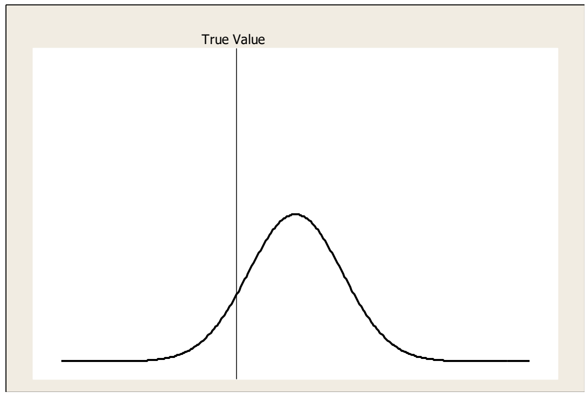
AP Statistics
Review Ch. 8

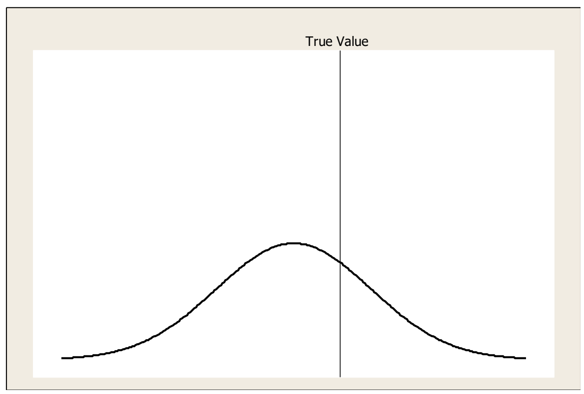
Name ___________________

1. Each figure below displays the sampling distribution of a statistic used to estimate a parameter. The true value of the population parameter is marked on each sampling distribution. Which is the sampling distribution of a statistic that is an unbiased estimator of the parameter of interest?

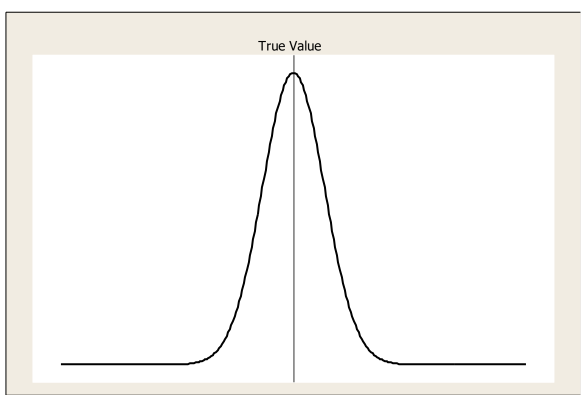
Statistic I



Statistic II



Statistic III

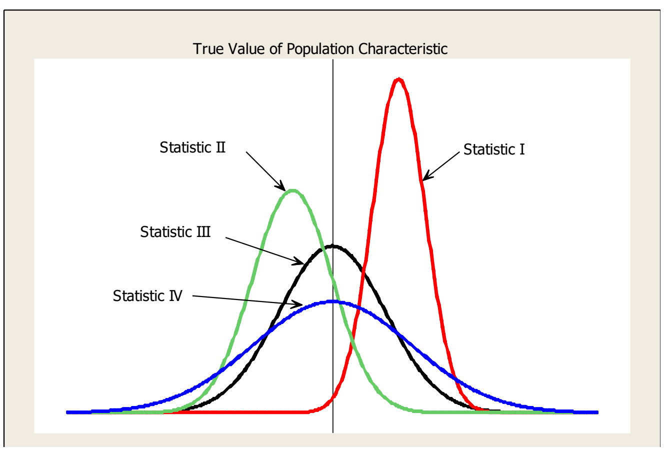


a. Statistic I only
b. Statistic II only
c. Statistic III only
d. Both Statistic I and Statistic II are unbiased
e. None of the three statistics are unbiased.

