SYLLABUS
SOCIAL SCIENCE 10B
PROBABILITY & STATISTICS FOR THE
SOCIAL SCIENCES

Instructor: Paul Shirey
Office: SSPB 4245
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remains
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Goals of this class:
A) 20% -- Knowing and understanding the details of statistics (such as: means, standard
deviations, standard errors, & how statistical tests work)
B) 40% -- Knowing which statistical test to use (see the included page from last year’s
final for spring quarter)
C) 40% -- Coming to sensible conclusions about the test results

Comments: The percentages represent relative importance in doing statistical analysis. In
many ways, Goal B and Goal C are the only things one really has to know how to do in order to
be a successful analyst. The percentages, however, DO NOT represent how much time we will
spend on them in class. We will spend most of our time with Goal A. This will include basic
calculations. It will also emphasize understanding of why we are doing what we are doing.
Why will we spend so much time with Goal A? Because only by knowing the details of
statistics can we conquer Goals B and C (especially B). In the Fall quarter we will begin
discussing terms like interval scale and standard deviation. Are these terms important in and of
themselves? Not really. So why do we learn them? Simple: In order to master Goals B and
C. It is impossible to be able to determine which test to use if we do not know the scale of
measurement. Likewise, it may be impossible to determine which test to use unless we know
facts about the standard deviation. Certainly it becomes hard to draw sensible conclusions
without this knowledge.

Thus, there is a direct goal in mind: The acquisition of knowledge on how to analyze data;
specifically, (1) which test do we use to analyze the data, and (2) what conclusions can we
draw from the results.

How do we Accomplish These goals?
Lectures will be well-organized and comment on, but not necessarily repeat, the material
covered in the text. If I do not add anything new, even if it is just an insight or a clearer
understanding, I am not helping you. Thus, in order to help you, I must address topics that may
be only tangential (at that point) to the reading. Trust me, it will become integral later on. I
will also take time to explore any concept in the book that students are having trouble
understanding. Unfortunately, understanding statistics is not a straightforward excursion. It is
not a collection of unrelated subjects that can be covered one, two, three. Nor is it a tower of
knowledge where we first learn A, then B, then C, then D, etc. Like many subjects, what you
need to do is learn a little about A, then a little about B, then a little about C, then go back to A
and you will be able to learn more, then a little about D, and back to B, then back to A again,
and so on until the material is mastered. This requires work and can be frustrating. I will repeat myself in lecture; this is intentional. Ironically enough, some of the least important concepts take the most amount of time to explain, and the most important concepts take the least amount of time. Time and difficulty are not necessarily good measures of relative importance. Finally, you will have to read some sections in the text more than once, maybe more than twice; this is necessary.

I will also give you “reading guides” once a week. These are merely tasks to reinforce your reading and understanding of the material. They do not need to be turned in.

In order to succeed, you should:

1) Read the material BEFORE I lecture on it; this may involve reading it more than once; go through the “reading guide.”

2) Write questions on the material. Try to stump yourself. Try to stump your friends. Hold competitions with other students. Don’t write cheap, banal questions, but probing questions that will help you (and your friends) learn. ADDED BONUS: Turn in to me questions you have written. If you do this at least 2-4 days before the test, and if I like the question (I like the probing, thoughtful questions – not definitions), and if it is unique, I will put it on the test. You will be rewarded in two ways: (a) you’ll know a question on the test, and (b) ten points of extra credit. Again, if you write dozens of simple questions, you’ll probably never get extra credit, but if you put thought into them you’ll make an A all the easier to obtain.

3) Ask questions if you don’t understand. Feel free to ask in class. Interrupt me if you want to (as long as it’s on the material). However, many of you would rather fail than ask a question in front of 200+ people. If this is the case, please feel free to ask me after class, or ask me in my office hours. I WANT people to come to office hours; if you don’t I’ll have to sit and clean it – it is a mess. Feel free to visit the TAs also. You don’t have to be constrained to “your” TA. Everyone explains things differently and in different styles. Find the person whose style most matches your own. (I tend to favor visual learning.)

4) Try to learn the material in its wholeness. Do not merely try to memorize a few definitions or get a fuzzy idea of a concept merely to get by on the test. My tests don’t often work that way, and before long you’ll be buried in complete confusion. If you only vaguely understand certain concepts (such as ordinal scale or parameter), by the time Spring quarter comes along, if you still are fuzzy on these concepts, you will do poorly.

5) Memorizing a definition is not the same thing as understanding a concept. If you can tell me the “definition” of a parameter, but you fail to clearly identify one in a simple example of an experiment, one must conclude that your understanding is limited.

