Chapter 9 Multiple Choice Practice ANSWER KEY

Directions. *Identify the choice that best completes the statement or answers the question. Check your answers and note your performance when you are finished.*

1. The average yield of a certain crop is 10.1 bushels per plant. A biologist claims that a new fertilizer will result in a greater yield when applied to the crop. A random sample of 25 of plants given the fertilizer has an average yield of 10.8 bushels and a standard deviation of 2.1 bushels. The appropriate null and alternative hypotheses to test the biologist's claim are
   (A) $H_0: \mu = 10.8$ against $H_a: \mu > 10.8$.
   (B) $H_0: \mu = 10.8$ against $H_a: \mu \neq 10.8$.
   (C) $H_0: \mu = 10.1$ against $H_a: \mu > 10.1$.
   (D) $H_0: \mu = 10.1$ against $H_a: \mu < 10.1$.
   (E) $H_0: \mu = 10.1$ against $H_a: \mu \neq 10.1$.

2. An opinion poll asks a random sample of 200 adults how they feel about voting for an amendment in an upcoming election. In all, 150 say they are in favor of the amendment. Does the poll provide evidence that the proportion p of adults who are in favor of the amendment is greater than 60%? The null and alternative hypotheses are
   (A) $H_0: p = 0.6$ against $H_a: p > 0.6$.
   (B) $H_0: p = 0.6$ against $H_a: p \neq 0.6$.
   (C) $H_0: p = 0.6$ against $H_a: p < 0.6$.
   (D) $H_0: p = 0.6$ against $H_a: p = 0.75$.
   (E) $H_0: p = 0.75$ against $H_a: p < 0.6$.

3. A test of significance produces a P-value of 0.035. Which of the following conclusions is appropriate?
   (A) Accept H_a at the $\alpha = 0.05$ level
   (B) Reject H_a at the $\alpha = 0.01$ level
   (C) Fail to reject H_0 at the $\alpha = .05$ level
   (D) Reject H_0 at the $\alpha = 0.05$ level
   (E) Accept H_0 at the $\alpha = 0.01$ level

   $p = .035 < \alpha = .05$

4. A Type II error is
   (A) rejecting the null hypothesis when it is true.
   (B) failing to reject the null hypothesis when it is false. definition (memorize this!)
   (C) rejecting the null hypothesis when it is false.
   (D) failing to reject the null hypothesis when it is true.
   (E) more serious than a Type I error.

5. A researcher plans to conduct a significance test at the $\alpha = 0.05$ significance level. She designs her study to have a power of 0.85 for a particular alternative value of the parameter. The probability that the researcher will commit a Type II error for the particular alternative value of the parameter at which she computed the power is
   (A) 0.05.
   (B) 0.15.
   (C) 0.80.
   (D) 0.95.
   (E) equal to the 1 - (P-value) and cannot be determined until the data have been collected.

   power = 1 − P(type 2)
   .85 = 1 − P(type 2)

6. In hypothesis testing β is the probability of committing a Type II error in a test with significance level α. The probability of committing a Type I error is
   (A) $1 - \beta$
   (B) $1 - \alpha$
   (C) $\beta - \alpha$
   (D) α
   (E) Can not be determined

7. A claimed psychic was presented with 200 cards face down and asked to determine if the card was one of five symbols: a star, cross, circle, square, or three wavy lines. The "psychic" was correct in 50 cases. To determine if he has ESP, we test the hypotheses H_0: $p = 0.20$, H_a: $p > 0.20$, where p represents the true proportion of cards for which the psychic would correctly identify the symbol in the long run. Assume the conditions for inference are met. The P-value of this test is
   (A) between .10 and .05.
   (B) between .05 and .025.
   (C) between .025 and .01.
   (D) between .01 and .001.
   (E) below .001.

