

Part IV: Statistical Inference

Statistical Inference accounts for 30%-40% of the material covered on the AP Exam. "Statistical Inference guides the selection of appropriate models."

Check your understanding of the following topics from

Chapters 18-26 in our Stats textbook

IV. STATISTICAL INFERENCE: ESTIMATING POPULATION PARAMETERS AND TESTING HYPOTHESES

A. Estimation (point estimators and confidence intervals)

- 1. Estimating population parameters and margins of error
- 2. Properties of point estimators, including unbiasedness and variability
- 3. Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals
- 4. Large sample confidence interval for a proportion
- 5. Large sample confidence interval for a difference between two proportions
- 6. Confidence interval for a mean
- 7. Confidence interval for a difference between two means (unpaired and paired)
- 8. Confidence interval for the slope of a least-squares regression line

B. Tests of significance

- 1. Logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided tests; concepts of Type I and Type II errors; concept of power
- 2. Large sample test for a proportion
- 3. Large sample test for a difference between two proportions
- 4. Test for a mean
- 5. Test for a difference between two means (unpaired and paired)
- 6. Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables)
- 7. Test for the slope of a least-squares regression line

2015 Multiple Choice Practice Exam

8. On the day before an election in a large city, each person in a random sample of 1,000 likely voters is asked which candidate he or she plans to vote for. Of the people in the sample, 55 percent say they will vote for candidate Taylor. A margin of error of 3 percentage points is calculated. Which of the following statements is appropriate?
- (A) The proportion of all likely voters who plan to vote for candidate Taylor must be the same as the proportion of voters in the sample who plan to vote for candidate Taylor (55 percent), because the data were collected from a random sample.
 - (B) The sample proportion minus the margin of error is greater than 0.50, which provides evidence that more than half of all likely voters plan to vote for candidate Taylor.
 - (C) It is not possible to draw any conclusion about the proportion of all likely voters who plan to vote for candidate Taylor because the 1,000 likely voters in the sample represent only a small fraction of all likely voters in a large city.
 - (D) It is not possible to draw any conclusion about the proportion of all likely voters who plan to vote for candidate Taylor because this is not an experiment.
 - (E) It is not possible to draw any conclusion about the proportion of all likely voters who plan to vote for candidate Taylor because this is a random sample and not a census.
11. From a random sample of 50 people, sitting pulse rates and standing pulse rates were measured for each person. A coin was flipped to determine whether the sitting or the standing pulse rate would be measured first. Let μ_{sitting} represent the mean sitting pulse rate in the population, μ_{standing} represent the mean standing pulse rate in the population, and μ_d represent the mean of the differences between the sitting and standing (sitting – standing) pulse rates in the population. Which of the following represents an appropriate test and hypotheses to determine if there is a difference in mean pulse rates between sitting and standing in the population?
- (A) A two-sample t -test with $H_0 : \mu_{\text{sitting}} = \mu_{\text{standing}}$ and $H_a : \mu_{\text{sitting}} \neq \mu_{\text{standing}}$
 - (B) A two-sample t -test with $H_0 : \mu_{\text{sitting}} = \mu_{\text{standing}}$ and $H_a : \mu_{\text{sitting}} < \mu_{\text{standing}}$
 - (C) A two-sample z -test with $H_0 : \mu_{\text{sitting}} = \mu_{\text{standing}}$ and $H_a : \mu_{\text{sitting}} \neq \mu_{\text{standing}}$
 - (D) A matched-pairs t -test with $H_0 : \mu_d = 0$ and $H_a : \mu_d \neq 0$
 - (E) A matched-pairs t -test with $H_0 : \mu_d = 0$ and $H_a : \mu_d < 0$
14. A 90 percent confidence interval for the slope of a regression line is determined to be $(-0.181, 1.529)$. Which of the following statements must be true?
- (A) The correlation coefficient of the data is positive.
 - (B) The sum of the residuals for the data based on the regression line is positive.
 - (C) A scatterplot of the data would show a linear pattern.
 - (D) The slope of the sample regression line is 1.348.
 - (E) The slope of the sample regression line is 0.

