Name: _____

Chapter 9 Practice MC Test: Testing a Claim

Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. 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) $H_0: \mu = 0.2; H_a: \mu < 0.2$

   B) $H_0: \mu < 0.2; H_a: \mu = 0.2$

   C) $H_0: \bar{x} = 0.2; H_a: \bar{x} < 0.2$

   D) $H_0: \bar{x} = 0.19; H_a: \bar{x} = 0.2$

   E) $H_0: \mu = 0.2; H_a: \mu \neq 0.2$

2. A significance test allows you to reject a hypothesis H_0 in favor of an alternative *Ha* at the 5% level of significance. What can you say about significance at the 1% level?

   A) H_0 can be rejected at the 1% level of significance.

   B) There is insufficient evidence to reject H_0 at the 1% level of significance.

   C) There is sufficient evidence to accept H_0 at the 1% level of significance.

   D) *Ha* can be rejected at the 1% level of significance.

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

3. In a test of H_0: $\mu = 100$ against H_a: $\mu \neq 100$, 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 $\mu \neq 100$.

   B) there is sufficient evidence to conclude that $\mu = 100$.

   C) there is insufficient evidence to conclude that $\mu = 100$.

   D) there is insufficient evidence to conclude that $\mu \neq 100$.

   E) there is sufficient evidence to conclude that $\mu = 103$.

4. Which of the following is *not* a condition for performing inference about a population mean μ?

   A) Inference is based on *n* independent measurements.

   B) The population distribution is Normal or the sample size is large (say $n > 30$).

   C) The sample size must be less than 10% of the population size.

   D) The data are obtained from an SRS from the population of interest.

   E) Both *np* and $n(1 - p)$ are 10 or greater.

5. Resting pulse rate is an important measure of the fitness of a person's cardiovascular system, with a lower rate indicative of greater fitness. The mean pulse rate for all adult males is approximately 72 beats per minute. A random sample of 25 male students currently enrolled in the Faculty of Agriculture was selected and the mean resting pulse rate was found to be 80 beats per minute with a standard deviation of 20 beats per minute. The experimenter wishes to test if the students are

less fit, on average, than the general population.

A possible Type II error here would be to

A) conclude that the students are less fit (on average) than the general population when in fact they have equal fitness on average.
B) conclude that the students have the same fitness (on average) as the general population when in fact they are less fit (on average).
C) conclude that the students have the same fitness (on average) as the general population when in fact they have the same fitness (on average).
D) conclude that the students are less fit (on average) than the general population, when, in fact, they are less fit (on average).
E) conclude that the students have the same fitness (on average) when in fact they are more fit (on average).

6. Resting pulse rate is an important measure of the fitness of a person's cardiovascular system, with a lower rate indicative of greater fitness. The mean pulse rate for all adult males is approximately 72 beats per minute. A random sample of 25 male students currently enrolled in the Faculty of Agriculture was selected and the mean resting pulse rate was found to be 80 beats per minute with a standard deviation of 20 beats per minute. The experimenter wishes to test if the students are less fit, on average, than the general population.

A possible Type I error here would be to

A) conclude that the students are less fit (on average) than the general population when in fact they have equal fitness on average.
B) conclude that the students have the same fitness (on average) as the general population when in fact they are less fit (on average).
C) conclude that the students have the same fitness (on average) as the general population when in fact they have the same fitness (on average).
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E) conclude that the students have the same fitness (on average) when in fact they are more fit (on average).

7. Which of the following conditions are <u>not</u> necessary for the use of the one-proportion z procedures?

A) The sample size is at least 30
B) the data must be a random sample from the population of interest
C) The sample size is less than 10% of the population size
D) $np_0 \geq 10$
E) $n(1-p_0) \geq 10$

8. You are thinking of using a t-procedure to test hypotheses about the mean of a population using a significance level of 0.05. You know the population distribution is normal. Which of the following statements is correct?

A) You should not use the t-procedure here since the populatiuon mean is less than 30.
B) You may use the t-procedure here provided you have a sample size that is 30 or greater.
C) You may use the t-procedure here with any sample size.
D) You should not use the t-procedure here because this is a problem of proportions
E) You may use the t-procedure here provided there are no outliers or strong skewness in the sample data.

