Statistics 1001  
Fall 1997  
Geyer  
Final Exam  
December 10, 1997

The exam is closed book and closed notes. You may use a calculator and the two normal curve tables handed out in class. Put all of your work on this test form (use the back if necessary). Show your work or give an explanation of your answer. No credit for numbers with no indication of where they came from.

The points for the questions total to 200. There are 3 pages and 9 problems.

1. [25 pts.] A poll with a sample size of 1600 had 851 respondents (53.2%) say they intended to vote for candidate Jones. Perform a test of significance of whether Jones is really ahead as opposed to the hypothesis that the true population percentage favoring Jones is only 50% of the vote and the observed lead (53.2%) is “just chance variation.” Assume the poll used a simple random sample of the population.

Give the $P$-value for the test, and show all the steps in your calculation. Do a one-tailed test (even though a two-tailed test is more appropriate).

2. [25 pts.] In a randomized double-blind placebo-controlled trial of a new sleeping pill, the treatment group averaged 7.15 hours of sleep a night with an SD of 0.81 hours and the control group averaged 6.88 hours of sleep a night with an SD of 0.87 hours. There were 100 individuals in each group. Perform a test of significance of whether the treatment is really effective as opposed to the hypothesis that there is no treatment effect and the observed difference between the groups is “just chance variation.”

Give the $P$-value for the test, and show all the steps in your calculation. Do a one-tailed test.
3. [20 pts.] This problem involves almost no calculation. It tests whether you know what $P$-values mean and the relationship between one-tailed and two-tailed tests.

In two polls one month apart candidate Smith was favored by 38% in the first poll and 42% in the second poll. Both polls had sample sizes of 750. Assume both used simple random samples. A political scientist considering whether or not the 4% difference between the two polls was “just chance variation” did a one-tailed $z$-test, dividing the 4% difference by its standard error, call that $z$, and looking up the tail area under the normal curve past $z$ giving the $P$-value $P = 5.7\%$.

(a) Interpret this $P$-value. Does it say the difference is “just chance variation” or not? How strong is this conclusion?

(b) Suppose you think that the political scientist should have done a two-tailed test instead of a one-tailed test. What is the $P$-value for the two-tailed test?

If the sample sizes had been 1500 instead of 750 but the percentages for Smith remained the same, 38% and 42%, then the correct $P$-value for the one-tailed test would be $P = 1.3\%$.

(c) Redo part (a) for this $P$-value.

4. [20 pts.] The verbal SAT scores for last year’s college-bound seniors had average 505 and SD 110. The histogram followed the normal curve. What was the percentage of students that scored above 650 on the verbal SAT?

5. [20 pts.] A survey of men age 18–24 found the following summary statistics for height and weight

<table>
<thead>
<tr>
<th></th>
<th>average</th>
<th>SD</th>
<th>$r = 0.47$</th>
</tr>
</thead>
<tbody>
<tr>
<td>height</td>
<td>70 inches</td>
<td>3 inches</td>
<td></td>
</tr>
<tr>
<td>weight</td>
<td>162 pounds</td>
<td>30 lbs</td>
<td></td>
</tr>
</tbody>
</table>

The scatter plot was approximately football shaped. What is the regression prediction for the weight of a man whose height is 62 inches?
6. [20 pts.] Five dice are rolled.
   (a) What is the probability that they are all sixes?
   (b) What is the probability that they are all ones or twos?
   (c) What is the probability that there is at least one six?

7. [25 pts.] 100 draws with replacement are made from the box
   \[1\ 3\ 4\ 5\ 7\]
   (a) What is the expected value for the average of draws?
   (b) What is the standard error for the average of draws?
   (c) What is the chance that the average of draws is greater than 4.4?

8. [25 pts.] Twenty-five measurements of the mass of the electron had average 511.13 KeV (kilo electron volts) and SD 0.23 KeV.
   (a) Give a 95% confidence interval for the true mass of the electron calculated from these measurements.
   (b) What do you need to assume about these measurements in order for the confidence interval to be valid?

9. [20 pts.] A food scientist reported an experiment in which 10 different treatments (ways of preparing a food product) were compared with one control (the current method). For each treatment a random sample of consumers was selected to compare taste of that treatment and the control. A one-sample z-test was done for each of the 10 treatments using the null hypothesis that there was no difference between the treatment and control and hence 50% of the population would choose treatment and 50% the control.

   The report of the study said that two of the 10 treatments had a statistically significant taste improvement \((P < 5\%)\), that is, they were preferred by more than 50% and the difference from 50% was not just chance variation. The other eight treatments had no significant improvement.

   There are two things wrong with this report. What are they?