

**DEPARTMENT OF POLITICAL SCIENCE
POSC/UAPP 815
PUBLIC MANAGEMENT STATISTICS**

**APPLIED STATISTICS FOR SOCIAL, POLITICAL, AND
POLICY SCIENCES**

**Fall 2000
H. T. Reynolds**

**PLEASE READ THIS INFORMATION CAREFULLY
ASK IF YOU HAVE ANY QUESTIONS**

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Statistical thinking will be as necessary for efficient citizenship as the ability to read and write.

-H. G. Wells

Thou shalt not sit with statisticians nor commit a social science.

-W. H. Auden

Nothing in education is so astonishing as the amount of ignorance it accumulates in the form of inert facts.

- Henry Brooks Adams

When you can measure what you are speaking about, and express it in numbers, you know something about it; but...when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.

-Lord Kelvin

Get your facts first and then you can distort 'em as much as you please.

-Mark Twain

There are three kinds of lies--lies, damned lies, and statistics.

-Benjamin Disraeli

Here's an issue that's being debated throughout the country: do guns save lives.

A study, *More Guns, Less Crime* by John Lott, Jr., answers "yes" and uses statistical methods and seemingly hard data to back up its claim. Other social and policy analysts, however, argue that guns do nothing to reduce violent crime and may in fact contribute to it. These individuals also invoke statistics to support their position.

Who's right? More important, how do we know who to believe? What constitutes good evidence and sound reasoning? Do numbers lie? mislead? confuse?

This case represents just one of countless examples of the use of data and statistics not merely to understand social problems but to advance particular ideas, policies, causes, and even ideologies. Consequently, however one views the topic, statistics--the analysis, presentation, and interpretation of data--dominates the way the nation makes its public policies

Naturally social and policy scientists rely on statistical analysis to make their points. But these techniques have seeped into popular culture as well. Every newspaper carries stories containing assertions purportedly resting on "hard" facts: "Evidence proves that capital



punishment deters crime." "Data show that dioxin causes cancer." "Scientific studies reveal that the American economy is becoming less competitive." "Blacks receive disproportionately harsh penalties for drug offenses." "Laboratory experiments point to the harmful effects of television violence [or pornography or tobacco advertisements], which should therefore be outlawed." "Census reports imply that.."

One can go on in this vein indefinitely, but the point is clear: everyone--common citizens along with social scientists and policy analysts--are constantly bombarded by claims and counter-claims, all backed by numerical evidence, about public policy and current events. These arguments have political, moral, economic, social, and practical dimensions. But what often unites them is their reliance on statistics of one sort or another.

In light of these considerations this course has four broad objectives:

- First, it provides a one-semester introduction to statistical reasoning and concepts. I hope, in other words, to present enough information to enable everyone to evaluate intelligently assertions that rest on statistical methods and inferences. By the end of the semester, for example, you should know enough to analyze critically a claim such as "There are positive correlations between the generosity of welfare benefits, undesirable social behavior, and dependency on public assistance."
- Second, you will learn to use several statistical methods to summarize and interpret some interesting data. My goal is to encourage you to think about what (if any thing) a batch of numbers says about the "real" world.
- Third, you should be able to locate, retrieve, and analyze data from a variety of different public and private sources.
- Finally, the course offers a foundation for those who want to pursue the subject in more depth. Most disciplines--sociology, political science, law, psychology, public administration, and economics--expect their practitioners to use at least elementary statistics in their research. This level of expertise normally takes two or three semester to acquire, and 815 tries to lay a solid foundation for more advanced study.

Needless to say, not everyone can become a statistician. That's neither a realistic nor desirable goal. But it is possible to learn enough basic concepts and methods that will allow one to ask intelligent questions and to know what constitutes reasonable responses.

METHOD:

Each day I will try to explain what various concepts and terms mean, how to calculate important statistical quantities (by hand and with a computer), and what assumptions underlie these methods. For the most part I'll follow Agresti and Finlay's book, *Statistical Methods for the Social Sciences*, 3rd edition. There should be plenty of opportunity to ask questions and



discuss matters of common concern.