9. An educational researcher is collecting data for a study on the job market for graduating business majors in 2012. One variable of interest is the percentage of business grads who were able to find employment in their field within 6 months of obtaining their degree. The researcher hypothesizes in advance of the study that less than 40% of business grads will be able to find jobs within 6 months of graduation. To answer this question, one should use

A) one-proportion z test
B) one-sample t test

C) one-sample z test
D) one-proportion t test
E) none of the above

10. A random sample survey of 175 skiers at a large European resort found that 28% of the those surveyed had taken a ski vacation outside their own country within the past year. The observed value of the test statistic for testing the null hypothesis $H_0: p = 0.3$ versus the alternative hypothesis $H_a: p < 0.3$ is

A) $z = \dfrac{0.3 - 0.28}{\sqrt{\dfrac{0.3(0.7)}{175}}}$

B) $z = \dfrac{0.28 - 0.3}{\sqrt{\dfrac{0.28(0.72)}{175}}}$

C) $z = \dfrac{0.3 - 0.28}{\sqrt{\dfrac{0.28(0.72)}{175}}}$

D) $z = \dfrac{0.28 - 0.3}{\sqrt{\dfrac{0.3(0.7)}{175}}}$

E) None of the above

AP Statistics Chapter 9 Practice FR Test: Testing a Claim

Show all work for the following on the answer sheet. Answer completely and clearly.

1. A certain intelligence test is designed to have a population of scores following a normal distribution with a mean score of 100. Below are scores on this intelligence test from 6 randomly selected undergraduate students from Thorndike University.

110	118	110	122	110	150

   a) Do these scores suggest that, on average, the population of undergraduates at Thorndike University have higher than average intelligence scores? Carry out an appropriate test at the 5% level to help answer this question.

   b) What would constitute a Type I error for this test?

2. A drug manufacturer claims that 9 out of 10 doctors (90%) recommend aspirin for their patients with headaches. To test this claim, a random sample of 100 doctors is obtained. Of these 100 doctors, 82 indicate that they recommend aspirin.

   a) Do these results support the claim of the drug manufacturer? Support your conclusion with a test of significance. Use $\alpha = .01$.

   b) What would constitute a Type II error for this test?

3. Is a person's pulse rate higher when they are standing than when that person is sitting? To answer this question, a group of 14 students measured each other's pulse rate in both positions. The data collected are given in the table below. Consider this to be a random sample taken from a population in which the difference between these two pulse rate measurements is normal.

Member	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Pulse Rate Sitting	62	74	82	88	68	66	72	84	72	82	80	72	64	62
Pulse Rate Standing	68	78	80	92	64	76	72	91	82	76	92	74	60	58
Difference	6	4	-2	4	-4	10	0	7	10	-6	12	2	-4	-4

   a) Carry out an appropriate test to answer the students' question. Use $\alpha = .05$.

   b) Explain why the design of this experiment is better than having two separate treatment groups with one group of students measured while sitting and the other group measured while standing.

Name:
Score: 0 / 10 points (0%)

Chapter 9 Practice MC Test: Testing a Claim

Multiple Choice

Identify the choice that best completes the statement or answers the question.

___ 1. 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) $H_0: \mu = 0.2; H_a: \mu < 0.2$

B) $H_0: \mu < 0.2; H_a: \mu = 0.2$

C) $H_0: \bar{x} = 0.2; H_a: \bar{x} < 0.2$

D) $H_0: \bar{x} = 0.19; H_a: \bar{x} = 0.2$

E) $H_0: \mu = 0.2; H_a: \mu \neq 0.2$

ANSWER: A

The null hypothesis (H_0) always refers to the population value for the mean (0.2).

The alternate hypothesis (H_a) always refers to the belief or theory of the researchers in relation to the supposed mean of the population. Here it is stated "It is believed that this causes eggshells to be thinner and weaker than normal and makes the eggs more prone to breakage." Thinner eggshell means the thickness will be *less than* the normal mean.

POINTS: 0 / 1

___ 2. A significance test allows you to reject a hypothesis H_0 in favor of an alternative *Ha* at the 5% level of significance. What can you say about significance at the 1% level?

A) H_0 can be rejected at the 1% level of significance.

