building
12:30pm - 1:45pm, Tuesday & Thursday

Welcome to SOCY 201! This course helps you understand the characteristics of numerical data – the shape of the distribution, central tendency, and variability of the data. We know that students take this course with varying backgrounds and comfort levels with some of the mathematical concepts and operations taught in this class. Please know that we are both here to help you learn the material of this course. If at any time you need additional assistance, please do not hesitate to reach out. You are always welcome to drop into either of our office hours, or e-mail to help find an alternative time that works.

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o
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"Let no-one untrained in geometry enter" is said to have been inscribed above the door of Plato's Academy, the school he founded in ancient Athens.
Whispered in the Hall of Sociology, "let no-one ignorant of statistics enter."
Welcome to SOCY 201!

COURSE DESCRIPTION

This course is an introduction to elementary statistics for sociological analysis. It consists of a set of techniques to summarize and organize empirical data and analyze univariate and bivariate distributions. The course covers both descriptive and inferential statistics.

Prerequisites
Sociology 100 and Math 107 or Math 111. Note:

Subject Matter and Objectives
In this course, you will learn about the subject of **social statistics**. It is divided into two parts. The first part of the course covers **descriptive statistics**. It involves learning how to organize, summarize, and interpret numerical data. Descriptive statistics consists of a set of conceptual tools and simple mathematical operations that are used to organize, summarize, and interpret a dataset.

The second part of the course covers **inferential statistics**. Inferential statistics entails learning how to make rational guesses or inferences about the unknown fixed characteristics of the population from the known but variable characteristics of sample data. To make rational guesses is to calculate the likelihood or the probability that the sample data represent the population. This part involves learning some of the basic concepts in probability theory and the characteristics of probability distribution.

Major topics include the levels of measurement, frequency distribution, interpretation of graphs, measures of central tendency and dispersion, probability, sampling distribution, estimation, hypothesis testing and decision making. These are critical topics in the field of sociology because they provide the necessary skills for the study of large populations.

By the end of the course, my goal for you is that you will both *understand the key concepts in differential and inferential statistics*, and that you will be able to *read, understand, evaluate, and use statistical data*.

Text
Roger E. Kirk, *Introductory Statistics.* Belmont, CA: Thomson Wadsworth, 2008*.*
http://students.aiu.edu/submissions/profiles/resources/onlineBook/t7w8z8_Statistics_An_Introduction.pdf.

This title is available in digital format **at no cost to you**. For your convenience, I have uploaded a copy into our ELMS course site.

ASSIGNMENTS

There are several components to learning and mastering the course material. In each lecture, you will be introduced to key topics in introductory statistics. These topics are built on those discussed in the previous lectures. It is thus important for you to attend all the lectures. In the labs, the TA will review the materials from the lectures, give additional examples if necessary, and answer your questions related to the assignments.

Grades are a way of assessing how much of the course material you have mastered.

Here are some tips to help you succeed.

- Come to class and participate -- so you can see how concepts are introduced and discussed, statistical problems are presented, mathematical operations are used, and data are analyzed.
- Practice what you learn in class as soon as you can. This means that you go over the definitions of the concepts and the examples presented in the lectures, make sure you understand them by reciting the definitions and redoing the examples without looking at your notes, and try to figure out what you don't understand. Go over the relevant pages of the textbook. Bring your questions to class/lab/office hours and make sure you get them answered before moving on.
- Before the exams, redo previous examples given in the lectures, the assignments, and any other suggested problems, and make sure to get assistance with topics that you don't understand.
- Study for and repeatedly practice the problems before each of the (non-cumulative) exams.

Class participation 10%

- Class participation is an important component of learning statistics and an integral aspect of this class.
- To earn participation points for each day, come to class and participate in the activity of the day, which will often be opportunities to practice the concepts that you are learning, either individually or with your classmates.

Four in-Class Exams 80%

- Each exam is worth 20% of your final grade.
- The exams are not cumulative, but some of the topics build on previous ones, so it is important to go back and make sure you understand each of the foundational topics before taking later exams.
- Each exam will have 10-20 multiple choice or true/false questions and several statistical problems based on the problems we solved in class and problems from the appropriate sections in the textbook. In order to learn these, come to class regularly and on time, practice the problems from class and your textbook repeatedly, and ask questions.

Assignments 10%

- The assignments are meant to help solidify your understanding of the course material.
- To succeed, do them as soon after class as you can, while the material is fresh in your mind. Bring questions to your lab sections and make sure you understand how to properly solve the problems before moving to the next topic.
- Assignments are submitted biweekly and are graded for completion so that you have the opportunity to learn, make mistakes, and master the material before the exams.