By staying in this class, you are committing yourself to these tasks. It is understood that you know you have to do these things in order to succeed.

Tests: There are five tests. Each of the five tests is worth 150 points. The tests are short answer: some will involve calculating, some will only involve identifying something, and some will require an explanation. Each of the five tests cover the previous week’s material. If you think a test has been mis-graded, you have one week from the date the test is returned to resubmit it for re-grading. You will do this by returning the test to the person who graded it with an attached note explaining what is wrong. The TA will then take it home and evaluate it again and return it to you. If you are still unhappy with the grading, you can bring the test to me, but only after it has gone through this process. We will not consider any case, no matter how legitimate, after that week. When going over a test, you should also make sure that your score is added up correctly. It is also suggested that you keep your test as proof of your score. In
rare instances bookkeeping mistakes occur. If your score is mis-recorded, we will only be able to change the score if we have proof that it was mis-recorded. Of course, this means that you have to pick up your tests.

Test Structure: Each test will have questions totaling 180 points. You must choose which 30 points you want to discard (such as the questions you find difficult). You must cross out these questions – make it obvious. If no questions are crossed out, the last 30 points on the test will be crossed out. Most likely, the questions will be 10 points each, thus there will be eighteen questions of which you must cross out three. You do not get extra credit for answering all eighteen. The above paragraph describes each and every test you will have in this class all year long.

Test Notes: During a test, you may have a handwritten page of notes. You may also use tables (if applicable) and a calculator (if necessary). As long as your calculator adds, subtracts, multiplies, divides, and calculates square roots, you will be fine.

Missed Tests: If you miss a test, most likely you will simply receive a zero for that test, but don’t despair, because everyone gets to drop her or his worst score. [See Grading below.] Generally speaking, I only let people make up tests if they have a schedule already set up which will cause them to miss more than one test. You must make me aware of this schedule before the first test. You should try to make every test. Who knows, the test you miss may be easy.

Homework: There are five homework assignments worth 30 points each. Only your top four scores will be counted, for a total of 120 points. Some homework questions will be similar to test questions. Some will be different than test questions: some are assigned to make you think about deeper issues – issues that are hard to test (that's why they are homework). A good way to study for the tests is to look at all of the questions in the text. Homework will be turned in at the beginning of class, on Friday. If it is turned in after 11:00, it will be considered late. You may always turn in your homework early. If it is one class late (beginning at 11:00) you will receive only 15 points. If it is more than one-class late (e.g., after 11:00 on Monday), you will receive no credit. You are expected to do the homework yourself. If you do not do all of the questions, you will only receive partial credit. A correct answer is not necessary to receive full credit, but a good and complete effort is required. Most of you should expect (if you try) to receive 120 total homework points. The only ways you can fail to receive points are (1) not answering the question – this includes answering the wrong question or answering only part of a multiple-part question or being exceedingly brief in your answer; (2) not showing work when work is necessary in order to rationally come to a sound conclusion; (3) having identical homework with someone else. Note: you do not need to get a correct answer, and you do not even really need to know what you’re doing as long as you try – however, if you are so confused that you leave the answer blank, you will not receive credit. Thus, I suggest that you try to do your homework well before it is due. This way you can ask questions before it is too late. Also staple it!

Labs: Attendance is not strictly required, but it is an easy source of points. For every lab that you attend, you will receive 30 points. Once you receive 120 points (four labs), you cannot receive any more points. Attendance will be taken. It is your responsibility to make sure that your attendance or participation was recorded. You only get points for attending the entire lab (or almost the entire lab). If you arrive 45 minutes late, do not expect credit. Likewise, if you leave after five minutes, expect the TA to cross off your name. All lab points are at the TAs discretion.

Grades I: There are nine sources of points: (1) Test 1 (150 points); (2) Test 2 (150 points); (3) Test 3 (150 points); (4) Test 4 (150 points); (5) Test 5 (150 points); (6) Lab Attendance (120
points); (7) Homework (120 points); and (8) Extra Credit (undefined). This gives us a grand total of at least 990 points; however, we will drop your lowest score. Thus, your total points will consist of the sum of your seven highest point sources (not counting extra credit which won’t be dropped). The maximum number of points is thus 870. Some of you might think (upon examination) that there’s no need to do homework and attend labs because they are only worth 120 points and will be dropped anyway. This is a bad strategy. Homework points and Lab points are relatively easy ways to get points. Many of you will easily get 120 total points for homework and labs. Less than 20% of you will consistently score above 120 points on your tests, and less than 5% will have all test scores above 120. Thus, about 95% of you will receive a higher total score if you do all the homework and labs. (It also gives you more of a cushion if you are sick and miss a test.) Your final grade will be determined strictly by how many points you have (such as 695 or more is a B+). Read on.