16. A matched-pairs t -test is NOT an appropriate way to analyze data consisting of which of the following?
- (A) Measurements of annual income taken both before and after a two-year training course for a random sample of 100 people who took the course
 - (B) Measurements of annual income for each twin for 100 randomly selected pairs of twins
 - (C) Measurements of annual income for both individuals in pairs formed by matching 100 people from State A and 100 people from State B based on level of education
 - (D) Measurements of annual income for both individuals in pairs formed by assigning 100 people to pairs at random
 - (E) Measurements of annual income recorded for both spouses of 100 randomly selected married couples
18. An airline claims that the mean flight time between City X and City Y is 38 minutes. After taking many flights, a local business group believes that the claim is unrealistic and that the actual mean flight time is greater than 38 minutes. If the group conducts a study to investigate its belief, which of the following hypotheses should be tested?
- (A) $H_0 : \bar{x} = 38$ versus $H_a : \bar{x} \neq 38$
 - (B) $H_0 : \bar{x} = 38$ versus $H_a : \bar{x} < 38$
 - (C) $H_0 : \bar{x} = 38$ versus $H_a : \bar{x} > 38$
 - (D) $H_0 : \mu = 38$ versus $H_a : \mu < 38$
 - (E) $H_0 : \mu = 38$ versus $H_a : \mu > 38$
20. A national health study reported that the proportion of students with elevated blood pressure is 0.15. The principal of a local high school believes that the proportion of students in the school with elevated blood pressure is greater than 0.15. If a large random sample is used, which of the following is the most appropriate test to investigate the principal's belief?
- (A) A z -test for a proportion
 - (B) A z -test for a difference between two proportions
 - (C) A chi-square test for homogeneity of proportions
 - (D) A t -test for a mean
 - (E) A matched-pairs t -test
22. A two-sample t -test of the hypotheses $H_0 : \mu_1 - \mu_2 = 0$ versus $H_a : \mu_1 - \mu_2 > 0$ produces a p -value of 0.03. Which of the following must be true?
- I. A 90 percent confidence interval for the difference in means will contain the value 0.
 - II. A 95 percent confidence interval for the difference in means will contain the value 0.
 - III. A 99 percent confidence interval for the difference in means will contain the value 0.
- (A) I only
 - (B) III only
 - (C) I and II only
 - (D) II and III only
 - (E) I, II, and III

23. A medical doctor uses a diagnostic test to determine whether a patient has arthritis. A treatment will be prescribed only if the doctor thinks the patient has arthritis. The situation is similar to using a null and an alternative hypothesis to decide whether to prescribe the treatment. The hypotheses might be stated as follows.

H_0 : The patient does not have arthritis.

H_a : The patient has arthritis.

Which of the following represents a Type II error for the hypotheses?

- (A) Diagnosing arthritis in a patient who has arthritis
 - (B) Failing to diagnose arthritis in a patient who has arthritis
 - (C) Diagnosing arthritis in a patient who does not have arthritis
 - (D) Failing to diagnose arthritis in a patient who does not have arthritis
 - (E) Prescribing treatment to a patient regardless of the diagnosis
26. A school administrator is interested in estimating the proportion of students in the district who participate in community service activities. From a random sample of 100 students in the district, the administrator will construct a 99 percent confidence interval for the proportion of all district students who participate in community service activities. Which of the following statements must be true?
- (A) The population proportion will be in the confidence interval.
 - (B) The probability that the confidence interval will include the population proportion is 0.99.
 - (C) The probability that the confidence interval will include the sample proportion is 0.99.
 - (D) The population proportion and the sample proportion will be equal.
 - (E) The probability that the population proportion and the sample proportion will be equal is 0.99.
28. A large city newspaper periodically reports the mean cost of dinner for two people at restaurants in the city. The newspaper staff will collect data from a random sample of restaurants in the city and estimate the mean price using a 90 percent confidence interval. In past years, the standard deviation has always been very close to \$35. Assuming that the population standard deviation is \$35, which of the following is the minimum sample size needed to obtain a margin of error of no more than \$5 ?
- (A) 90
 - (B) 112
 - (C) 133
 - (D) 147
 - (E) 195
30. A 95 percent confidence interval for the mean time, in minutes, for a volunteer fire company to respond to emergency incidents is determined to be (2.8, 12.3). Which of the following is the best interpretation of the interval?
- (A) Five percent of the time, the time for response is less than 2.8 minutes or greater than 12.3 minutes.
 - (B) The probability is 0.95 that a randomly selected time for response will be between 2.8 minutes and 12.3 minutes.
 - (C) Ninety-five percent of the time the mean time for response is between 2.8 minutes and 12.3 minutes.
 - (D) We are 95% confident that the mean time for response is between 2.8 minutes and 12.3 minutes.
 - (E) We are 95% confident that a randomly selected time for response will be between 2.8 minutes and 12.3 minutes.

