Midterm 3B–Stat 100–Spring 1997

You may use calculators, and ONE page of notes (writing allowed on both sides). Each problem is worth 20 points. Different parts of a problem have equal weight unless otherwise indicated. Do not spend too much time on any one problem. Put a box around the final answer to a question.

1. In a sample of 100 bottles of a new brand of beer, the mean alcohol content was 5.1% with standard deviation 0.5% . Does this data provide strong evidence that the average alcohol content for this brand is different from 5%? To this end,

a. Formulate the null and the alternative hypotheses.
b. Define the appropriate test statistic.
c. Give the form of the decision procedure at level of significance α.
d. Calculate the P-value for the sample mean found above and determine for which α the null hypothesis is retained.

2. Suppose we have the following random sample of 6 observations from a normal population:

16, 14, 12, 8, 10, 6

For this data, the sample mean is 11 and the sample standard deviation is $\sqrt{14} \approx 3.742$.

a. Give a point estimate and a 98%-confidence interval for the population standard deviation σ.
b. Do the above observations provide strong evidence that $\sigma \neq 3.5$? Test at $\alpha = 0.02$.

3. In a random sample of 100 New York residents, the average weekly salary is \$510 and the standard deviation is \$100. In a random sample of 200 Chicago residents, the average weekly salary is \$450 and the standard deviation is \$85. Let μ_N be the average weekly salary of New York residents and μ_C be the average weekly salary of Chicago residents.
Find a 90% confidence interval for $\mu_C - \mu_N$.

**********THERE ARE MORE PROBLEMS ON THE BACK SIDE**********

.

IN THE PROBLEMS BELOW:

If your answer involves a complicated formula, you need not take the time to evaluate it on your calculator; just write it out with the appropriate numbers inserted.

---

4. A farmer has paired 5 adjacent plots of land and is going to plant green beans. On the first plot, the farmer has used the fertilizer "Grow-ever." On the second plot, the farmer has used the fertilizer "Healthy-Soil." The number of gallons of green beans produced on each plot of land is given below.

	1	2	3	4	5
Grow-ever	50	58	60	65	42
Healthy-Soil	45	60	50	63	37

Test the claim that using the fertilizer "Grow-ever" results in a higher yield of green beans than using "Healthy-Soil." Use a 5% significance level. In your response,

a. Define the null and alternative hypotheses.
b. Define the test statistic and rejection region.
c. Determine the value of the test statistic.
d. Decide if the data support the claim that "Grow-ever" is better than "Healthy-Soil" for growing green beans.

5. At a certain factory, a time study of two assembly methods is conducted, in which nine workers use method 1 and eleven workers use method 2. The means and standard deviations of the assembly times are as follows:

	Method 1	Method 2
mean	77.0	85.1
standard deviation	4.1	9.2

a. (14 pts.) Compute a conservative 95% confidence interval for $\mu_1 - \mu_2$, the mean difference in assembly time for the two methods at the factory.
b. (3 pts.) In what way is a *conservative* 95% confidence interval for $\mu_1 - \mu_2$ different from a 95% confidence interval for $\mu_1 - \mu_2$?
c. (2 pts.) Briefly indicate any assumption you make to justify this procedure.
d. (3 pts.) Would you be justified in pooling to compute a 95% confidence interval? Briefly explain.