Statistics 515 - Fall 2002 - Exam 2 ***(slightly modified)***

Part I: Answer seven of the following eight questions. If you complete more than seven, I will grade only the first seven. Five points each.

1) Fifty-one percent of the U.S. population is female according to the census bureau. Use the central limit theorem to approximate the probability that 45 or fewer women would be found in a random sample of size 100.

2) Define what is meant by "α-level".

3) Define what is meant by "the p-value (or observed significance level) of a test".

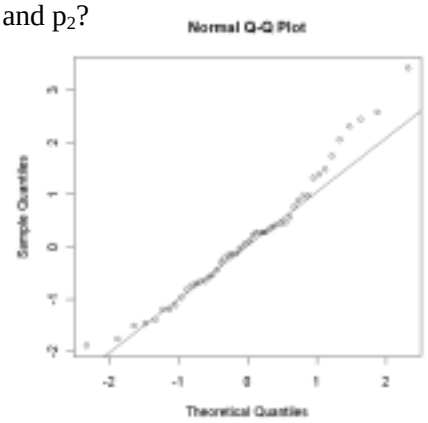
4) (Circle the correct answers) A $(1-\alpha)100\%$ confidence interval becomes **wider / narrower** if the sample size is increased, and **wider /narrower** if α increases.

5) A sample of size 20 results in $\bar{x} = 10.0$ and $s = 2.4$. Assume that the necessary assumptions are met and construct a 95% CI for σ^2.

6) Consider the formula for comparing two population proportions (or percentages). If we were using that to make a confidence interval for p_1-p_2, what do you put in the denominator instead of p_1 and p_2? If we are conducting a test of the null hypothesis that $p_1=p_2$, what do you put in the denominator instead of p_1 and p_2?

7) Consider the q-q plot shown to the right. For each of the following tests, indicate whether the result should be fairly trustworthy or not trustworthy.

	Trust	Don't Trust
t-test for testing a mean	_____	_____
χ^2 test for testing a variance	_____	_____
F test for testing 2 variances	_____	_____



8) The output at the bottom of the page was generated using PROC TTEST on SAS for random samples from two populations N and S. Both samples appeared to have been drawn from populations that were approximately normally distributed.

(Circle the correct answers) At α=0.10 we **accept/reject** the null hypothesis that $\sigma^2_N = \sigma^2_S$. At α=0.01 we **accept/reject** the null hypothesis that $\sigma^2_N = \sigma^2_S$.

The TTEST Procedure

T-Tests

Variable	Method	Variances	DF	t Value	Pr > |t|
value	Pooled	Equal	20	1.99	0.0604
value	Satterthwaite	Unequal	14.5	1.91	0.0763

Equality of Variances

Variable	Method	Num DF	Den DF	F Value	Pr > F
value	Folded F	9	11	2.57	0.1419

Part II: Answer every part of the next two problems. Read each problem carefully, and show your work for full credit. Twenty points each.

1) A manufacturer of alkaline batteries wants to be reasonably certain that fewer than 5% of its batteries are defective before each manufacturing run is shipped. To check this a random sample of 300 batteries will be selected from each manufacturing run and tested.

A) State the appropriate null and alternate hypotheses for testing if the broker will be able to ship the current manufacturing run of batteries. Be sure to identify what the parameter(s) you are using mean in terms of the problem (e.g. if you use $\mu, p, \sigma^2, s^2, \bar{x}, \hat{p}$ say what the symbol stands for.)

B) A sample of size 300 is acquired and 10 defective batteries are found in it. Test the hypothesis in A at an α=0.01 level and state whether the manufacturer should ship this manufacturing run or not.

C) Besides the sample being randomly chosen, what other assumption(s) are required to trust the test in part B? <u>If possible</u>, check that the assumption(s) hold.

2) A psychologist wishes to compare the spatial geometry ability of male and female college students. To do this a random sample of eighty men and eighty women are selected from students at USC and nagged until they consent to participate in the experiment. Each student is then given a score ranging from 0 to 100 (higher is more ability). The male subjects had an average score of 57.4, a standard deviation of 18.4 (variance=338.56), and seemed to be from a population that is approximately normally distributed. The female subjects had an average score of 44.5 a standard deviation of 8.7 (variance=75.69) and seemed to be from a population that was approximately normally distributed.

A) State the appropriate null and alternate hypothesis for determining whether there is a difference in the spatial geometry ability of male and female college students. Be sure to identify what the using mean in terms of the problem (e.g. if you use $\mu, p, \sigma^2, s^2, \bar{x}, \hat{p}$ say what the symbol stands for.)

B) Conduct the appropriate test of the hypothesis in part A, and report whether there is a significant difference in their spatial geometry ability at an α=0.10 level.

C) An alternative to conducting the test of hypotheses would be to construct a confidence interval for the difference of the average male and average female scores. Construct a 95% confidence interval for this difference. Does a positive difference mean that men are more able, or that women are more able?