2. A planning board in Elm County is interested in estimating the proportion of its residents that are in favor of offering incentives to high-tech industries to build plants in that county. A random sample of Elm County residents was selected. All of the selected residents were asked, "Are you in favor of offering incentives to high-tech industries to build plants in your county?" A 95 percent confidence interval for the proportion of residents in favor of offering incentives was calculated to be 0.54 ± 0.05. Which of the following statements is correct?

a. At the 95% confidence level, the estimate of 0.54 is within 0.05 of the true proportion of county residents in favor of offering incentives to high-tech industries to build plants in the county.
b. At the 95% confidence level, the majority of area residents are in favor of offering incentives to high-tech industries to build plants in the county.
c. In repeated sampling, 95% of sample proportions will fall in the interval (0.49, 0.59)
d. In repeated sampling, the true proportion of county residents in favor of offering incentives to high-tech industries to build plants in the county will fall in the interval (0.49, 0.59).
e. In repeated sampling, 95% of the time the true proportion of county residents in favor of offering incentives to high-tech industries to build plants in the county will be equal to 0.54

3. Four different statistics are being considered for estimating a population characteristic. The sampling distributions of the four statistics are shown here. Which statistic is most likely to result in an estimate that is close to the true value of the population characteristic?



a. Statistic I
b. Statistic II
c. Statistic III
d. Statistic IV
e. Statistics III and IV are equally likely to result in an estimate that is close to the true value.

4. In a random sample of 300 elderly men, 65% were married, while in a similar sample of 400 elderly women, 48% were married. What is the 99% confidence interval estimate for the difference between the proportions of elderly men and women who were married?

a. $.17 \pm .0036$ b. $.17 \pm .096$ c. $.55 \pm .067$ d. $.56 \pm .067$ e. $.565 \pm .096$

5. Given a choice of unbiased statistics, the best statistic would be the one with a sampling distribution that

a. is most closely approximated by a normal curve.
b. has the smallest variance.
c. has the largest standard error.
d. is most nearly symmetric.
e. is most closely approximated by a *t* distribution.

6. To estimate the proportion of faculty at a state university who own a home, a random sample of faculty is selected. For which of the following combinations of n and $\hat{p}$ would it be appropriate to use the confidence interval $\hat{p} \pm (\text{z critical value})\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$?

a. n = 20 and $\hat{p}$ = 0.40
b. n = 40 and $\hat{p}$ = 0.20
c. n = 100 and $\hat{p}$ = 0.05
d. n = 150 and $\hat{p}$ = 0.45
e. n = 200 and $\hat{p}$ = 0.02

7. A 90 percent confidence interval is to be created to estimate the proportion of television viewers in a certain area who favor moving the broad cast of the late weeknight news to an hour earlier than it is currently. Initially, the confidence interval will be created using a simple random sample of 9,000 viewers in the area. Assuming that the sample proportion does not change, what would be the relationship between the width of the original interval and the width of a second 90 percent confidence interval that is created based on sample of only 1,000 viewers in the area?

a. The second confidence interval would be 9 times as wide as the original confidence interval.
b. The second confidence interval would be 3 times as wide as the original confidence interval.
c. The width of the second confidence interval would be equal to eh width of the original confidence interval.
d. The second confidence interval would be $\frac{1}{3}$ times as wide as the original confidence interval.
e. The second confidence interval would be $\frac{1}{9}$ times as wide as the original confidence interval.

8. Suppose that a random sample of 100 high school classrooms in the state of California is selected and a 95% confidence interval for the proportion that has internet access is (0.62, 0.78). Which of the following is a correct interpretation of the 95% confidence level?

a. The method used to construct the interval will produce an interval that includes the value of the population proportion about 95% of the time in repeated sampling.
b. We are 95% confident that the sample proportion is between 0.62 and 0.78.
c. There is a 95% chance that the true proportion of high school classrooms in California that have internet access is between 0.62 and 0.78.
d. We are 95% confident that the true proportion of high school classrooms in California that have internet access is between 0.62 and 0.78.
e. None of the above is a correct interpretation of the confidence level.