Total 100%

GRADING
For all assignments and the final grade, grading will be done on the basis of percentages, which will then be converted into symbols according to the following schema: >96%=A+; 91%-96%=A; 89%-90%=A-; 87%-88%=B+; 81%-86%=B; 79%-80%=B-; 77%-78%=C+; 71%-76%=C; 69%-70%=C-; 68%-60%=D; <60%=F.

COURSE OUTLINE

III. INTRODUCTION TO STATISTICS: AN OVERVIEW - DESCRIPTIVE STATISTICS

January 26

a) The process of scientific research: Wonder, conceptualization, theory, operationalization and the level of measurement, hypothesis, observation, and assessment
Roger E. Kirk, *Introductory Statistics,* Chapter 1: Introduction to Statistics, pp. 1-18.
Practice questions: 1a, 2a-f, p. 10; 6a-c, 10, 12, p. 21; 1, 2, 4a-g, p. 25.

January 31 – February 2

b) Constructing frequency distribution
Kirk, *Introductory Statistics,* Chapter 2: Frequency Distributions and Graphs, pp. 29-41.
Practice questions: 1-6, 8, 10, pp. 39-40.

c) Graphic presentation of data
Kirk, *Introductory Statistics,* Chapter 2: Graphs for Qualitative Variables, pp. 41.
Practice questions: 14, 16, pp. 43-44.
Kirk, *Introductory Statistics,* Chapter 2: Graphs for Quantitative Variables, pp. 44-48.
Practice questions: 19, 21-22, 24, 26, pp. 48.

d) Shapes of Distributions
Kirk, *Introductory Statistics,* Chapter 2: Shapes of Distributions, pp. 44-59.
Practice questions: 28, p. 51; 4-6, 11, 18, 21, 27, pp. 54-57.
Assignment 1 due: Sunday, February 5

February 7 & 9

e) Central Tendency: Mode, Median, Mean

Kirk, *Introductory Statistics,* Chapter 3: Measures of Central Tendency, pp. 61-59.

(1) Mode (pp. 62-64)

(2) Median (pp. 68-71)

Practice questions: 19, p. 79; 1, 6, 8, 10-11, 16, pp. 83-85.

f) Measures of variability or dispersion

Kirk, *Introductory Statistics,* Chapter 4: Measures of Dispersion, Skewness, and Kurtosis, pp. 89-99.

(1) Range (pp. 91-95)

(2) Standard deviation (95-99)

(3) Standard score & z distribution

(4) Area under the normal curve

(5) Tchebysheff's Theorem and area under a skewed distribution

Practice questions: 1, 3-6, pp. 101-103

Assignment 2 due: Sunday, February 12

February 14, 16, & 21

II. BIVARIATE DISTRIBUTION
Correlation & Regression

a) Bivariate data

Kirk, *Introductory Statistics,* Chapter 5: Correlation, pp. 123-

b) Linear correlation: Pearson product-moment correlation coefficient, pp. 129-133

Practice questions: 7-8, p. 134.

Explained and unexplained variation (pp. 135-137)

Practice questions: 1

c) Linear regression

Kirk, *Introductory Statistics,* Chapter 6: Regression, pp. 159-168.

Practice questions: 1-3, pp. 168-169

Assignment 3 due: Sunday, February 19

EXAM I: February 23

III. FOUNDATION OF STATISTICAL INFERENCES: PROBABILITY, VIEWS, BASIC CONCEPTS, AND RULES

February 28 & March 2

a) **Basic Concepts in Probability Theory**

Roger E. Kirk, *Introductory Statistics,* Chapter 7: Probability, pp. 183-190:

(1) Different views of probability: the subjective, classical/logical, and empirical-relative frequency, pp. 184-186
Practice questions: 1-4, pp. 186-187
(2) Basic concepts, pp. 187-189
Practice questions: 5-8, p. 189

b) **Rules of Probability**
Kirk, Chapter 7, pp. 190-198
Practice questions: 10-13, p. 197; & questions 3, 4, 5, 6, 7, 10, 13, pp. 203-205

March 7 & 9

c) **Random Variables and Probability Distribution**
Kirk, Chapter 8: Random Variables and Probability Distribution, pp. 207-218
(1) Random variable and the difference between a discrete and continuous random variable, pp. 212-213
(2) Distribution of a discrete random variable, pp. 213-214
(3) Expected value and the standard deviation of a random variable, pp. 214-218
Practice questions: 8, 10, 11, p. 218; and 8, 11, 12, p. 226

d) **Normal Distribution, Standard Normal Distribution, and Finding Areas Under the Normal Curve**
Kirk, Chapter 9: Normal Distribution and Sampling Distributions, pp. 229-237
(1) The normal distribution, pp. 230-232
(2) Converting scores to standard scores, pp. 232-233
(3) Findings areas under the normal distribution, pp. 233-235
(4) Finding scores when the area is known, pp. 235-236
(5) Normal approximation to the binomial distribution, pp. 236-237
Practice questions: 1, 3, 4, 5, 6, 7, 8, p. 237