B) There is insufficient evidence to reject H_0 at the 1% level of significance.

C) There is sufficient evidence to accept H_0 at the 1% level of significance.

D) *Ha* can be rejected at the 1% level of significance.

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

ANSWER: E

Unless we actually know the p-value, we cannot reach any of the conclusions made in a-d. For example, if the p-value was 0.0321, it would NOT be significant at the 1% level. But if the p-value was .0031, it WOULD be siginificant at the 1% level.

Both of those values are significant at the 5% level, but only one of them is at the 1% level.

POINTS: 0 / 1

3. In a test of H_0: $\mu = 100$ against H_a: $\mu \neq 100$, 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 $\mu \neq 100$.
   B) there is sufficient evidence to conclude that $\mu = 100$.
   C) there is insufficient evidence to conclude that $\mu = 100$.
   D) there is insufficient evidence to conclude that $\mu \neq 100$.
   E) there is sufficient evidence to conclude that $\mu = 103$.

   ANSWER: D
   Since the p-value is greater than the level of significance, our sample evidence is not sufficient to reject the null hypothesis.
   POINTS: 0 / 1

4. Which of the following is *not* a condition for performing inference about a population mean μ ?
   A) Inference is based on n independent measurements.
   B) The population distribution is Normal or the sample size is large (say $n > 30$).
   C) The sample size must be less than 10% of the population size.
   D) The data are obtained from an SRS from the population of interest.
   E) Both np and $n(1 - p)$ are 10 or greater.

   ANSWER: E
   The condition in answer (E) is used for inference about a popluation *proportion*, not a population mean.
   POINTS: 0 / 1

5. Resting pulse rate is an important measure of the fitness of a person's cardiovascular system, with a lower rate indicative of greater fitness. The mean pulse rate for all adult males is approximately 72 beats per minute. A random sample of 25 male students currently enrolled in the Faculty of Agriculture was selected and the mean resting pulse rate was found to be 80 beats per minute with a standard deviation of 20 beats per minute. The experimenter wishes to test if the students are less fit, on average, than the general population.

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   E) conclude that the students have the same fitness (on average) when in fact they are more fit (on average).

   ANSWER: B
   A Type II error is concluding that the null hypothesis is true, when it actually isn't. Answer (B) makes such a statement.
   POINTS: 0 / 1

6. Resting pulse rate is an important measure of the fitness of a person's cardiovascular system, with a lower rate indicative of greater fitness. The mean pulse rate for all adult males is approximately 72 beats per minute. A random sample of 25 male students currently enrolled in the Faculty of Agriculture was selected and the mean resting pulse rate was found to be 80 beats per minute with a standard deviation of 20 beats per minute. The experimenter wishes to test if the students are less fit, on average, than the general population.

A possible Type I error here would be to

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E) conclude that the students have the same fitness (on average) when in fact they are more fit (on average).

ANSWER: A

A Type I error is concluding that the null hypothesis is false, when it actually it is true. Answer (A) makes such a statement.

POINTS: 0 / 1

7. Which of the following conditions are <u>not</u> necessary for the use of the one-proportion z procedures?

A) The sample size is at least 30
B) the data must be a random sample from the population of interest
C) The sample size is less than 10% of the population size
D) $np_0 \geq 10$
E) $n(1-p_0) \geq 10$

ANSWER: A

The requirement that the sample size be at least 30 is for using a t-test for a test of a population mean, not for a one-proportion test.

POINTS: 0 / 1

8. You are thinking of using a t-procedure to test hypotheses about the mean of a population using a significance level of 0.05. You know the population distribution is normal. Which of the following statements is correct?

A) You should not use the t-procedure here since the populatiuon mean is less than 30.
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C) You may use the t-procedure here with any sample size.
D) You should not use the t-procedure here because this is a problem of proportions
E) You may use the t-procedure here provided there are no outliers or strong skewness in the sample data.

ANSWER: C

Since the population distribution is given as normal, inference can be done on samples of any size from this population.