9. An SRS of size 100 is taken from a population having proportion 0.8 successes. An independent SRS of size 400 is taken from a population having proportion 0.5 successes. The sampling distribution for the difference in sample proportions has what standard error?

a. 1.3 b. 0.40 c. 0.047 d. 0.0002
e. None of the above. The answer is ______________________________.

10. Which of the following must be true of a sample in order for it to be appropriate to use a z confidence interval to estimate the population proportion?

a. The sample is a random sample from the population of interest.
b. $n\hat{p} \geq 10$ and $n(1-\hat{p}) \geq 10$
c. The population distribution is normal.
d. All of the above are required assumptions to use the z confidence interval to estimate the population proportion.
e. Only (a) and (b) are required assumptions to use the z confidence interval to estimate the population proportion.

11. Which of the following would tend to decrease the width of a confidence interval?

I. Increasing the sample size
II. Using a higher confidence level
III. Using a lower confidence level

a. I only
b. II only
c. III only
d. I and II only
e. I and III only

12. A researcher has conducted a survey using a simple random sample of 50 registered voters to create a confidence interval to estimate the proportion of registered voters favoring the election of a certain candidate for mayor. Assume that a sample proportion does not change. Which of the following best describes the anticipated effect on the width of the confidence interval if the researcher were to survey a random sample of 200, rather than 50, registered voters?

a. The width of the new interval would be about one-fourth the width of the original interval.
b. The width of the new interval would be about one-half the width of the original interval.
c. The width of the new interval would be about the same width as the original interval.
d. The width of the new interval would be about twice the width of the original interval.
e. The width of the new interval would be about four times the width of the original interval.

13. A large-sample 98 percent confidence interval for the proportion of hotel reservations that are canceled on the intended arrival day is (0.048, 0.112). What is the point estimate for the proportion of hotel reservations that are canceled on the intended arrival day from which this interval was constructed?

a. 0.032
b. 0.064
c. 0.080
d. 0.160
e. It cannot be determined from the information given.

14. Each individual in a random sample of 50 internet users was asked how many minutes he/she spends online in a typical day. The data was then used to construct a 99% confidence interval for the mean number of minutes spent online in a typical day for all internet users. The confidence interval was (80, 200) minutes per day. Which of the following is a correct interpretation of the confidence interval?

a. There is a 99% chance that the mean number of minutes spent online in a typical day of all internet users is between 80 and 200.
b. We are 99% confident that the sample mean is between 80 and 200 minutes.
c. We are 99% confident that for all internet users the mean number of minutes spent online in a typical day is between 80 and 200.
d. 99% of all internet users will spend between 80 and 200 minutes online in a typical day.
e. 99% of the people in the sample spent between 80 and 200 minutes online in a typical day.

15. In a large school district, 16 of 85 randomly selected high school seniors play a varsity sport. In the same district, 19 of 67 randomly selected high school juniors play a varsity sport. A 95 percent confidence interval for the difference between the proportion of high school seniors who play a varsity sport in the school district and high school juniors who play a varsity sport in the school districted is calculated. What is the standard error of the difference?

a. 0.0347 b. 0.0695 c. 0.1362 d. 0.9800 e. 1.6900

16. Which of the following is certain to reduce the width of a confidence interval?

a. larger sample size and higher confidence level
b. larger sample size and lower confidence level
c. smaller sample size and higher confidence level
d. smaller sample size and lower confidence level
e. None of the above.

17. The critical value for a 99% confidence interval for p =

a. 2.33 b. 2.58 c. 2.97 d. 3.09 e. 3.29

18. Based on a survey of a random sample of 900 adults in the United States, a journalist reports that 60 percent of adults in the United States are in favor of increasing the minimum hourly wage. If the reported percent has a margin of error of 2.7 percentage points, which of the following is closest to the level of confidence?

a. 80.0% b. 90.0% c. 95.0% d. 95.5% e. 99.0%

19. Assuming that the data came from a random sample, what other conditions must be met in order to perform a z-interval on a single proportion?

a. The sample size is greater than 30 or the data are roughly normal.
b. The population of interest is greater than the sample size.
c. The population is greater than 10 times the sample size.
d. The probability of success times sample size is greater than 10 as well as the probability of failure times the sample size is greater than 10.
e. Both C and D must be true for a proportion interval to be constructed.