33. Researchers will conduct a study of the television-viewing habits of children. They will select a simple random sample of children and record the number of hours of television the children watch per week. The researchers will report the sample mean as a point estimate for the population mean. Which of the following statements is correct for the sample mean as a point estimator?
- (A) A sample of size 25 will produce more variability of the estimator than a sample of size 50.
 (B) A sample of size 25 will produce less variability of the estimator than a sample of size 50.
 (C) A sample of size 25 will produce a biased estimator, but a sample size of 50 will produce an unbiased estimator.
 (D) A sample of size 25 will produce a more biased estimator than a sample of size 50.
 (E) A sample of size 25 will produce a less biased estimator than a sample of size 50.
34. A research study indicated a negative linear relationship between two variables: the number of hours per week spent exercising (exercise time) and the number of seconds it takes to run one lap around a track (running time). Computer output from the study is shown below.

Variable	N	Mean	SE Mean	StDev
Running time	11	74.81	2.21	7.33
Predictor	Coef	SE Coef		
Constant	88.01	0.49		
Exercise time	-2.20	0.07		
S = 0.76		R-Sq = 99.0%		

Assuming that all conditions for inference are met, which of the following is an appropriate test statistic for testing the null hypothesis that the slope of the population regression line equals 0 ?

- (A) $t = \frac{88.01}{0.49}$
 (B) $t = \frac{74.81}{7.33}$
 (C) $t = \frac{74.81}{2.21}$
 (D) $t = \frac{-2.20}{0.07}$
 (E) $t = \frac{-2.20}{\frac{0.07}{\sqrt{11}}}$

35. The table below shows historical data for the distribution of the number of customers, in half-hour time periods, who visit the electronics department of a retail store. For example, in 25 percent of the time periods for which data were collected, no customers were observed in the electronics department of the store.

Number of customers	0	1	2	3 or more
Proportion of time periods	0.25	0.20	0.30	0.25

To investigate if the distribution has changed, the number of customers who visited the electronics department of the store was recorded for each of 50 randomly selected time periods. The results are shown in the table below.

Number of customers	0	1	2	3 or more
Number of time periods	4	13	14	19

A chi-square goodness-of-fit test was conducted to determine whether the data provide convincing evidence that the distribution has changed. The test statistic was 10.13 with a p -value of 0.0175. Which of the following statements is true?

- (A) At the significance level $\alpha = 0.05$, the data provide convincing evidence that the current distribution is different from the historical distribution.
- (B) At the significance level $\alpha = 0.10$, the data do not provide convincing evidence that the current distribution is different from the historical distribution.
- (C) The mean number of customers in a randomly selected time period is 12.5.
- (D) No valid conclusion can be made because the observed frequency for one cell is less than 5.
- (E) The chi-square statistic has $50 - 1 = 49$ degrees of freedom.
38. A machine is designed to dispense at least 12 ounces of a beverage into a bottle. To test whether the machine is working properly, a random sample of 50 bottles was selected and the mean number of ounces for the 50 bottles was computed. A test of the hypotheses $H_0 : \mu = 12$ versus $H_a : \mu < 12$ was conducted, where μ represents the population mean number of ounces of the beverage dispensed per bottle by the machine. The p -value for the test was 0.08. Which of the following is the most appropriate conclusion to draw at the significance level of $\alpha = 0.05$?
- (A) Because the p -value is greater than the significance level, there is convincing evidence that the population mean number of ounces dispensed into a bottle is 12 ounces.
- (B) Because the p -value is greater than the significance level, there is convincing evidence that the population mean number of ounces dispensed into a bottle is less than 12 ounces.
- (C) Because the p -value is greater than the significance level, there is not convincing evidence that the population mean number of ounces dispensed into a bottle is less than 12 ounces.
- (D) Because the p -value is less than the significance level, there is convincing evidence that the population mean number of ounces dispensed into a bottle is 12 ounces.
- (E) Eight percent of the bottles will be filled with less than 12 ounces.