   $p = .0385$

   Calculator
   1-prop z test
   $p_0 = .20$ choose $> p_0$
   $x = 50$ calculate
   $n = 200$

8. The most important condition for drawing sound conclusions from statistical inference is usually
   (A) that the population standard deviation is known.
   (B) that at least 30 people are included in the study.
   (C) that the data come from a random sample or a randomized experiment.
   (D) that the population distribution is exactly Normal.
   (E) that no calculation errors are made in the confidence interval or test statistic.

   THE MOST IMPORTANT IS ALWAYS SRS

9. The mean weight of a random sample of 35 athletes is found to be 165 pounds with a standard deviation of 20 pounds. It is believed that a mean weight of 160 pounds would be normal for this group. To see if there is evidence that the mean weight of the population of all athletes of this type is significantly higher than 160 pounds, the hypotheses H_0: $\mu = 160$ vs. H_a: $\mu > 160$ are tested. You obtain a P-value of 0.0742. Which of the following is true?
   (A) At the 5% significance level, you have proved that H_0 is true.
   (B) You have failed to obtain sufficient evidence against H_0.
   (C) At the 5% significance level, you have failed to prove that H_0 is true, and a larger sample size is needed to do so.
   (D) Only 7.42% of the athletes weigh less than 160 pounds.
   (E) None of the above. A significance test is inappropriate in this setting.

   * we don't EVER prove anything in a significance test, no matter what the results are.

10. A medical researcher wishes to investigate the effectiveness of exercise versus diet in losing weight. Two groups of 25 overweight adult subjects are used, with a subject in each group matched to a similar subject in the other group on the basis of a number of physiological variables. One of the groups is placed on a regular program of vigorous exercise but with no restriction on diet, and the other is placed on a strict diet but with no requirement to exercise. The weight losses after 20 weeks are determined for each subject, and the difference between matched pairs of subjects (weight loss of subject in exercise group - weight loss of matched subject in diet group) is computed. The mean of these differences in weight loss is found to be 2 lb with standard deviation $s_x = 4$ lb. Is this convincing evidence of a difference in mean weight loss for the two methods? To answer this question, you should use
    (A) one-proportion z test.
    (B) one-sample z interval for μ_d.
    (C) one-proportion z interval.
    (D) one-sample t test for μ_d. ← this is the same thing as a matched pairs t test
    (E) none of the above.

1. C 2. A 3. D 4. B 5. B 6. D 7. B 8. C 9. B 10. D

FRAPPY! Free Response AP® Problem, Yay!

The following problem is modeled after actual Advanced Placement Statistics free response questions. Your task is to generate a complete, concise response in 15 minutes. After you generate your response, view two example solutions and determine whether you feel they are "complete", "substantial", "developing" or "minimal". If they are not "complete", what would you suggest to the student who wrote them to increase their score? Finally, you will be provided with a rubric. Score your response and note what, if anything, you would do differently to increase your own score.

During a recent movie promotion, Fruity O's cereal placed mini action figures in some of its boxes. The advertisement on the box states 1 out of every 4 boxes contains an action figure. A group of promotional-toy collectors suspects the proportion of boxes containing the action figure may be lower than 0.25. The group purchased 70 boxes of cereal and found 12 action figures. Assuming the 70 boxes represent a random sample of all of the cereal boxes, is there evidence to support the toy collector's belief that the proportion of boxes containing the figure is less than 0.25? Provide statistical evidence to support your answer.

$H_0: p = .25$ where p is the true proportion of boxes containing the action figure

$H_a: p < .25$

we will use a one-proportion z test with $\alpha = .05$

CONDITIONS

* They said to assume that this is a random sample
* $70\left(\frac{12}{70}\right) = 12 \geq 10$ so the sampling distribution is approx. Normal
  $70\left(\frac{58}{70}\right) = 58 \geq 10$
* There are more than 10(70) cereal boxes in the population, so we will verify independence.

$z = -1.52$

$p = .064$

Since $p > \alpha$ we fail to reject H_0. We don't have convincing evidence that true proportion of boxes containing the action figure is less than the manufacturers claim of 25%.