Note: if it was not possible cover sampling and sampling distribution before the date of the second exam, this topic (sampling and sampling distribution, see below) will be discussed under part III, inferential statistics.
Assignment 4 due: Sunday, March 12

March 14, 16, & 28

e) **Sampling and Sampling Distribution**
Kirk, Chapter 9: Sampling Distribution, pp. 242-249
(1) Estimation, point estimate, and interval estimate, pp. 242-243
(2) Sampling distribution, p. 243
(3) Sampling distribution of the sample means, pp. 244-247
(4) Central limit theorem, p. 247
(5) Standard error of a statistic, pp. 247-248
(6) Properties of good estimators, p. 248

(7) Test statistics, pp. 248-249. This section will be discussed more extensively under part III (if it is unclear, don't worry), pp. 248-249.

Practice questions: 15, 17, 18, 19, pp. 249-250; and questions 2, 3, 4, 5, 6, 7, 13, 14, pp. 251-252

Assignment 5 due: Sunday, March 26

SPRING BREAK: March 19-26 (Sunday-Sunday)

EXAM II: March 30

IV. INFERENTIAL STATISTICS: ESTIMATION AND HYPOTHESIS TESTING

April 4 & 6

a) **Hypothesis Testing about Population Mean: One-Sample Tests**

Kirk, Chapter 10: Statistical Inference: pp. 257-263

(1) Null and alternative hypothesis, p. 260-262

(2) The role of logic in evaluating a scientific hypothesis, p. 262-263

Practice questions: 3,4, p. 263

(3) Hypothesis testing, pp. 263-270

Practice questions: 7, 9, 12, 13, pp. 270-271, and 15-17, p. 274

(4) More about hypothesis testing, pp. 274-277

(5) Type I and Type II errors, pp. 277-280

(6) More about Type and Type II errors, pp. 280-283

Practice questions: 20-22, p. 284; and questions 7, 8-11, 16, 24ab, pp. 287-288

April 11 & 13

b) **Statistical inference: One-sample confidence interval**

Kirk, Chapter 11: One-sample conf uh idence internal, pp. 292-

(1) Criticism of null hypothesis significance testing, pp. 292-293

(2) Confidence internal for μ, pp. 293-298

(3) Interval estimation versus hypothesis testing, pp. 298-299

Practice questions: 2, 3a&b, 4; and 2a-d, 4a-d, 5a-b, p. 304

Assignment 6 due: Sunday, April 16

April 18 & 20

c) **Hypothesis Testing about Population Mean: Two-Sample Tests - Independent Samples**

Kirk, Chapter 13: Statistical Inference for Two samples, pp. 323-3

(1) Two-sample test and confidence interval for $\mu_1 - \mu_2$, using independent samples, pp. 324-326

(2) Computational example for *t* test for $\mu_1 - \mu_2$, pp. 326-330

(3) Two-sample *z* test for $\mu_1 - \mu_2$, pp. 331-332

(4) *t* Confidence interval for $\mu_1 - \mu_2$ with unequal variances, pp. 334

Practice questions: 2, 3, 4abe, 5abcefg, pp. 335-336

April 25 & 27

d) **Two-sample *t* test and confidence interval for $\mu_1 - \mu_2$ - dependent samples,**

Kirk, Chapter 13: Dependent samples, pp. 341-

(1) *t* Test for $\mu_1 - \mu_2$, pp. 342-344

(2) Computational example for *t* Test, pp. 344-347

(3) *t* Confidence interval for $\mu_1 - \mu_2$, pp. 347-348

Practice questions: 16, 17, pp. 349-351, and questions 9, 11, 14, 15, pp. 354-357

Assignment 7 due: Sunday, April 30

EXAM III: May 2

V. CHI-SQUARE AND ANALYSIS OF VARIANCE

May 4, 9 & 11

a) **Analysis of Variance (ANOVA)**

Kirk, Chapter 15, Introduction to the Analysis of Variance, pp. 391-402

(1) Analysis of variance versus ding multiple t Test, pp. 393-394

(2) Basic concepts in ANOVA, pp. 394-399

Practice questions: 1, 11, 12, 13

b) **Chi-square**

Kirk, Chapter 17, Statistical inference for frequency data

(1) Three applications of Pearson's chi-square statistic, pp. 468-469

(2) **Chi-square as a test of goodness of fit**, pp. 470-476

(3) **Chi-square as a test of independence,** pp. 477-482

Practice questions: 3, 4, 8, 9, 10

Assignment 8 due: May 14

FINAL EXAM: Thursday, May 18, 1:30pm – 3:30pm