**AP Statistics** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chapters 11-12 Quiz Review** Hour: \_\_\_\_\_\_

1. The one sample *t* statistic from a sample of *n* = 19 observations for the two-sided test of *H*0: *µ* = 6, *H*a: *µ* ≠ 6 has the value *t* = 1.93. Based on this information, which of the following would be true?

(A) We would reject the null hypothesis at *α* = 0.10.

(B) 0.025 < *p*-value < 0.05.

(C) We would reject the null hypothesis at *α* = 0.05.

(D) Both (B) and (C) are correct.

(E) We would not reject the null hypothesis in a two-sided test, but would reject it in a one-sided test at ** =

 0.10.

2. When performing a significance test for a null hypothesis,, against the alternative hypothesis,, the *p-*value is...

(A) the probability that  is true.

(B) the probability that  is true.

(C) the probability that  is false.

(D) the probability of observing a value of a test statistic at least as extreme as that observed in the sample if  is true.

(E) the probability of observing a value of a test statistic at least as extreme as that observed in the sample if  is true.

3. The mayor of a large city will run for governor if he believes that more than 30 percent of the voters in the state already support him. He will have a survey firm ask a random sample of *n* voters whether or not they support him. He will use a large sample test for proportions to test the null hypothesis that the proportion of all voters who support him is 30 percent or less against the alternative that the percentage is higher than 30 percent. Suppose that 35 percent of all voters in the state actually support him. In which of the following situations would the power for this test be highest?

(A) The mayor uses a significance level of 0.01 and *n* = 250 voters.

(B) The mayor uses a significance level of 0.01 and *n* = 500 voters.

(C) The mayor uses a significance level of 0.01 and *n* = 1,000 voters.

(D) The mayor uses a significance level of 0.05 and *n* = 500 voters.

(E) The mayor uses a significance level of 0.05 and *n* = 1,000 voters.

4. In a test of  versus , a sample of size 220 leads to a *p*-value of 0.034. Which of the following must be true?

(A) A 95% confidence interval for *μ* calculated from these data will not include.

(B) At the 5% level if is rejected, the probability of a Type II error is 0.034.

(C) The 95% confidence interval for *μ* calculated from these data will be centered at = 8.

(D) The null hypothesis should not be rejected at the 5% level.

(E) The sample size is insufficient to draw a conclusion with 95% confidence.

5. A significance test was performed to test the null hypothesis versus the alternative . The test statistic is *z* = 1.40. The *p*-value for this test is approximately…

(A) 0.16 (B) 0.08 (C) 0.003 (D) 0.92 (E) 0.70

6.

7. DDT is an insecticide that accumulates up the food chain. Predator birds can be contaminated with quite high levels of the chemical by eating many lightly contaminated prey. One effect of DDT upon birds is to inhibit the production of the enzyme carbonic anhydrase, which controls calcium metabolism. It is believed that this causes eggshells to be thinner and weaker than normal and makes the eggs more prone to breakage. (This is one of the reasons why the condor in California is near extinction.) An experiment was conducted where 16 sparrow hawks were fed a mixture of 3 ppm dieldrin and 15 ppm DDT (a combination often found in contaminated prey). The first egg laid by each bird was measured, and the mean shell thickness was found to be 0.19 mm. A "normal" eggshell has a mean thickness of 0.2 mm. The null and alternative hypotheses are

(A)  (B) 

(C)  (D) 

 (E) 

8. In a test of  against , a sample of size 80 produces *z* = 0.8 for the value of the test statistic. The *p*-value of the test is thus equal to…

(A) 0.20 (B) 0.40 (C) 0.29 (D) 0.42 (E) 0.21

9. In a test of against , a sample of size 10 produces a sample mean of 103 and a *p*-value of 0.08. Thus, at the 0.05 level of significance...

(A) there is sufficient evidence to conclude that .

(B) there is sufficient evidence to conclude that .

(C) there is insufficient evidence to conclude that .

(D) there is insufficient evidence to conclude that .

(E) there is sufficient evidence to conclude that .

10. A significance test allows you to reject a hypothesis in favor of an alternative  at the 5% level of significance. What can you say about significance at the 1% level?

(A) The  is rejected at the 1% level of significance.

(B) There is insufficient evidence to reject  at the 1% level of significance.

(C) There is sufficient evidence to accept  at the 1% level of significance.

(D) The  is rejected at the 1% level of significance.

(E) The answer can't be determined from the information given.