20. What size would a sample need to be in order for it to be within 3 percentage points on a 95% confidence interval when the proportion of successes is 36%?

a. 984 b. 983 c. 256 d. 255 e. 250

21. Which of the following would **not** decrease the width of a confidence interval?
I. increasing the sample size
II. increasing the standard deviation
III. decreasing the confidence interval

a. I only b. II only c. III only d. I and II e. II and III

22. A polling organization asks a random sample of 1,000 registered voters which of two candidates they plan to vote for in an upcoming election. Candidate A is preferred by 400 respondents, Candidate B is preferred by 500 respondents, and 100 respondents are undecided. George uses a large sample confidence interval for two proportions to estimate the difference in the population proportions favoring the two candidates. This procedure is not appropriate because

a. the two sample proportions were not computed from independent samples
b. the sample size was too small
c. the third category, undecided, makes the procedure invalid
d. the sample proportions are different therefore, the variances are probably different as well
e. George should have taken the difference $\frac{500-400}{1,000}$ and then used a large sample confidence interval for a single proportion instead

23. In a study with a new antibiotic for children, a random sample of 64 showed that 52 of the children had positive results within 12 hours. Find a 95% confidence interval for the proportion of children who will experience positive results within 12 hours on this antibiotic.

a. 0.8125 ± 0.096 b. 0.8125 ± 0.080 c. 0.8125 ± 0.071 d. 0.8254 ± 0.079 e. 0.8253 ± 0.094

24. A random sample of 432 voters revealed that 100 are in favor of a certain bond issue. A 95 percent confidence interval for the proportion of the population of voters who are in favor of the bond issue is

a. $100 \pm 1.96\sqrt{\frac{0.5(0.5)}{432}}$ b. $100 \pm 1.645\sqrt{\frac{0.5(0.5)}{432}}$ c. $100 \pm 1.96\sqrt{\frac{0.231(0.769)}{432}}$

d. $0.231 \pm 1.96\sqrt{\frac{0.231(0.769)}{432}}$ e. $0.231 \pm 1.645\sqrt{\frac{0.231(0.769)}{432}}$

25. In 2009 a survey of Internet usage found that 79 percent of adults age 18 years and older in the United States use the Internet. A broadband company believes that the percent is greater now than it was in 2009 and will conduct a survey. The company plans to construct a 98 percent confidence interval to estimate the current percent and wants the margin of error to be no more than 2.5 percentage points. Assuming that at least 79 percent of adults use the Internet, which of the following should be used to find the sample size (n) needed?

a. $1.96\sqrt{\frac{(0.5)}{n}} \le 0.025$ b. $1.96\sqrt{\frac{(0.5)(0.5)}{n}} \le 0.025$ c. $2.33\sqrt{\frac{(0.5)(0.5)}{n}} \le 0.05$

d. $2.33\sqrt{\frac{(0.79)(0.21)}{n}} \le 0.025$ e. $2.33\sqrt{\frac{(0.79)(0.21)}{n}} \le 0.05$

26. When the sample size is increased what effect does this have on the size of the confidence interval?

a. It makes it wider. Depending on how much the sample is increased by, this will make the interval wider.
b. It will make the interval narrower. The larger the sample gets, the smaller the width of the interval.
c. It will have no effect on the width because this would only change based on the level of confidence.
d. It will double the width of the interval since you are now multiplying by and additional $\sqrt{n}$ size.
e. It will cut the interval in half since you are now dividing by an additional $\sqrt{n}$ size.