POINTS: 0 / 1

9. An educational researcher is collecting data for a study on the job market for graduating business majors in 2012. One variable of interest is the percentage of business grads who were able to find employment in their field within 6 months of obtaining their degree. The researcher hypothesizes in advance of the study that less than 40% of business grads will be able to find jobs within 6 months of graduation. To answer this question, one should use

A) one-proportion z test
B) one-sample t test
C) one-sample z test
D) one-proportion t test
E) none of the above

ANSWER: A

We are looking at a percentage representing a success rate of getting a job after college. This statistic is a proportion. The single-sample result is being compared to a hypothesized value. This calls for a one-proportion z test.

POINTS: 0 / 1

___ 10. A random sample survey of 175 skiers at a large European resort found that 28% of the those surveyed had taken a ski vacation outside their own country within the past year. The observed value of the test statistic for testing the null hypothesis $H_0: p = 0.3$ versus the alternative hypothesis $H_a: p < 0.3$ is

A) $z = \dfrac{0.3 - 0.28}{\sqrt{\dfrac{0.3(0.7)}{175}}}$

B) $z = \dfrac{0.28 - 0.3}{\sqrt{\dfrac{0.28(0.72)}{175}}}$

C) $z = \dfrac{0.3 - 0.28}{\sqrt{\dfrac{0.28(0.72)}{175}}}$

D) $z = \dfrac{0.28 - 0.3}{\sqrt{\dfrac{0.3(0.7)}{175}}}$

E) None of the above

ANSWER: D

The correct test statistic for a one-proportion z-test is $z = \dfrac{\hat{p} - p_0}{\sqrt{\dfrac{p_0(1-p_0)}{n}}}$

For this data, $\hat{p} = 0.28$, $p_0 = 0.3$ and $n = 175$ so $z = \dfrac{0.28 - 0.3}{\sqrt{\dfrac{0.3(0.7)}{175}}}$

POINTS: 0 / 1

AP Statistics Chapter 9 Practice FR Test: SOLUTIONS

1. a) **One-Sample *T* Test**

Hypotheses	**Test Statistic and P-value**
μ = intelligence score of Thorndike U. students H_0: μ = 100 H_a: μ > 100	$\bar{x} = 120,\ s = 15.543$ $t = \frac{120 - 100}{15.543/\sqrt{6}} = 3.152$, P = .013
Conditions SRS: random sample stated Normal: stated as normal Independent: 10*n* = 60. The population of students should easily be more than 60	**Decision and Conclusion** • Reject the null at the 5% level • The undergrad students at Thorndike Univ. appear to be of higher intelligence than the average person, as judged by this test.

b) A Type I error would be concluding that Thorndike U. students have higher intelligence test scores when in fact they do not.

2. a) **One-Proportion *Z* Test**

Hypotheses	**Test Statistic and P-value**
p = proportion of doctors who recommend aspirin for their patients with headaches H_0: p = 0.9 H_a: p < 0.9	$\hat{p} = \frac{82}{100} = 0.82,\ n = 100$ $z = \frac{0.82 - 0.9}{\sqrt{\frac{(0.9)(0.1)}{100}}} = -2.667$, P = .004
Conditions SRS: random sample stated Normal: 100(.9) = 90 ≥ 10, 100(.1) = 10 ≥ 10 Independent: 10*n* = 1000. The population of doctors should easily be more than 100	**Decision and Conclusion** • Reject the null at the 1% level • The drug manufacturer claim that 90% of doctors recommend aspirin as a treatment for headaches does not appear to be true.

b) A Type II error would be concluding that 90% of doctors do recommend aspirin for headaches when in fact less than 90% of doctors recommend aspirin for headaches.

3. a) **Paired Differences *T* Test**

Hypotheses	**Test Statistic and P-value**
μ = mean difference between sitting and standing pulse rates (diff = standing – sitting) H_0: μ = 0 H_a: μ > 0	$\bar{x} = 2.5,\ s = 5.984$ $t = \frac{2.5 - 0}{5.984/\sqrt{14}} = 1.563$, P = .071
Conditions SRS: random sample stated Normal: stated as normal Independent: 10*n* = 140. The population of students should easily be more than 140	**Decision and Conclusion** • Fail to reject the null at the 5% level • The pulse rate measurements on these students do not provide significant evidence that standing pulse rate is higher than the sitting pulse rate.

b) A matched-pairs design like this allows for direct comparison of the treatments on each subject. This eliminates lurking variables that exist due to differences between people.