11. What is a *p*-value?

12. (a) If the *p*-value of a test is less than , you… (b) If the *p*-value of a test is greater than , you…

13. (a) What is a Type I error? (b) What is a Type II error?

14. (a) What is power? (b) How do you increase the power of a test?

15. A consumer organization was concerned that an automobile manufacturer was misleading customers by overstating the average fuel efficiency (measured in miles per gallon, or mpg) of a particular car model. The model was advertised to get 27 mpg. To investigate, researchers selected a random sample of 10 cars of that model. Each car was then randomly assigned a different driver. Each car was driven for 5,000 miles, and the total fuel consumption was used to compute mpg for that car.

(a) Define the parameter of interest and state the null and alternative hypotheses the consumer organization is interested in testing.

One condition for conducting a one-sample *t*-test in this situation is that the mpg measurements for the population of cars of this model should be normally distributed. However, the boxplot and histogram shown below indicate that the distribution of the 10 sample values is skewed to the right.



(b) One possible statistic that measures skewness is the ratio . What values of that statistic (small, large, close to one) might indicate that the population distribution of mpg values is skewed to the right? Explain.

(c) Even though the mpg values in the sample were skewed to the right, it is still possible that the population distribution of mpg values is normally distributed and that the skewness was due to sampling variability. To investigate, 100 samples, each of size 10, were taken from a normal distribution with the same mean and standard deviation as the original sample. For each of those 100 samples, the statistic  was calculated. A dotplot of the 100 simulated statistics is shown on the next page.



In the original sample, the value of the statistic  was 1.03. Based on the value of 1.03 and the dotplot above, is it plausible that the original sample of 10 cars came from a normal population, or do the simulated results suggest the original population is really skewed to the right? Explain.

(d) The table below shows summary statistics for mpg measurements for the original sample of 10 cars.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Minimum | Q1 | Median | Q3 | Maximum |
| 23 | 24 | 25.5 | 28 | 32 |

Choosing only from the summary statistics in the table, define a formula for a different statistic that measures skewness.

What values of that statistic might indicate that the distribution is skewed to the right? Explain.

16. The developers of a training program designed to improve manual dexterity claim that people who complete the 6-week program will increase their manual dexterity. A random sample of 12 people enrolled in the training program was selected. A measure of each person's dexterity on a scale from 1 (lowest) to 9 (highest) was recorded just before the start of and just after the completion of the 6-week program. The data are shown in the table below.

|  |  |  |
| --- | --- | --- |
| **Person** | **Before Program** | **After Program** |
| A | 6.7 | 7.8 |
| B | 5.4 | 5.9 |
| C | 7.0 | 7.6 |
| D | 6.6 | 6.6 |
| E | 6.9 | 7.6 |
| F | 7.2 | 7.7 |
| G | 5.5 | 6.0 |
| H | 7.1 | 7.0 |
| I | 7.9 | 7.8 |
| J | 5.9 | 6.4 |
| K | 8.4 | 8.7 |
| L | 6.5 | 6.5 |
| **Total** | **81.1** | **85.6** |

Can one conclude that the mean manual dexterity for people who have completed the 6-week training program has significantly increased? Give appropriate statistical evidence to support your response.

17. A recent report stated that less than 35 percent of the adult residents in a certain city will be able to pass a physical fitness test. Consequently, the city’s Recreation Department is trying to convince the City Council to fund more physical fitness programs. The council is facing budget constraints and is skeptical of the report. The council will fund more physical fitness programs only if the Recreation Department can provide convincing evidence that the report is true.

The Recreation Department plans to collect data from a sample of 185 adult residents in the city. A test of significance will be conducted for the following hypotheses.

H0: *p* = 0.35

 Ha: *p* < 0.35,

where *p* is the proportion of adult residents in the city who are able to pass the physical fitness test.

(a) Describe what a Type II error would be in the context of the study, and also describe a consequence of making this type of error.

(b) The Recreation Department recruits 185 adult residents who volunteer to take the physical fitness test. The test is passed by 77 of the 185 volunteers, resulting in a *p*-value of 0.97 for the hypotheses stated above. Interpret what this *p*-value measures in the context of this study.

(c) If it was reasonable to conduct a test of significance for the hypotheses stated above using the data collected from the 185 volunteers, what would the *p*-value of 0.97 lead you to conclude?

(d) Describe the primary flaw in the study described in part (b), and explain why it is a concern.