Name Key
(Please ALSO write your name on the back of the last page.)

Ag 400 - Quiz 2
Fall 2008

(16) A. Suppose that Math Aptitude Tests for 8th grade students are known to be Normally distributed in the US population with a mean of 60 and a standard deviation of 8. Answer the following in terms of these data.

1. What proportion of the population of 8th grade students in the US have Math Aptitude Scores of 72 or more?

$Z = \frac{72-60}{8} = 1.50$

$p = .5 - .4332 = .0668$

2. What is the probability of selecting a random sample of 25 8th grade students in the US and obtaining a sample with a mean Math Aptitude Test score of between 62 and 64?

$Z = \frac{62-60}{8/\sqrt{25}} = 1.25$

$Z = \frac{64-60}{8/\sqrt{25}} = 2.50$ $\quad p = .4938 - .3944 = .0994$

3. In a random sample of 64 eighth grade students, how many students would you expect to have Math Aptitude Test scores of 58 or more?

$Z = \frac{58-60}{8} = -.25$ $\quad p = .5 + .0987 = .5987$

$(.5987)(64) = 38.32$

4. What is the probability of selecting an 8th grade student at random from the population and obtaining an individual with a Math Aptitude Score of between 50 and 80?

$Z = \frac{50-60}{8} = -1.25$

$p = .3944 + .4938 =$

$Z = \frac{80-60}{8} = 2.50$

$.8882$

B. Data were compiled on the number of boys who were dues paying members last year and this year in each of eleven Boy Scout troops selected at random from all Boy Scout troops in County A. The following statistics were obtained:

	Troop	Last Year	This Year	D
		-----number of members-----		
	1	15	17	+2
	2	10	18	+8
	3	18	17	-1
	4	20	21	+1
	5	12	12	0
	6	16	20	+4
	7	14	16	+2
	8	19	22	+3
	9	11	13	+2
	10	15	14	-1
	11	15	17	+2
				$22 = \Sigma D$
Mean number of members per troop		15.0	17.0	
Total members		165	187	
Sum of the squares of the members in the troops		2577	3281	
Sum of the squares of the deviations about the mean		102	102	

$\bar{D} = \frac{22}{11} = 2.0$

$\Sigma d^2 = 108 - \frac{(22)^2}{11} = 64$

(22) 1. Based on the above data what can you conclude about the differences between last year and this year in regard to the number of Boy Scout members in a troop. Use the .05 level and a two-tailed test in making your conclusion. Specify the following:

a. State the Null Hypothesis and the Alternative Hypothesis.

$H_0: \mu_{Last\ Year} = \mu_{This\ Year}$

$H_A: \mu_{Last\ Year} \neq \mu_{This\ Year}$

b. Show the necessary calculations.

$$t = \frac{\bar{D}}{\sqrt{\frac{\Sigma d^2}{N(N-1)}}} = \frac{2}{\sqrt{\frac{64}{(11)(10)}}} = 2.62$$

c. Specify degrees of freedom, if appropriate.

10

d. State the critical value of the test statistic.

2.228

e. Reject or do not reject the Null Hypotheses.

Reject H_0

f. What is the probability that you have made a Type I error in (e) above?

$.02 < \alpha < .05$

g. What is the probability that you have made a Type II error in (e) above?

$\beta = 0$

h. State your conclusion precisely in terms of the problem.

There is a difference in the number of troop members between last year and this year. There are more members this year than last year.

(16) 2. Indicate whether each of the following statements is true (T) or false (F) in terms of these data. If any part of a statement is untrue, it should be marked false (F). Add comments if you wish to clarify your answers.

F a. The statistical unit is a Boy Scout member.

F b. Because the number of members per troop in the sample data is larger this year than last year, a one-tailed test would be appropriate here.

T c. In the above analysis, the independent variable is measured by a two category nominal scale (last year/this year); the dependent variable, number of troop members, is measured by an interval scale.

T d. The figure calculated in (B1b) above is an inferential statistic.

F e. In any test of significance, you will either make a Type I or a Type II error.

T f. If a two-tailed test for this difference between two sample means is statistically significant at the .05 level, a one tailed test of the same difference using the same data would also be statistically significant at the .05 level.

T g. If you reject the Null Hypothesis and it (The Null Hypothesis) is false, $\alpha = 0.00$, $\beta = 0.00$.

