KEY #14 – Power 2019 VERSION

AP Stats Chapter 9 Practice ~~MC~~ MC+FRQ Test

MULTIPLE-CHOICE QUESTIONS

1. A psychologist reports that the result of a hypothesis test was statistically significant at the 0.05 level. Which of the following is consistent with this statement?
   (A) The *P*-value calculated was smaller than the significance level of 0.05.
   (B) The *P*-value calculated was larger than the significance level of 0.05.
   (C) The significance level calculated was larger than 0.05.
   (D) The significance level calculated was smaller than 0.05.
   (E) There was not enough information to make a decision.

2. A concrete learner is a student who learns best when various types of hands-on or manipulative activities are used to illustrate abstract concepts. Researchers have long believed that 60% of all students remain concrete learners until they are between 16 and 21 years of age. Each student in a random sample of 32 students age 17 to 19 was evaluated, and it was found that 24 of the 32 were concrete learners. Would it be appropriate to use the *z* test for a population proportion to test to determine if the proportion of concrete learners in this age group is less than 0.60?
   (A) Yes. Since $32(0.6) = 19.2$ and $32(1 - 0.6) = 12.8$, and we can proceed with the test.
   (B) Yes. Since 32 is larger than 30, the sample is sufficiently large and we can proceed with the test.
   (C) Yes. Since we know from the sample was a random sample, we can proceed with the test.
   (D) No. Since $32(0.05) = 1.6$, we do not have a large enough sample to proceed with test.
   (E) No. While 32 is larger than 30, it is so close to 30 and we don't know if the population distribution is normal.

3. A Type I error occurs in which of the following situations?
   (A) H_a is rejected and the null hypotheses is true.
   (B) H_0 is not rejected and the null hypotheses is false.
   (C) H_0 is rejected and the null hypotheses is true.
   (D) The *P*-value is too small to reject the null hypothesis.
   (E) The α level is too small and so the null hypothesis is rejected.

BY DEFINITION

4. A Type II error occurs in which of the following situations?
   (A) H_0 is rejected and the null hypotheses is true.
   (B) H_0 is not rejected and the null hypotheses is false.
   (C) H_a is not rejected and the null hypotheses is false.
   (D) The *P*-value is too small to reject the null hypothesis.
   (E) The α level is too large and so the null hypothesis is rejected.

5. A graduate student at a private university wanted to study the amount of money that students at his university carried with them. A recent study reported that the average amount of money carried by college students is \$31. He decides to collect data and carry out a test to see if there is evidence that the average is higher for students at his university. Which of the following describes a Type II error in this context?
   (A) This would lead to the incorrect idea that students at his university, on average, spend more money each month than students at other universities.
   (B) This would lead to the incorrect idea that students at his university carry, on average, more than \$31.
   (C) This would lead to the incorrect idea that students at his university carry, on average, less than \$31.
   (D) This would lead to the incorrect idea that there was no reason to believe that students at his university carry, on average, more than \$31.
   (E) This would lead to the correct idea that students at other campuses carry, on average, less than \$31.

6. An animal rights group has been very supportive of a new silicon product that caps the nails on cats as an alternative to surgically declawing the pets. The company who makes the caps claims they last for an average of 69 days before needing to be replaced. Before publically endorsing the product, the animal rights group plans to collect data to see if there is convincing evidence that the mean time before replacement is needed is actually less than what the company claims. Which of the following would be an appropriate pair of hypotheses for the animal rights group to test?
   (A) $H_0: \mu = 69$ days, $H_a: \mu > 69$ days
   (B) $H_0: \mu = 69$ days, $H_a: \mu < 69$ days
   (C) $H_0: \mu = 69$ days, $H_a: \mu \neq 69$ days
   (D) $H_0: \bar{x} = 69$ days, $H_a: \bar{x} > 69$ days
   (E) $H_0: \bar{x} = 69$ days, $H_a: \bar{x} < 69$ days

7. Neutering dogs is a common surgical practice. The mean time to recover from the general anesthetic used is 28 hours. A veterinarian believes that since changing to a new anesthetic, the mean recovery time is shorter than before. To investigate, she selects a random sample of 40 surgeries done with the new anesthetic and finds that the mean recovery time was 25 hours and the standard deviation was 2.5. She plans to use this sample data to test to see if there is evidence that the recovery time is shorter with the new anesthetic. Which of the following is the correct test statistic for this study?

