

## Statistics 515 - Spring 2001 - Exam 2

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) Define what is meant by "significance level ( $\alpha$ ) of a test".
- 2) Define what is meant by "Type II error".
- 3) Define what is meant by "the p-value (or observed significance level) of a test".
- 4) (Circle the correct answers) A test results in a p-value of 0.034. For  $\alpha=0.05$  we **accept / reject**  $H_0$ . For  $\alpha=0.01$  we **accept / reject**  $H_0$ .
- 5) For testing  $H_0:\mu=0$  vs.  $H_A:\mu\neq 0$ , SAS returns a t-statistic of  $-1.5$  and a p-value of 0.086. What would the p-value be for testing  $H_A:\mu<0$ ?
- 6) (Circle the correct answers) If you increase the sample size, you will likely **increase / decrease** the width of a confidence level, and be **more / less** likely to reject a false  $H_0$  in a test of hypotheses.
- 7) It is desired to  $H_0:\sigma^2=1$  vs.  $H_A:\sigma^2>1$  using a chi-squared test. What would the rejection region be for a sample size of 10 and  $\alpha=0.10$ ?
- 8) The output at the bottom of the page was generated using PROC TTEST and PROC INSIGHT on SAS for random samples from two data sets N and S. In terms of  $\mu_N$ ,  $\mu_S$ ,  $\sigma^2_N$  and  $\sigma^2_S$ , what null and alternate hypotheses are being tested by the p-values labeled A and B?

A)  $H_0$ : \_\_\_\_\_  $H_A$ : \_\_\_\_\_

B)  $H_0$ : \_\_\_\_\_  $H_A$ : \_\_\_\_\_

The TTEST Procedure						
T-Tests						
Variable	Method	Variances	DF	t Value	Pr >  t	
value	Pooled	Equal	20	1.55	<b>0.1364</b>	◀ A
value	Satterthwaite	Unequal	19.8	1.56	0.1336	
Equality of Variances						
Variable	Method	Num DF	Den DF	F Value	Pr > F	
value	Folded F	11	9	1.18	<b>0.8148</b>	◀ B

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. Suppose 300 batteries are randomly selected from a very large shipment; each is tested and 10 defective batteries are found.

- A) State the appropriate null and alternate hypotheses to test if fewer than 5% of the batteries are defective.
- B) Demonstrate that the sample size of 300 is large enough to conduct the test in A (do not conduct the test).
- C) Instead of performing a test, it may also be desirable simply to form a confidence interval for the actual percent of defective batteries. Construct such a 95% confidence interval.

2) The EPA is testing whether a manufacturing plant pollutes the nearby river. To test this they gather six samples of water upstream from (before) the plant and six samples of water downstream from (right after) the plant. They then measure the amount of pollutant in the water samples.

- A) State the appropriate null and alternate hypothesis for determining whether the EPA has significant evidence that the plant is polluting the river.
- B) What assumptions must be true in order to test this hypothesis?
- C) Assume that the assumptions in part B are met, that the observations from upstream had a mean of 29.6167 and a standard deviation of 0.961, and the values downstream had a mean of 32.1000 and a standard deviation of 1.302. Test the hypothesis in A at an  $\alpha=0.05$  level.