Stat 202
Fall 2014
Final Exam Practice 1
12/11/14
Time Limit: 150 Minutes

Name (Print): _____

This exam contains 5 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may *not* use your books, or notes, or cell phone. A calculator is OK as long as it has no internet. You may use the browser on the lab computer (but not your computer) to access StatCrunch. No other computer use is allowed.

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided.
- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.
- If you need more space, use the back of the pages; clearly indicate when you have done this.
- Do not write in the table to the right.

Problem	Points	Score
1	15	
2	55	
3	10	
4	10	
5	10	
Total:	100	

1. (15 points) Note: for all problems on this exam, if StatCrunch asks for information I have not indicated, use the default value. Load the data "statcourse8," from the data page of my website under the section titled "Chapter 2." There are three columns to this dataset. We will work only with the first two—labeled "First" and "Second." Ignore the last column—labeled "Final".

   (a) (5 points) First assume that the "First" column refers to scores on the first midterm, the "Second" column refers to scores on the second midterm, and the rows correspond to 8 students randomly selected (as an SRS) out of 1432 students taking a basic statistics at a large university. The elements of each row correspond to scores from the *same* student on different exams. On which test (first or second) did the 8 students in the sample do better, on average? Is there evidence to support the claim that all 1432 students did better on that exam? To answer this question, construct an appropriate test and report the p-value.

   (b) (5 points) Now suppose there exist two sections of the statistics course, taught by different professors, each with 716 students. Use the same data, but this time, interpret the columns as exam scores for the "First" section of the class and the for "Second" section of the class. Now, unlike in part (a), we are talking about the *same exam*, but *different sections* and therefore *different students*. Now, do we have supporting evidence that one section did better than the second? To answer this question, construct an appropriate test and report the p-value.

   (c) (5 points) If two random samples, each an SRS, and each of size 8, are used to compare the means of two populations that, in actuality, have different means, explain why you may not find evidence to support the hypothesis that the means are different. Is something deficient in the design of the test and if so, what could you do to correct it?

2. (55 points) Consider the student population at a large university. Suppose in the fall of 2013, the average SAT score of the incoming freshman class was 530. Suppose you want to address the question of whether the average SAT score is going up, down, or staying the same, between freshmen in 2013, and current year's freshmen in 2014. To answer this question you plan to use a test of significance based on a random sample the SAT scores of 45 freshmen in 2014, as well as the known mean of the SAT scores across the whole freshman class in year 2013.

   (a) (5 points) What is the appropriate null hypothesis for your test?

   (b) (5 points) What is the appropriate alternative hypothesis?

   (c) (5 points) (i) What kind of test will you use? (ii) What name does the correct test statistic for this test have? (iii) If your null hypothesis is correct, what distribution (indicating the values of all of its parameters) will this test statistic have?

   (d) (5 points) Did you use a one-sided alternative or a two-sided alternative for your alternative hypothesis? Explain why your choice was the appropriate one.

(e) (5 points) Continuing with Question (2), suppose the mean SAT score for the 45-student 2014 freshman-class sample is 540 and the corresponding standard deviation is 80. What is the p-value for your test? Do you have evidence that the SAT score has changed at the 0.05 significance level?

Don't do this one

(f) (5 points) Let's say you use the traditional level of significance (0.05), and moreover that the true standard deviation of the SAT scores, for entire freshmen class in 2014, is, in fact, 80, by coincidence, same as measured in the sample. Then, according to StatCrunch (I didn't show you how to do this calculation), the power of the test (if it is framed correctly) to detect a true mean of 540 is 0.13. Now let's say you draw another random sample (SRS) of size 45 from the population. What is the probability that you will accept your null hypothesis using the same test but based on this second sample, assuming the mean SAT score, in reality, has not changed?

Or this one

(g) (5 points) Considering same the scenario considered in the part just above, what is the probability that you will accept your null hypothesis assuming that the true mean SAT score has, in fact, changed, and in 2014, is now 540? By this assumption, the first sample mean was, by coincidence, equal to this true mean.

(h) (5 points) Report a 99% confidence interval for the mean SAT score for the freshman class of 2014, based on the summary statistics for the first sample given above.

(i) (10 points) Based on this confidence interval (i) can we be confident (at the 99%-level) that the mean SAT score has not increased to 600? The answer to part (i) determines the result of a test of significance. (ii) What is the null hypothesis of this test? (iii) What is the alternative hypotheses of this test? (iv) What is the level of significance of this test? (v) Based on the same summary statistics for the first sample given above, will the null hypothesis be accepted or rejected?

(j) (5 points) If 200 samples (SRS) of size 45 are drawn from the 2014 freshman class, and for each we compute the corresponding 99% confidence interval for the mean SAT score, then how many of these intervals can we expect will contain the true mean SAT score for the entire freshman class. By "expect," we mean: on average, assuming the procedure (of drawing 200 samples and computing corresponding confidence intervals) is repeated many times.

3. (10 points) A woman claims she has extra-sensory perception and can predict (at a rate better than chance) the result of coin tosses before the coins are thrown. You do a little experiment to test her claim. You throw a coin ten times and she makes the right prediction 7 times.

   (a) (5 points) What procedure in StatCrunch will you use to test her claim? Report and justify your null hypothesis.

   (b) (5 points) Based on this procedure, do you consider 7 in 10 correct predictions significant evidence (using $\alpha = 0.05$) that she performs as she claims?

4. (10 points) Out of 154 students surveyed at a particular university, 85 report that they have dieted to lose weight in the past year. Report a 95% confidence interval for the proportion of students at that university who have dieted in the past year.

5. (10 points) You aim to investigate the question does left-handedness prefer a particular gender. You survey 95 men and 104 women. Of the men, 10 are left-handed, and of the women, 15 are left-handed. Design a test to assess the strength of the evidence relevant to your question. What is your null hypothesis? What p-value do you report?