(A) $z = \dfrac{25-28}{2.5}$, with $df = 39$

(B) $t = \dfrac{25-28}{\frac{2.5}{\sqrt{39}}}$, with $df = 39$

(C) $t = \dfrac{25-28}{\frac{2.5}{\sqrt{40}}}$, with $df = 39$ ← σ UNKNOWN → t-test

(D) $t = \dfrac{25-28}{\frac{2.5}{\sqrt{40}}}$, with $df = 40$

(E) $t = \dfrac{25-28}{\frac{2.5}{\sqrt{39}}}$, with $df = 40$

8. A recently published study reported that 63% of the nation's students have some type of structured homework study time. A school surveyed each student in a random sample of 83 students who attend the school and found that only 52% reported having a structured homework time. This data was used to carry out a hypothesis test to determine if there was evidence that the proportion of students at the school who had structured homework time was less that the proportion reported in the national study. Which of the following would be the test statistic for this test?

(A) $z = \dfrac{0.52 - 0.63}{\sqrt{\dfrac{0.52(0.48)}{83}}}$

(B) $z = \dfrac{0.52 - 0.63}{\sqrt{\dfrac{0.52(0.48)}{82}}}$ P → Ztest!

(C) $z = \dfrac{0.52 - 0.50}{\sqrt{\dfrac{0.52(0.48)}{83}}}$

(D) $z = \dfrac{0.52 - 0.63}{\sqrt{\dfrac{0.63(0.37)}{83}}}$

(E) $z = \dfrac{0.52 - 0.63}{\sqrt{\dfrac{0.63(0.37)}{82}}}$

9. Bicycles purchased from a discount store come unassembled. The assembly instructions that come with the bicycle claim that the average assembly time is 30 minutes. A consumer group has received complaints from people who say that the assembly time was greater than the time claims. They decide to purchase 40 of these bikes and have asked 40 different people to assemble them. The consumer group believed that it was reasonable to regard these 40 people as representative of the population of people who might purchase this bike. For this sample, they found that the assembly times had a mean of 34.2 minutes and a standard deviation of 8.6 minutes. Is there convincing evidence that the claimed average assembly time is too low at the 0.05 significance level?

(A) No, $z = 0.49$ P-value = 0.312.
(B) Yes, $t = 3.09$, df = 39, P-value = 0.002.
(C) Yes, $t = 3.05$, df = 39, P-value = 0.004.
(D) No, $t = 0.49$, df = 39, P-value = 0.313.
(E) Yes, $t = 3.05$, df 40, P-value = 0.002.

10. The prom committee is thinking about changing the location of the prom. The new location is more expensive to rent, and for the increased cost to be reasonable, they would want to be fairly certain that more than 46% of the senior class would attend the prom. A survey of a random sample of 52 seniors found that 25 would attend if the site changed. Which of the following pairs of hypotheses should the prom committee test?
(A) $H_o: \mu = 46\%$, $H_a: \mu > 46\%$
(B) $H_o: \mu = 46\%$, $H_a: \mu \neq 48\%$
(C) $H_o: p = 0.46$, $H_a: p > 0.46$
(D) $H_o: p = 0.46$, $H_a: p \neq 0.46$
(E) $H_o: p = 0.46$, $H_a: p < 0.46$

11. Which of the following is closest to the *P*-value associated with a two-tailed *t* test with 20 degrees of freedom if the value of the test statistic is 2.0?
(A) 0.001
(B) 0.01
(C) 0.03
(D) 0.05
(E) 0.10

12. Which of the following statements are true?
I. The null hypothesis for test about a population proportion written as $H_0: \hat{p}$ = hypothesized value.
II. For the z test to be an appropriate test for a population proportion, the following condition must be met: $np \geq 10$ and $n(1-p) \geq 10$.
III. The standard deviation of the statistic $\hat{p}$ is $\sigma_{\hat{p}} = \sqrt{np(1-p)}$.
(A) I only
(B) II only
(C) III only
(D) II and III
(E) I, II, and III

Normal condition for p

13. A local group claims that more than 60% of the teens driving after 10 p.m. are exceeding the speed limit. They plan to collect data in hopes that a hypothesis test will provide convincing evidence in support of their claim. Which of the following is true about the hypotheses the group should test?
(A) The null hypothesis states that less than 60% of the teens are exceeding the speed limit.
(B) The null hypothesis states that more than 60% of the teens are exceeding the speed limit.
(C) The alternative hypothesis states that less than 60% of the teens are exceeding the speed limit.
(D) The alternative hypothesis states that less than or equal to 60% of the teens are exceeding the speed limit.
(E) The alternative hypothesis states that more than 60% of the teens are exceeding the speed limit.