2014 Multiple Choice Practice Exam

		Age of Child	
		2-year olds	3-year olds
Color Selected	Yellow	14	28
	Red	32	24
	Blue	19	16

5. Each of 133 children in a sample was asked to choose a pencil. Three different colors were available: yellow, red, and blue. The number of 2-year olds and 3-year olds who selected each color is shown in the table above. In a test of independence of age and color, which of the following is used as the expected cell count for 2-year olds who select a yellow pencil?
- (A) 14
- (B) $\frac{1}{6}(133)$
- (C) $\frac{1}{3}(14 + 32 + 19)$
- (D) $\frac{1}{2}(14 + 28)$
- (E) $\frac{(14 + 28)(14 + 32 + 19)}{133}$
13. The manager of a car company will select a random sample of its customers to create a 90 percent confidence interval to estimate the proportion of its customers who have children. Of the following, which is the smallest sample size that will result in a margin of error of no more than 6 percentage points?
- (A) 100
- (B) 125
- (C) 150
- (D) 200
- (E) 275
16. A pollster is interested in comparing the proportions of women and men in a particular town who are in favor of a ban on fireworks within town borders. The pollster plans to test the hypothesis that the proportion of women in favor of the ban is different from the proportion of men in favor of the ban. There are 4,673 women and 4,502 men who live in the town. From a simple random sample of 40 women in the town, the pollster finds that 38 favor the ban. From an independent simple random sample of 50 men in the town, the pollster finds that 27 favor the ban. Which of the following statements is true about this situation?
- (A) Because the samples are from normal populations, a two-proportion z -test would be valid.
- (B) Because the size of each sample is greater than 30, a two-proportion z -test would be valid.
- (C) Because the number who favored the ban is greater than 10 in both groups, a two-proportion z -test would be valid.
- (D) Because of the relative sizes of the populations and samples, a two-proportion z -test would be valid.
- (E) A two-proportion z -test would not be valid for these data.

23. A random sample of 300 students is selected from a large group of students who use a computer-equipped classroom on a regular basis. Occasionally, students leave their USB drive in a computer. Of the 300 students questioned, 180 said that they write their name on their USB drive. Which of the following is a 98 percent confidence interval for the proportion of all students using the classroom who write their name on their USB drive?
- (A) $0.4 \pm 2.33\sqrt{\frac{(0.4)(0.6)}{300}}$
- (B) $0.4 \pm 1.96\sqrt{\frac{(0.4)(0.6)}{300}}$
- (C) $0.6 \pm 2.33\sqrt{\frac{(0.6)(0.4)}{300}}$
- (D) $0.6 \pm 1.96\sqrt{\frac{(0.6)(0.4)}{300}}$
- (E) $0.6 \pm 2.05\sqrt{\frac{(0.6)(0.4)}{300}}$
25. A researcher constructed a 95 percent confidence interval for the mean number of alfalfa weevils on an alfalfa plant within a field. Based on 80 randomly selected alfalfa plants, the researcher found an average of 2.5 alfalfa weevils per plant and computed the 95 percent confidence interval to be 1.50 to 3.50. Which of the following statements is a correct interpretation of the 95 percent confidence level?
- (A) Approximately 95 percent of alfalfa fields sampled will have an average of 1.50 to 3.50 alfalfa weevils per plant, but nothing can be said about the sample mean number of alfalfa weevils for this or any other field.
- (B) Approximately 95 percent of alfalfa fields sampled will have an average of 1.50 to 3.50 alfalfa weevils per plant. The sample mean for this field was 2.50 alfalfa weevils per plant, but the sample means for other fields may be different.
- (C) If we repeatedly sampled this field, taking samples of 80 plants and constructing 95% confidence intervals, then, approximately 95 percent of these intervals would include 2.5, the mean for the sample described above.
- (D) If we repeatedly sampled this field, taking samples of 80 plants and constructing 95% confidence intervals, then, approximately 95 percent of these intervals would include the population mean number of alfalfa weevils on an alfalfa plant in this field.
- (E) If we repeatedly sampled this field, taking samples of 80 plants and constructing 95% confidence intervals, then, approximately 95 percent of these intervals would include the sample mean for that sample.

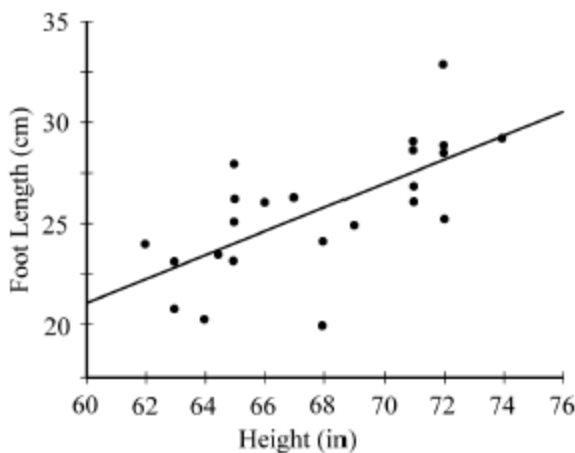
27. An amateur men's swimming association is trying to decide whether times in the 100-meter breaststroke will be reduced if the men shave their heads. From the population of swimmers, six were selected at random and agreed to swim two races — one before shaving their heads and one after shaving their heads. The results for each race, with times in seconds, are given in the table below.