But unlike many academic subjects statistics has to be learned "actively" by describing and analyzing data. Hence, as noted below, "assignments" or homework accompany nearly every class. Intended to clarify various ideas discussed in class these assignments should be completed carefully and promptly. (The due dates will always be clear.) It is very important that you keep up. You can't prepare simply by cramming before an exam. You need to think of statistics as though it's a foreign language: only by using it regularly do you only become comfortable with it.

WHAT YOU NEED:

- Agresti and Finlay, *Statistical Methods of the Social Sciences*, 3rd edition.
- SPSS Student Version 10.0 for Windows
- Optional: statistical calculator

Note that SPSS is available on many, if not most, personal computers in the public computing sites scattered around the campus (e.g., Smith Hall). Consequently, if you are willing to work on in public site and/or do not have your own PC, you don't need to bother with the Student Version. Most of the assignments can be done with any version of SPSS and even with other programs such as MINITAB. But the program used in instruction will be SPSS 10.0.

It seems to me that investment in a first-rate text such as *Statistical Methods for the Social Sciences* makes sense even for those people who do not intended to "do" statistics during their careers. After all, for the rest of your lives most of you will be discussing, if not formally evaluating, arguments that rest on at least some statistical methods. Having a good reference book ought to help greatly. Moreover, most of the problems will be drawn from this text.

REQUIREMENTS:

Assignments: (35 percent) Since I believe that statistics has to be learned interactively by doing, not observing, I want you to put your knowledge to work. Thus, the main course requirement consists of weekly assignments or homework. These assignments, most of which involve analyzing various types of data, should help you understand the concepts and methods described during the class. Some, but not all, will be graded. Those that are not formally graded are "scored" as follows:

- * ✓ = satisfactory
- * 0 = acceptable, but you should look at my comments to make sure that you fully understand.
- * X = Resubmit. Something has been calculated or expressed incorrectly. Correct the indicated errors and resubmit. Again the point is to make certain that you understand the material.



Since clear thinking and orderly work go hand-in-hand, I want you to get organized, write notes and intermediate calculations on scratch paper, and turn in neatly written sheets. Attach only the graphs, figures, or tables explicitly requested. Presenting reams of computer "print out" doesn't help anyone.

You can't expect to do well in the course if you don't conscientiously do the assignments **on time**. Missing assignments or a couple of "Xs" will lead to trouble.

Midterm Examination: (25 percent) October 25, 2000. This test like the final will ask you mostly to interpret the substantive and statistical meaning of various results. There will be few calculations and no proofs.

Final Examination: (40 percent). Although this exam, which will be given during finals week, will test all the material covered during the semester, it too will stress understanding, not computation or formal theory.

Since this is a fixed schedule, there won't be any "incompletes" except for health reasons. Mark your schedules and keep up.

E-MAIL AND THE INTERNET:

Everyone will be extensively using electronic mail and the world wide web as well as statistical computing. You thus have to have access to a desktop computer. Fortunately, numerous choices abound. For example, both Delaware's main and peripheral campuses house public "computing sites," places where students can find computers and (sometimes) consultants. Most of these machines are connected to the internet, which permits you to send and receive "e-mail" and access the course "web page." Moreover, the price of these devices has fallen in recent years to the point where even very sophisticated machines are within the budget of many students. If at all possible, I suggest that you either buy one or try to arrange for regular access to a friend or coworker's. But in case you can't there are plenty of machines on the various campuses, especially in Newark, that you can use for free.

DESKTOP COMPUTING AND STATISTICAL PROGRAMS:

One of the advantages of computing is that they take the drudgery out of statistical calculations. Since I want everyone to analyze as much data as possible and to concentrate on concepts, not calculating formulas, we will be spending a great deal of time using statistical program "packages," computer software that bundles innumerable procedures into a unified system.

Although dozens and dozens packages exist, most of them have the same features and work in the roughly the same way. So if you learn how to use one, you can easily transfer your



knowledge to others. Still, in order to provide some unity and continuity to the course I rely mostly on SPSS. If you want to try some other system, be my guest. But you're on your own because I don't have the documentation and experience with every statistical program out there. My personal opinion is that Excel, even with "add-ons" is not a very good choice.