14. A study by a geological research team found that a new piece of equipment designed to measure the forces of an earthquake is not effective. They based this conclusion on data from a sample of 40 pieces of equipment and they carried out a test with $\alpha = 0.05$. The manufacturer of the equipment claims this study was flawed and that their equipment is good. The research team is considering carrying out a second study with the intention of increasing the power of the test. Which of the following would ensure an increase in the power of the test?
    (A) Move the equipment to three randomly chosen new locations.
    (B) Change $\alpha = 0.05$ to $\alpha = 0.02$.
    (C) Carry out a two-sided test instead of a one-sided test.
    (D) Increase the sample size to 60 pieces of equipment being tested.
    (E) Decrease the sample size to 20 pieces of equipment being tested.

15. Suppose that the mean height of women in the United States is 64.5 in. with a standard deviation of 2.5 in. A clothing designer feels that women who use her products may actually be taller on average. She selects a random sample of 70 women from all women who have previously purchased her clothing. What is the population of interest, and what test would the designer use to test her claim?
    (A) The population is all women in the United States and the appropriate test is a t test with df = 70.
    (B) The population is all women in the United States and the appropriate test is a z test with = 2.5.
    (C) The population is all women who have previously purchased the designer's clothing and the appropriate test is a t test with df = 70.
    (D) The population is all women who have previously purchased the designer's clothing and the appropriate test is a t test with df = 69.
    (E) The population is all women who have previously purchased the designer's clothing and the appropriate test is a z test with = 2.5.

Review Section 9.3

"FRAPPY"

The following problem is taken from an actual Advanced Placement Statistics Examination. Your task is to generate a complete, concise statistical response in 15 minutes. You will be graded based on the AP rubric and will earn a score of 0-4. After grading, keep this problem in your binder for your AP Exam preparation.

A bridal gown industry publication claims that nationwide the average amount spent for a wedding gown is $1,012. A local bridal shop in an urban community has noticed their more expensive gowns are not selling well. Instead, the brides seem to be selecting only lower priced gowns or clearance gowns. The shop wonders if the average amount spent for a wedding gown is less than $1,012 for their customers. To investigate, they selected a random sample of 50 wedding gown sales. They found a sample mean of $985 and a standard deviation of $235.

Is there convincing evidence that the average amount spent on a wedding gown at this shop is less than the national figure? Test the relevant hypotheses using a 0.05 significance level. $\alpha = .05$

Scoring:

(a) E P I

(b) E P I

(c) E P I

(d) E P I

A μ = the true mean cost nationwide of a wedding dress

$H_0: \mu = \$1012$

$H_A: \mu < \$1012$

B 1 sample t-test for means

CONDITIONS

Random: SRS $n = 50$ wedding gowns at this shop

Independent: It is reasonable this shop has more than (10×50) 500 wedding dresses to sell.

Normal: Since the sample is large $50 > 30$, CLT says the normal condition is met

C

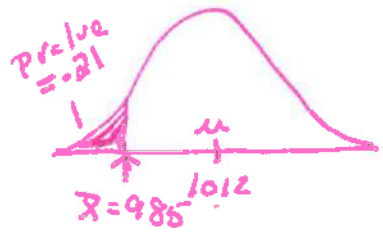
Sample

$n = 50 \quad \bar{x} = 985 \quad s_x = 235$

$$t = \frac{985 - 1,012}{235/\sqrt{50}} \qquad df = 49$$

$t = -.81$

$pvalue = P(t < -.81) = .2109$



D Since the pvalue (.2109) is greater than $\alpha = .05$, we fail to reject the null hypothesis. THERE IS NOT CONVINCING evidence that the average amount of a wedding gown at this shop is less than the national average of $1,012.

Total:__/4