27. A community wants to see if there is enough support to hold a town children's festival. Forty-two percent of the 150 residents said they would participate in the event. What would be the approximate standard error for this sample proportion?

a. 0.03 b. 0.24 c. 0.02 d. 0.04 e. 0.002

28. Independent random samples of 100 luxury cars and 250 non-luxury cars in a certain city are examined to see if they have bumper stickers. Of the 250 non-luxury cars, 125 have bumper stickers and of the 100 luxury cars, 30 have bumper stickers. Which of the following is a 90 percent confidence interval for the difference in the proportion of non-luxury cars with bumper stickers and the proportion of luxury cars with bumper stickers from the population of cars represented by these samples?

a. $(0.5-0.3)\pm 1.645\sqrt{\frac{(0.5)(0.5)}{250}+\frac{(0.3)(0.7)}{100}}$

b. $(0.5-0.3)\pm 1.96\sqrt{\frac{(0.5)(0.5)}{250}+\frac{(0.3)(0.7)}{100}}$

c. $(0.5-0.3)\pm 1.645\sqrt{\left(\frac{155}{350}\right)\left(\frac{195}{350}\right)\left(\frac{1}{250}+\frac{1}{100}\right)}$

d. $(0.5-0.3)\pm 1.96\sqrt{\left(\frac{155}{350}\right)\left(\frac{195}{350}\right)\left(\frac{1}{250}+\frac{1}{100}\right)}$

e. $(0.5-0.3)\pm 1.645\sqrt{(0.4)(0.6)\left(\frac{1}{250}+\frac{1}{100}\right)}$

29. A marketing company wants to estimate the proportion of consumers in a certain region of the country who would react favorable to a new marketing campaign. Further, the company wants the estimate to have a margin of error of no more than 5 percent with 90 percent confidence. Of the following, which is closest to the minimum number of consumers needed to obtain the estimate with the desired precision?

a. 136 b. 271 c. 385 d. 542 e. 769

30. A consumer group just published a study stating that 72% of Americans believe corporations are not concerned about public safety, with a 90% confidence level and a margin of error of 2%. What does this mean?

a. If the poll were conducted again, there is a 90% probability that Americans who believe corporations are not concerned about safety are within a margin of error of 2%.
b. There is a 90% chance that the proportion of Americans who believe corporations aren't concerned with public safety is between 70% and 74%.
c. From 90% of all Americans, about 70% to 74% believe corporations are not concerned with public safety.
d. They are 90% confident that the true percentage of Americans who believe corporations are not concerned with public safety is between 70% and 74%.
e. Ninety out of 100 Americans who believe corporations are not concerned with public safety is 70% and 74% in repeated sampling.

31. An SRS of size 100 is taken from a population having proportion 0.8 successes. An independent SRS of size 400 is taken from a population having proportion 0.5 successes. The sampling distribution of the difference in sample proportions has what mean?

a. 0.3
b. 0.15
c. The smaller of 0.8 and 0.5
d. The mean cannot be determined without the sampling results.
e. None of the above. The answer is ______________________________.

32. A city is interested in building a waste management facility in a certain area. One hundred randomly selected residents from this area were asked, "Do you support the city's decision to build a waste management facility in your area?" Of the 100 residents interviewed, 54 said no, 4 said yes, and 42 had no opinion. A large sample z-confidence interval, $\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$, was constructed from these data to estimate the proportion of this area's residents who support building a waste management facility in their area. Which of the following statements is correct for this confidence interval?

a. This confidence interval is valid because a sample size of more than 30 was used.
b. This confidence interval is valid because each area resident was asked the same question.
c. The confidence interval is valid because no conditions are required for constructing a large sample confidence interval for a proportion.
d. This confidence interval is not valid because the quantity $n\hat{p}$ is too small.
e. This confidence interval is not valid because "no opinion" was included as a response category for the question.

33. A 95% confidence interval for the difference between two population proportions is found to be (0.07, 0.19). Which of the following statements are true?

I. It is unlikely that the two populations have the same proportions
II. We are 95% confident that the true difference between the population proportions is between 0.07 and 0.19.
III. The probability is 0.95 that the true difference between the population proportions is between 0.07 and 0.19

a. I only b. II only c. I and II only d. I and III only e. II and III only

Free Response

34. A large Midwestern forest planted by the CCC at the end of the depression is now too thick for safe tree growth and many sections are beginning to die. The state forestry commission has hired a lumber company to begin cutting down enough trees to allow the healthier trees to continue to grow. A sample of 204 trees found that 28% of the trees must be removed to allow further growth.

