

**A.P. Statistics**  
**Assignment 8.2**

**Remember to show your thinking through your work.**

- 1) In what ways is the significance test with  $t$  different from the significance test with  $z$ ?

- 2) What does a  $p$ -value represent?

- 3) The one-sample  $t$  statistic for a test of

$$H_0: \mu = 20$$

$$H_a: \mu < 20$$

based on  $n = 12$  observations has the value  $t = -2.45$ .

- (a) What are the degrees of freedom for this statistic?

- (b) What is the exact  $p$ -value?

- 4) Poisoning by the pesticide DDT causes tremors and convulsions. In a study of DDT poisoning, researchers fed several rats a measured amount of DDT. They then measured electrical characteristics of the rats' nervous systems that might explain how DDT poisoning causes tremors. One important variable was the "absolutely refractory period," the time required for a nerve to recover after a stimulus. This period varies normally. Measurements on four rats gave the data below (in milliseconds).

1.6    1.7    1.8    1.9

- (a) Find the mean refractory period  $\bar{x}$  and the standard error of the mean.

- (b) Give a 90% confidence interval for the mean "absolutely refractory period" for all rats of this strain when subjected to the same treatment.

- (c) Suppose that the mean "absolutely refractory period" for un-poisoned rats is known to be 1.3 milliseconds. DDT poisoning should slow nerve recovery and

so increase this period. Do the data in the previous exercise give good evidence for this supposition? State  $H_0$  and  $H_a$  and do a t-test. What do you conclude from the test?

- 5) The amount of lead in a certain type of soil, when released by a standard extraction method, averages 86 parts per million (ppm). A new extraction method is tried on 40 specimens of the soil, yielding a mean of 83 ppm lead and a standard deviation of 10 ppm.

- (a) Is there significant evidence at the 5% level that the new method frees less lead from the soil? What about the 1% level?

- (b) A critic argues that because of variations in the soil, the effectiveness of the new method is confounded with characteristics of the particular soil specimens used. Briefly describe a better data production design that avoids this criticism.

- 6) The Acculturation Rating Scale for Mexican Americans (ARSMA) is a test that measures the extent to which Mexican Americans have adopted Anglo/English culture. A similar test, the Bicultural Inventory (BI), attempts to do the same thing. To compare the tests, researchers administer both tests to 22 Mexican-Americans. Both tests have the same range of scores (1.00 to 5.00) and are scaled to have similar means for the groups used to develop them. There was a high correlation between the two scores, giving evidence that both are measuring the same characteristics. The researchers wanted to know whether the population mean scores for the two tests were the same. The differences in scores ( $ARSMA - BI$ ) for the 22 subjects had  $\bar{x} = 0.2519$  and  $s = 0.2767$ .

- (a) Describe briefly how the administration of the two tests to the subjects should be conducted, including randomization.

- (b) Carry out a significance test for the hypothesis that the two tests have the same population mean. Give the P-value and state your conclusion.

- (c) Give a 95% confidence interval for the difference between the two population mean scores.