MATH 210 - Test #3 - 4/18/02

All hypothesis tests must include the *null and alternative hypotheses*, the *test statistic* and the *P-value*. All hypothesis tests and confidence intervals must included a *fully written conclusion* in the context of the study. Points in [brackets] sum to 100.

1. A national test assessing the readiness of first-year students for college-level work (e.g., motivation, discipline, academic preparation) has scores that are normally distributed with a mean of 50 and standard deviation of 10. You believe that Manchester students are more prepared than students nationwide. You give the test to a random sample of 40 first-year students at Manchester and compute a mean score of 54. [For parts (a) and (b) assume that the standard deviation is the same for Manchester students as nationally.]

   a. Using $\alpha=.05$, conduct a *hypothesis test* to determine if Manchester students are in fact better prepared.

[10]

   b. Construct a *99% confidence interval* for the mean score for all Manchester first-years students.

[10]

   c. Suppose you didn't know the national standard deviation. Instead you computed the standard deviation form your 40 students to be 9.5. Using this information, recompute your answer to part (b).

[10]

   d. Suppose you did not know that this test followed a normal distribution. Does this invalidate any of your answers to parts (a)–(c)? **Explain (on the back) why or why not!**

[5]

2. You wish to determine if viewing the movie *Blackhawk Down* influences M.C. students' opinions on the U.S. military. You choose an SRS of 10 Manchester students who agree to be in your study. Immediately before showing the movie you distribute a survey which is scored on a 100-point scale (a higher number indicates greater support for the military). You show the movie and immediately after distribute the same survey. The results are below:

Student	Before	After
1	70	73
2	90	85
3	50	56
4	60	70
5	20	15
6	40	55
7	60	64
8	80	79
9	70	70
10	90	91

a. Using $\alpha=.10$, conduct the appropriate hypothesis test to determine if there is a statistically significant change due to viewing the movie. Note that the relevant standard deviation is $s= 6.321$.

[15]

b. Because this sample is fairly small you should graphically examine the data. What data should you examine, and what should you be looking for in the graph.

[5]

c. The above experiment assesses the *short-term effect* of viewing the movie. Suppose you wanted to determine the movie's long-term effect. You conduct the same experiment as described except the "after" survey is administered six months later. Would this experiment provide valid answers to your research question? **Explain why or why not.**

[5]

3. You wish to determine who has more free time — Manchester faculty or students (define "free time" to be hours in a day not spent working, studying or taking care of family). You choose an SRS of 20 faculty and 30 students and ask them how much free time they typically have per week. The results are as follows:

Group	Mean	Std. Dev
Faculty	87	10
Students	99	20

a. Does this data provide evidence (at the .05 level) that students have more free time than faculty? (Conduct a formal hypothesis test.)

[12]

b. Construct a *90% confidence interval* for the difference between the means of the two groups.

[12]

4. Miscellaneous

a. Concluding the alternative hypothesis when the null is actually true is called a: (circle *one*)

[3]

- sampling error
- Type I error
- Type II error
- significance error

b. In a randomized-comparative experiment the researcher is trying to show that some treatment has an effect on the subjects.

[5]

- In general terms describe what the following represent:

  H_0:

  H_A:

- In this context, what does it mean to say an experiment has more statistical "power?"

c. Suppose you were wanting to initiate a mandatory nationwide vaccination program (say for influenza). When conducting your experiment to determine the effectiveness of the vaccine, would you want to use a smaller significance level (α) or a larger one? **Explain your answer in full.**

[4]

d. TRUE or FALSE? When using the standard deviation from a sample (rather than from the entire population) the margin of error for estimating a mean is generally larger. **Explain your answer in detail.**

[4]