Swimmer	I	II	III	IV	V	VI
Time before shaving (x_1)	66.2	67.5	64.3	68.0	67.2	63.9
Time after shaving (x_2)	65.9	67.0	66.3	67.1	67.5	64.2

Let μ_1 represent the population mean of swimming times before shaving and μ_2 represent the population mean of swimming times after shaving. Let μ_d represent the population mean of the differences, $X_1 - X_2$. These differences follow a normal distribution. Which of the following would be the most appropriate test and alternative hypothesis to use in testing this theory?

- (A) A two-sample t -test with $H_a: \mu_1 > \mu_2$
 - (B) A two-sample t -test with $H_a: \mu_1 \neq \mu_2$
 - (C) A two-sample t -test with $H_a: \mu_1 < \mu_2$
 - (D) A paired t -test with $H_a: \mu_d > 0$
 - (E) A paired t -test with $H_a: \mu_d \neq 0$
28. A newspaper poll found that 52 percent of the respondents in a large random sample of likely voters in a district intend to vote for candidate Smith rather than the opponent. A 95 percent confidence interval for the population proportion was computed to be 0.52 ± 0.04 . Based on the confidence interval, which of the following should the newspaper report to its readers?
- (A) Smith will win because a majority of voters are in favor of Smith.
 - (B) There is a 95% chance that Smith will win.
 - (C) The poll predicts Smith will win, but there is a 5% chance that the prediction is incorrect due to sampling error.
 - (D) With 95% confidence, there is convincing evidence that Smith will win.
 - (E) No prediction about who will win can be made with 95% confidence.

30. A statistics teacher wants to determine whether there is a linear relationship between high school students' heights, in inches (in), and the lengths of their feet, in centimeters (cm). The teacher obtains height and foot-length measurements for a random sample of 23 students at the high school and generates the following graph and computer output.



Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	-13.867	9.410	-1.474	0.1554
Height	0.583	0.138	4.208	0.0004

Provided that the assumptions for regression inference are satisfied, which of the following provides a 95 percent confidence interval estimate of the slope of the population regression line for predicting foot length from height?

- (A) $0.583 \pm (1.717)(0.138)$
- (B) $0.583 \pm (2.080)(0.138)$
- (C) $0.583 \pm (1.960)\left(\frac{0.138}{\sqrt{23}}\right)$
- (D) $0.583 \pm (2.074)\left(\frac{0.138}{\sqrt{23}}\right)$
- (E) $0.583 \pm (4.208)\left(\frac{0.138}{\sqrt{23}}\right)$

32. A controversial issue in the sport of professional soccer is the use of instant replay for making difficult goal line decisions. Each person in a representative sample of 102 players, fans, coaches, and officials was asked his or her opinion about the use of instant replay for goal-line decisions. The data are summarized in the two-way frequency table below.

		Opinion	
		Favor Use	Oppose Use
Category	Players	22	2
	Fans	18	6
	Coaches	15	26
	Officials	3	10

In testing to see whether opinion with respect to the use of instant replay is independent of the category of the person interviewed, a chi-square test statistic of 27.99 and a p -value less than 0.001 were calculated. Which of the following statements is correct?

