

Probability and Statistical Inference 3640

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OSH 373

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BUC 305, 9:10-10:30 Tuesdays and Thursdays

Office hours: 10:30-11:00 and 2:00-2:30 Tuesdays and Thursdays

This course applies probability theory and statistical methods. Topics include descriptive statistics, basic probability theory and inferential statistics. Basic computer skills are presumed, so is college algebra.

Descriptive statistics is a collection of methods for summarizing a large amount of quantitative information so that it is easily understood. This should help you in comprehending the quantitative information that you encounter on a daily basis. It should increase your skills in communication and understanding data.

Uncertainty is all around us. We do not yet know who will win the Super Bowl. You do not know whether you will have a traffic accident on your way home tonight? The theory of probability is a rigorous way to think about uncertain events.

When reading about the latest scientific findings about, for example, the connection between the coffee drinking and Alzheimer's disease, do you ever doubt the researcher's conclusion? If you have doubts, can you explain exactly the reason for these doubts? This course will explain the principles involved in judging the quality of such research. This topic is called inferential statistics.

Statistics offers tools important for all sciences. Unfortunately, students are often intimidated by this subject, and often postpone statistics courses as long as possible. This is unfortunate, since statistics is a method that can greatly enhance understanding. Instead of dread, I hope this class will show both the beauty and value of statistical methods.

The textbook is *Introduction to the Practice of Statistics*, Eighth Edition, by David Moore, George McCabe and Bruce Craig (MMC). The course coordinates with a series of video lessons, *Against All Odds* (AAO); David Moore was the consultant to the production of this PBS series. These are available online at <http://www.learner.org/resources/series65.html>. Several additional statistics videos have been produced at the University of Utah (UofU); These are available online at <http://www.youtube.com/user/EconomicsUofUtah/videos?flow=list&view=0&sort=da>.

The homework assignments are crucial to the course and will be reviewed in class. Late assignments lose points; copies and exact duplicates are unacceptable. Only online submission is accepted. If you seriously attempt these assignments, your chance of doing well on the exam is much improved. Answer keys will be posted. The final exam is comprehensive in coverage. The final exam must be taken at the scheduled time. Incompletes are not given for nonmedical reasons.

The Excel spreadsheet program will be used in the lecture videos and for homework assignments. If you are using a Windows version of Excel, then you have all the tools that are needed (although you may need to add them into your program). However, if you are using a Mac version, then some important statistical tools have been removed. In that case I suggest that you switch to the Windows 2013 version that is available in the College of Social and Behavioral Sciences Virtual Lab. You follow the CSBS installation [instructions](#), then launch the [Lab](#).

Grades are based on written assignments, project and the final exams according to the following weights:

- Reflective discussions 5%
- Your turn discussions 5%
- Assignments 15%
- Quizzes 30%
- Final Examination 45%

I will compute final grades by three methods; your grade will be the highest of the three:

- The traditional standard: with 100-93%=A, 92-90%=A-, 87-89%=B+, 83-86%=B, 80-82%=B-, and so on to 59-0%=E,
- The curve: with an overall average grade of B (GPA=3.0),

- The ace-the-final rule: you get an “A” for the course if you score an “A” on the final exam regardless of your point total.

#### Topic Outline

#### 1. Descriptive statistics

- measuring distributions
- location and variability
- box plots and histograms
- normal distributions

Reading: MMC chapter 1

Videos:

- AAO 1. What Is Statistics?
- AAO 2. Stemplots
- AAO 3. Histograms
- AAO 4. Measures of center
- AAO 5. Boxplots
- AAO 6. Standard deviation
- AAO 7. Normal Curves
- AAO 8. Normal Calculations
- AAO 9. Checking Assumption of Normality
- UofU Statistics Using Computer Spreadsheets
- UofU Statistics in Economics History

#### 2. Describing Relationships

- scatterplots and correlation
- simple regression
- correlation and  $r^2$  statistics
- causation

Reading: MMC chapters 2

Videos:

- AAO 10 Scatterplots
- AAO 11. Fitting lines to data
- AAO 12. Correlation
- AAO 14. The Question of Causation

#### 3. Probability theory

- probabilities concepts
- random variables
- normal distribution
- binomial distribution
- sampling

Reading: MMC chapters 4 and 5

Videos:

- AAO 19. Probability Models
- AAO 20. Random Variables
- AAO 21. Binomial Distributions
- AAO 22. Sampling Distributions
- UofU Statistics and the Gender Gap

#### 4. Inference

- confidence intervals
- significance tests
- inferences for one mean
- inferences for two means

Reading: MMC chapters 6 and 7

Videos:

- AAO 24. Confidence Intervals
- AAO 25. Tests of Significance
- AAO 26. Small Sample Inference for One Mean
- AAO 27. Comparing Two Means
- UofU Experimental Design and Significance Testing

5. More regression analysis

- inference on regressions
- $t$ -statistics and confidence intervals
- correlation and  $r^2$  statistics
- multiple regression

Reading: MMC chapters 10 and 11

Videos:

- AAO 30. Inference for Regression
- UofU Inferential Statistics and Multiple Regression

6. Review