T h. A Null Hypothesis is <u>always</u> stated in terms of parameters.

(14) C. Suppose that the regional Boy Scout Council has taken the position this year that in order to sustain a viable program Boy Scout troops should average at least 18 members. Does the information given in Section B above concerning the numbers of members in the sampled troops this year violate this standard? Use the .05 level and a one-tailed test to address this question.

a. State the Null Hypothesis and the Alternative Hypothesis.

$H_0: \mu \geq 18$

$H_A: \mu < 18$

b. Show your calculations.

$$t = \frac{17-18}{\sqrt{\frac{10.2}{11}}} = -1.04$$

c. Report degrees of freedom, if appropriate.

10

d. State your conclusion precisely in terms of the problem.

Do Not Reject H_0

We cannot conc. that the average troop size does not reach the Council's "standards"

(32) D. A random sample of Penn State undergraduate students was surveyed to determine their feelings on anxiety concerning their ability to maintain what they consider is a "good" grade point average. The data from the 610 students surveyed are included in an SPSS file called ANXIEY.sav. The following variables are used in the analysis of these data on the attached output.

SEX
1 = Males
2 = Females

SCORE
Anxiety Score. This score measures the level of anxiety expressed by each student. The higher the score, the more "anxious" is the student.

Indicate whether each of the following statements is true (T) or false (F) in terms of this output. If any part of a statement is untrue, it should be marked false. Add comments if you wish to clarify your answers.

T 1. The total data file has 610 rows and at least two columns.

T 2. In the sample, females are more anxious than are males, and this difference is statistically significant using a two-tailed test and the .05 level to determine significance.

F 3. Based on this analysis, you would reject the following Null Hypothesis at the .01 significance level.

$$H_o: \mu_{Males} = \mu_{Females}$$

when μ = the mean anxiety score for each of the populations.

T 4. Male's anxiety scores are more dispersed than are female's scores but this difference is not statistically significant at the .05 level.

F 5. Based on this analysis, you should conclude that the homogeneity of variance assumption is not valid and that the variances are not significantly homogeneous.

F 6. The t-value on this output is used to test the following Null Hypothesis

H_o: In the population, there is no relationship between males and females in regard to anxiety scores.

T 7. If, based on this analysis, you conclude that males and females differ in anxiety scores, you cannot have made a Type II error.

F 8. If, based on this analysis, you conclude that males and females do not differ in anxiety scores, you have made a Type II error.

F 9. The Null Hypothesis for the "t-test" reported on this output can (correctly) be stated as follows:

H_o: the mean anxiety score for males in the sample does not differ significantly from the mean anxiety score for females in the sample.

T 10. The standard error of the mean for both males and females in this analysis is less than the corresponding standard deviation. The standard error of the mean is never larger than the corresponding standard deviations.

F 11. The "Std Deviations" reported the output are estimates of the population standard deviations $(\hat{\sigma})$ and hence are parameters.

T 12. Suppose that previous research and theory suggests that females generally have higher anxiety levels than do males and that you believe that a one-tailed test is justified. Based on this analysis, you could reject the following Null Hypothesis in favor of the following Alternative Hypothesis at the .01 significance level (α = .0095).

H_o: $\mu_{Males} = \mu_{Females}$

H_A: $\mu_{Males} < \mu_{Females}$

T 13. Based on this analysis, your best point estimate of the difference between male and female mean anxiety scores in the population is 2.16 points, with females scoring higher than males.

T 14. The figures reported in the table labeled "Group Statistics" are Descriptive Statistics. In the table labeled "Independent Samples Test" "t," "sig," and the information on Confidence Intervals are "Inferential Statistics."

F 15. The 95% confidence interval estimating the mean anxiety score for males in the population equals

$$51.40 \pm (2.355)\frac{11.853}{\sqrt{256}}$$

F 16. The t-test on this output is called a "One Sample Test" since both males and females are part of the same sample.

T-Test

Group Statistics

	SEX	N	Mean	Std. Deviation	Std. Error Mean
SCORE	1 Males	256	51.40	11.853	.741
	2 Females	344	53.56	10.538	.568

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SCORE	Equal variances assumed	1.694	.194	-2.355	598	.019	-2.16	.918	-3.964	-.359
	Equal variances not assumed			-2.315	511.605	.021	-2.16	.934	-3.996	-.327