- (A) The number of degrees of freedom for the test is $8 - 1 = 7$.
 - (B) The chi-square test should not have been used because two of the counts in the table are less than 5.
 - (C) The null hypothesis states that there is an association between category and opinion about the use of instant replay, and the small p -value suggests that the null hypothesis should be rejected.
 - (D) The small p -value suggests that there is evidence of an association between category and opinion about the use of instant replay.
 - (E) The chi-square test shows that fans favor the use of instant replay.
33. A large clinical trial was designed to determine whether a certain vitamin improves the general health of adults. The investigators first identified 85 variables that measure various aspects of the general health of adults. Because each adult in the clinical trial was to serve as his or her own control, the 85 variables were measured for each adult, both before taking the vitamin and after taking the vitamin for three months. The investigators then performed 85 matched-pair t -tests, one for each variable. They found statistically significant results at the 0.05 level in 2 of the variables, both in the direction of improved general health. Which of the following should the investigators conclude?
- (A) There is evidence that the vitamin improves the health of adults because 2 of the 85 tests were statistically significant.
 - (B) There is evidence that the vitamin improves the health of adults because in clinical trials investigators typically underestimate the proportion of the population that is helped by a vitamin.
 - (C) There is insufficient evidence that the vitamin improves the health of adults because at the 0.05 significance level, one could easily get statistically significant results in 2 out of 85 tests just due to chance variability.
 - (D) There is insufficient evidence that the vitamin improves the health of adults because the sample size of 85 is not large enough to draw a conclusion.
 - (E) No conclusion can be drawn because an even number of variables is needed for a matched-pairs design.

36. A department store manager wants to know if a greater proportion of customers on the store's mailing list would redeem a coupon for \$5 off the price of an item than would redeem a coupon for 10 percent off the price of an item. The manager mails a \$5 off coupon to a random sample of 500 customers and mails a 10 percent off coupon to an independent random sample of 500 customers. The number of coupons of each type that were redeemed was recorded. Assuming that the conditions for inference are met, what test procedure should be used to answer the manager's question?
- (A) A one-sample t -test for a mean
 - (B) A one-sample z -test for a proportion
 - (C) A t -test for the slope of a regression line
 - (D) A matched-pairs t -test for a mean difference
 - (E) A two-sample z -test for a difference between two proportions

37. A one-sided hypothesis test is to be performed with a significance level of 0.05. Suppose that the null hypothesis is false. If a significance level of 0.01 were to be used instead of a significance level of 0.05, which of the following would be true?
- (A) Neither the probability of a Type II error nor the power of the test would change.
 (B) Both the probability of a Type II error and the power of the test would decrease.
 (C) Both the probability of a Type II error and the power of the test would increase.
 (D) The probability of a Type II error would decrease and the power of the test would increase.
 (E) The probability of a Type II error would increase and the power of the test would decrease.
39. Frank, who lives in Texas, and his sister Lilly, who lives in Japan, correspond regularly. From what he can tell from the postmarks on both his and his sister's letters, it appears that it takes longer for Lilly's mail from Japan to reach him in Texas than it does for his letters from Texas to reach her in Japan. When Frank called his post office to ask if there was a reason for this, the postmaster told him that the delivery time of letters in both directions should be the same. Frank and his sister decided to collect data to see if letters from Japan to Texas take longer to be delivered than letters from Texas to Japan. They recorded the delivery time in days. After convincing themselves that the assumptions were reasonable, they performed a two-sample t -test and obtained the following computer output.

Two sample T for To Texas vs To Japan				
	N	Mean	StDev	SE Mean
To Texas	12	8.74	2.92	0.84
To Japan	9	6.75	2.56	0.85

95% CI for μ To Texas - μ To Japan: (-0.53, 4.51)
 T-Test μ To Texas = μ To Japan (vs >): T = 1.66 P = 0.058 DF = 18

- Using a significance level of 0.05, which of the following statements best describes the conclusion that can be drawn from these data?
- (A) There is convincing evidence that there is no difference in the mean delivery times.
 (B) There is convincing evidence that there is a difference in the mean delivery times.
 (C) There is convincing evidence that the mean delivery time from Japan to Texas is greater than the mean delivery time from Texas to Japan.
 (D) There is not convincing evidence that the mean delivery time from Japan to Texas is greater than the mean delivery time from Texas to Japan.
 (E) The t -test cannot be used for sample sizes that are this small.
40. In a national study on transportation patterns, 1,000 randomly selected adults will be asked the question: How many trips per week do you make to the grocery store? The sample mean will be computed. Let μ denote the population mean response to the question if everyone in the population is to be asked the question. Is the sample mean \bar{x} unbiased for estimating μ ?
- (A) Yes, because for random samples the mean (expected value) of the sample mean \bar{x} is equal to the population mean μ .
 (B) Yes, because with a sample size of 1,000 the standard deviation of the sample mean \bar{x} is small.
 (C) Yes, because the wording of the question is not biased.
 (D) No, because the sample mean \bar{x} does not always equal the population mean μ .
 (E) No, because number of trips to the grocery store is not normally distributed so the mean (expected value) of the sample mean \bar{x} does not equal the population mean μ .