OFFICE AND GETTING HELP:

My office is in 434 Smith Hall where I will be on Tuesday and Thursday, approximately 1:30 to 3 pm. In addition, I am more than willing to meet at other times of mutual convenience.

An excellent way to stay in touch and ask questions is via E-mail. My address is **htr@udel.edu**.

If you are having trouble doing the assignments, please let me or the teaching assistant (if there is one) know immediately. When seeking assistance, though, please keep these points in mind:

- You should make an initial effort to do the problems. That way we can determine what you do and do not know.
- Bring printout (if applicable). Having this "diary" will help us pinpoint any mistakes you may be making. Do not try to reconstruct what you have done from memory; bring a "hard copy" of your work.
- Write down specific questions. Writing may help clarify the situation in your own mind. In other words, you need to ask specific questions.
- Do not be afraid to ask. Since the subject matter is cumulative, it is important that you understand everything as we go along.

ATTENDANCE:

Note: Attendance is **always** required. If work or research obligations present a problem, you might wish to consider the Focus section of the course.

SUGGESTIONS:

This class does not assume any knowledge of statistics, computers, or research methods. (For some it may be too elementary, and they are encouraged to take a more challenging course.) What is important is a good attitude: the material can be useful to your professional development if you keep an open mind and make an honest effort to learn.



Experience tells me that the students who experience most difficulty learning statistics or computer programs such as SPSS are often somewhat disorganized and sloppy in their work habits. It is important to be neat and systematic. Read directions carefully before undertaking any assignment. As an example, do not sit down at a PC without having first read the assignment, gathered the materials you need, put them in the order in which they will be used, have blank scratch paper available, and list what it is you are supposed to do. Leave extraneous or unnecessary items at home. That way you will work faster with fewer errors.

IMPORTANT NUMBERS AND ADDRESSES:

- Office: 434 Smith Hall - Phone 302-831-1940
- Political Science Department: 347 Smith Hall - Phone 302-831-1940
Fax: 302-831-4452
- E-mail: htr@udel.edu
- Course web page: www.udel.edu/htr/Statistics
Note: that this site is shared by a number of courses including the so-called “Focus” or distance learning versions of 815 and 816. So not every thing on it will be relevant to the course. In particular, the notes that you see are for the Focus sections and have little or nothing to do with the current class.

LIST OF TOPICS:

Except perhaps for the first, each topic will take 2 or 3 class periods. You will always be told what you should be reading. This material covers approximately the first half of Agresti and Finlay’s *Statistical Methods*.

INTRODUCTION

- Topic I: Introduction and Desktop Computing
Agresti and Finlay, *Statistical Methods*, Chapter 1.
- Topic II: Variables and Sampling
Agresti and Finlay, *Statistical Methods*, Chapter 2. (We’ll discuss sampling in more detail later.)

SUMMARIZING DATA

- Topic III: Tabular and Graphical Summaries of Data Batches.
Agresti and Finlay, *Statistical Methods*, Chapter 3, pages 35 to 44.
- Topic IV: Measures and Plots of Central Tendency and Dispersion.
Agresti and Finlay, *Statistical Methods*, Chapter 3, pages 45 to 67.



- Topic V: Measures of Association for Categorical Variables.
Agresti and Finlay, *Statistical Methods*, Chapter 8, pages 248 to 253 and 265 to 278.

- S** Topic VI: Linear Regression and Correlation
Agresti and Finlay, *Statistical Methods*, Chapter 9, pages 301 to 326.

STATISTICAL INFERENCE

- Topic VII: Probability Distributions.
Agresti and Finlay, *Statistical Methods*, Chapter 4.
- Topic VIII: Statistical Estimation.
Agresti and Finlay, *Statistical Methods*, Chapter 5
- Topic IX: Statistical Inference and Tests of Significance
Agresti and Finlay, *Statistical Methods*, Chapter 6.
- Topic X: Two Sample Tests.
Agresti and Finlay, *Statistical Methods*, Chapter 7.
- Topic XI: The Chi Square Test
Agresti and Finlay, *Statistical Methods*, Chapter 8, pages 253 to 265.
- Topic XII: Inference for Regression.
Agresti and Finlay, *Statistical Methods*, Chapter 9, pages 326 to 342.