Grades II

<table>
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<tr>
<th>Grade</th>
<th>Points</th>
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<tbody>
<tr>
<td>A+</td>
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<tr>
<td>A</td>
<td>745</td>
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<tr>
<td>A-</td>
<td>720</td>
</tr>
<tr>
<td>B+</td>
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<td>D-</td>
<td>480</td>
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To estimate how well you are doing at any particular time, calculate how many points you have. Figure out how many more points you need to receive the grade you desire. Calculate how many more points are available, and ask yourself if that seems reasonable and if you are on target. For example let’s say that you have just received test three back, and that for your three test total you have 370 points. Let’s say that you want at least a B+ (695 points). Well, you need 325 more points. You have been doing all your homework and attending all the labs, and you anticipate receiving 120 points for each. That’s 240 points, which leaves 85 points you still need. Well, there’s two more tests and extra credit to consider. You’ve received 10 points of extra credit so far, so thus you need 75 more points. Remember, you’re going to drop your lowest score, so you can’t spread them out (e.g., 40 points on each test), but if you do get a 75 on either of the remaining two tests, you have the B+. (And a 100 gives you an A- and a 125 gives you an A.) At first this may seem confusing, but it is exceedingly fair and flexible, and after awhile easy to understand; and it is better to be fair and flexible than initially easy to understand.

Another way to look at grading is this: An A- is 720 points. There are six sources of points to be added up at the end of class and 120 x 6 = 720. Thus, if you average 120 points, you will receive an A-. (This includes tests, homework, labs, and lab quizzes.) Similarly, if you do all of your homework, attend all the labs, and successfully pass the lab quiz, you need to average 100 on your four highest test scores to get a B-. Of course, if you don’t do your homework or attend discussion sections, you’ll have to average a bit higher. Similarly, if you average 80 on your four highest test scores (and do all your homework, etc.), you’ll get a C-. An average of 60 points works out to a D- (again, assuming all your other work is complete). This does not even include extra credit. Of course, it would be a mistake to rely on extra credit.

Cheating: Absolutely not tolerated. The associate dean will be notified, a letter will be sent to your home indicating what the perceived problem is, and, unless you successfully appeal your case with the associate dean, ninety points will be deducted from your score. Your second offense will result in dismissal from class with an F, and your record will clearly indicate why. Cheating includes copying answers from another person, supplying answers to another person, knowing the questions before the test, and changing answers after the test and then submitting the test to be re-graded. If there is assigned seating, not sitting in the assigned seat is also considered to be cheating. For a full description of cheating, check the academic dishonesty section in the schedule of classes.
Your: You should pick up your tests and homeworks. They are your proof that you got credit for them just in case a bookkeeping error occurs. The TA will often show the class the grade sheet.

Responsibilities: You should check it in order to make sure everything is as you believe it to be. You are responsible for knowing when tests are and what the requirements of this class are. I've spelled everything out in painful detail. I hope all of your questions have been answered, but if you are still confused or uncertain, please ask for clarification. I know I’d be confused if I were you.

Talking in Class: Not at all to each other, but please ask questions of me. Please let me know if I am going too quickly or too slowly. Ask good questions; ask bad questions; ask silly questions; ask for more detail; ask for another example; ask whatever you want. I like an interactive class. One of the worse things you can do is just sit there, especially if you are lost, confused, or bored.

**SS10B – AN OUTLINE OF THINGS TO COME**

**Week One: The Binomial Distribution.**

**Monday:** Introduction to the class. Probability distributions for discrete and continuous variables. The Binomial Distribution.

**Wednesday:** Sampling (i.e., Chance) Error: Let’s look at a coin, and let’s look at height. Also Sampling Distributions. Read 8.0, 8.1 & 8.2. Hypothesis Testing & The Null Hypothesis & Test Statistics and Their Sampling Distributions & Using the Normal Distribution to Test Hypotheses. This is a lot, and I hope to do it all today, but if you are having questions, please slow down the lecture and ask questions. Read 8.3, 8.4, 8.5 & 8.6. Type I and Type II Error along with One- and Two-Tailed Tests & Chapter Review. Read 8.7 - 8.11.