If the forestry commission wants to estimate the proportion of the total forest population that will need to be removed, calculate a 95% confidence interval to predict the amount of cutting that will occur.

35. A humane society wanted to estimate with 95 percent confidence the proportion of households in its county that own at least one dog.

(a) Interpret the 95 confidence level in this context.

The humane society selected a random sample of households in its county and used the sample to estimate the proportion of all households that own at least one dog. The conditions for calculating a 95 percent confidence interval for the proportion of households in this county that own at least one dog were checked and verified, and the resulting confidence interval was 0.417± 0.119.

(b) A national pet products association claimed that 39 percent of all American households owned at least one dog. Does the humane society's interval estimate provide evidence that the proportion of dog owners in its county is different from the claimed national proportion? Explain.

(c) How many households were selected in the humane society's sample? Show how you obtained your answer.

36. According to the *Almanac*, the percentage of adults 25 years of age and older who have completed 4 or more years of college are 23.6% for females and 27.8% for males. A random sample of women and men who were 25 years old or older was surveyed with these results. Estimate the true difference in proportions with 95% confidence and compare your interval with the *Almanac* statistics.

	Women	Men
Sample Size	350	400
No. who completed 4 or more years	100	115

Answer Key:

1. c 2. a 3. c 4. b 5. b 6. d 7. b 8. a 9. c 10. e 11. e 12. b 13. c 14. c 15. b

16. b 17. b 18. b 19. e 20. a 21. b 22. a 23. a 24. d 25. d 26. b 27. d 28. a 29.b 30. d

31. a 32. d 33. c

34. State: We are estimating the proportion (p) of trees from the forest the need to be removed with a 95% confidence interval.

Plan: We are creating a 1 sample z-interval for p
Random: We are assuming the 204 trees selected are a random sample, proceed with caution.
10%: 204 < .1 of all the trees in the forest (ok to assume this)
Large count: $204(0.28) = 57.12 \geq 10$, this is ok and $204(0.72) = 146.88 \geq 10$, this is ok

Do: (0.218, 0.341). Using technology: 1-Prop z interval (x = 28, n = 204, C level = 95)

Conclude: I am 95% confident that the true proportion of trees needing to be removed from the forest is between 21.8% and 34.1%.

35. a. The 95 percent confidence level means that if one were to repeatedly take random samples of the same size from the population and construct a 95 percent confidence interval from each sample, then in the long run 95 percent of those intervals would succeed in capturing the actual value of the population proportion of households in the county that own at least one dog.

b. No. The 95 percent confidence interval 0.417 ± 0.119 is the interval (0.298, 0.536). This interval includes the value 0.39 as a plausible value for the population proportion of households in the county that own at least one dog. Therefore, the confidence interval does not provide evidence that the proportion of dog owners in this county is different from the claimed national proportion.

c. The sample proportion is 0.417, and the margin of error is 0.119. Determining the sample size requires solving the equation $0.119 = 1.96 \times \sqrt{\frac{(0.417)(1-0.417)}{n}}$ for *n*.

Thus, $n = \frac{1.96^2(0.417)(1-0.417)}{0.119^2} \approx 65.95$, so the humane society must have selected 66 households for its sample.

36. State: We want to construct a 95% confidence the true difference $p_M - p_W$, in the proportions of men and women who have completed 4 or more years of college. p_M is the proportion of men 25 years or older who have completed 4 or more years of college and p_W is the proportion of women 25 years or older who have completed 4 or more years of college.
Plan: SRS -- State that the samples were randomly selected. 10% -- There are at least 10(400) men and 10(350) women 25 years or older in the population. Normal – 350(.286) = 100.1, 350(.714) = 249.9, 400(.288) = 115.2, and 400(.712) = 284.8 are all more than 10.
Do: (-.0666, .06308)
Conclude: We are 95% confident that interval -.0666 to .06308 captures the difference in the proportion of 25 or older men who complete 4 or more years of college with the proportion of 25 or older women who complete 4 or more years of college. The Almanac said that the difference is .278 - .236 = .042, since this is captured in our confidence interval we agree with the Almanac.