MATH 210 - Test #3 - 4/20/00

Be sure to interpret the meaning of confidence intervals and hypothesis tests in the context of the given problem. For hypothesis tests clearly state H_0 and H_A , your test statistic (z or t) and your P-value. Points in [brackets] total 100.

1. A machine is supposed to fill bags with a mean of 100 pounds of cement. As time goes by the mean may vary from the intended amount due to vibrations or other factors. Historical data show that the filling process has a standard deviation of one pound regardless of the mean. At the end of one hour's production you choose an SRS of 20 bags and compute the mean amount to be 101.5 pounds.

   a. Does this result provide evidence at the .01 level that the mean of the bagging process is no longer 100 pounds? (Conduct a formal hypothesis test!)

[12]

   b. What graphical check should be made of the data to justify the legitimacy of the above statistical test? (Explain what kind of plot you should make, what things should be observed, and why you are required to make these checks)

[3]

   c. Why might you choose a significance level of a=.01 in this context? (HINT: Think about what the quality control manager will do if they conclude H_A.)

[3]

2. You wish to know if taking Vitamin C supplements reduces the incidence of the common cold. You set up a randomized-comparative experiment with the control group receiving a daily placebo and the treatment group receiving a daily supplement of 1000 mg. Vitamin C. (Participants agree not to take any Vitamin C supplements unless given to them as part of the experiment.) After one year each participant reports the number of days that they had a cold throughout the year. The results are summarized below:

		n	$\bar{0}$	s
1.	Control	34	12.3	2.0
2.	Treatment	35	11.2	3.0

a. Conduct a formal hypothesis test to determine if the Vitamin C was effective in reducing colds. (Use a=.05)

[14]

b. Estimate (with 99% confidence) the difference in mean days with a cold for those taking 1000 mg. Vitamin C versus those taking no Vitamin C supplement.

[8]

c. After you conduct the analysis you make histograms of the data for each group. Group 1 has no outliers but is strongly skewed to the right. Group 2 is close to normal except for one very low outlier. Should you be concerned by either the outlier or the skewness? **Explain!**

[5]

3. You are the campaign manager for a political candidate. You wish to determine if watching a campaign video improves people's rating of your candidate. You choose a random sample of 10 registered votes and they agree to be in your experiment. First you have each person rate the candidate on a scale of 1 to 10 (10 indicates greatest approval). Immediately after showing the video you have them rate the candidate a second time. The results are as follows:

Person	Before	After
1	6	7
2	8	10
3	8	7
4	9	9
5	5	7
6	7	8
7	6	6
8	6	9
9	9	10
10	6	7

a. Describe how you would analyze this data to determine if watching the video improves viewers perception of the candidate. You do not need to do the calculations, just **describe** the procedure as follows. (*Use the empty space above, if needed.)*

[15]

- Describe **all the values that are computed from the above data**.
- Write the **form of the hypothesis test** you will you use (i.e., state the null and alternative hypotheses, both in words and in symbols).
- Write the **equation for the appropriate test statistic** (either a *t* or *z* score).

b. Would this type of experiment be effective in determining whether there is a long-term increase in the candidate's rating due to watching the video? (e.g., suppose the "after" ratings were done six month's after people saw the video, rather than right afterwards) **Explain your answer.**

[5]

4. You wish to estimate the percent of people in the U.S. who have a favorable view of Bill Gates

(Mr. Microsoft). You randomly choose 500 people in a nationwide poll. 242 of those surveyed say they have a favorable view.

a. Construct a *90% confidence interval* for the percent of the entire U.S. population that view Gates favorably.

[15]

b. Suppose you still want to have 90% confidence in your estimate but desire a margin of error of only 1%. How many people do you need to survey?

[5]

2. Short Answer

a. Suppose you conduct a hypothesis test using a=.05 and at the end of the test you conclude the alternative hypothesis is correct. How sure are you that you have reached the right conclusion? 5%, 10%, 95%, 100%. **Explain your answer!**

[5]

b. When attempting to assess a cause-and-effect relationship, a matched pairs experiment is considered to be more powerful than a randomized-comparative experiment. Explain what "more powerful" means *in the context of assessing causal relationships*.

[5]

c. Explain why requiring more confidence increases the margin of error associated with an estimate. **(Explain using everyday language rather than technical jargon.**)

[5]