**Friday:** **TEST NUMBER ONE**

Homework 1 Due: Binomial probability questions (handout) This is the easy homework. You only have half as much this week as you usually have, but it counts just as much.

Week Two: Sampling Distributions and Hypothesis Testing (This is a very important and abstract concept, and we lose one day to a holiday. If we need more time, we will extend the discussion into week three. It is important that we all understand this.)

**Monday:** Finishing the rest of Chapter 8. Poisson Distributions (not in text).

**Wednesday:** Testing a Sample Mean When \( \sigma \) is Known. Read 12.0 – 12.2

Homework #2a due: Let’s revisit question 5.17 (Homework 9 from first quarter). You’ve already calculated the average for each sample (\( \bar{X} \)) along with the variance for each sample using N-1 (which I am labeling \( \hat{\sigma}^2 \)). This means it is an estimate of the population variance and the variance for each sample using N (which I am labeling \( s^2 \)). Now there are a few parts to this exercise. Part 1) calculate the average of the of the \( \bar{X} \)’s which is labeled E(\( \bar{X} \)), in other words, it is the expected value of the averages, or if you will, the average of the averages. This is also called the expected value of the sampling distribution. You should have already done this last year. Part 2) Show that E(\( \bar{X} \)) = \( \mu \). In other words, calculate the population average and show that it equals what you got in Part 1. Part 3) Explain why Part 2 is important. Part 4) Calculate the standard deviation of the \( \bar{X} \)’s. This is called the standard error of the sampling distribution. It is labeled \( \sigma_{\bar{X}} \). Part 5) Show that \( \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{N}} \). In other words, calculate the population standard deviation and divide it by the square root of the sample size (not the population size). Show that this equals what you got in Part 4. Part 6) Explain why Part 5 is important. Note. We have only been using the \( \bar{X} \)’s, not \( \hat{\sigma}^2 \) or \( s^2 \). We have been demonstrating that the Central Limit Theorem is true. (For more on the central limit theorem, see page 225. We will be visiting it shortly.) Part 7) Last quarter you should have calculated the average of all the \( \hat{\sigma}^2 \)’s and the average of all the \( s^2 \)’s. Which
one of these two averages equals $\sigma^2$, the variance of the population? Only one should, and it should be exact. MAKE A COPY OF THIS HOMEWORK.

Homework #2b due: 8.2, 8.11, 8.14, 8.16, 8.18 (for 8.11, use your own words and improve upon the answer in the book, which only makes sense if you know what you’re talking about. Please supply an example.)

Friday: **FOURTH OF JULY! Go set off some (legal and safe) fireworks**

Week Three: Hypothesis Tests Applied to Means: One Sample

Monday: **TEST NUMBER TWO** Testing a Sample Mean When $\sigma$ is Unknown. Read 12.3 & 12.4

Wednesday: Finishing Monday’s Lecture. Confidence Limits. Read 12.5-12.9

Friday: **TEST NUMBER THREE**

Homework #3a due: Let’s look at Homework 3 again. If you understood it very well the first time, and your work is complete with in depth answers, simply write “I completely understood it the first time” on a new sheet of paper and turn it in attached to Homework 3 (or a copy of homework three). If you didn’t completely understand it, take a clean sheet of paper and fix up any holes you had the first time. This time around, your homework will be graded on quality because it is the second time through.

Homework #3b due: 12.2, 12.6, 12.10, 12.15, and 12.16


Monday: Related Samples. Read Chapter 13. If there is a lot of time left over, we will begin Chapter 14.

Wednesday: Independent Samples. Read Chapter 14.

Friday: **TEST NUMBER FOUR**

Homework #4a due: 13.2 (the answer to 13.1 is on page 479), 13.4, 13.6, 13.10, and 13.20

Homework #4b due: 14.2 (the answer to 14.1 is on page 480), 14.7, 14.8, 14.10, and 14.12.

Week Five: Some Non-parametric tests and Chi-square

Monday: Wilcoxon’s Matched-Pairs Signed Ranks Test & The Mann-Whitney Test. Read 20.0-20.2. The sign test (not in the text) will also be discussed. The Chi-Square Goodness-of-Fit Test (One Classification Variable). Read 19.0 & 19.1

The Chi-square test of Independence (Two Classification Variables – Contingency Table) Read 19.2 & 19.9

Wednesday: Chi-Square Miscellany and The Use of Chi-Square as a Test on Proportions. Read 19.3-19.8, 19.10 Using z-tests when variables have only two-categories


Homework #5b due: 19.3, 19.8, 19.10, 19.12, & 19.14

**TEST NUMBER FIVE**