Chapter 8 CI's

1. 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.

2. A botanist collected one leaf at random from each of 10 randomly selected mature maple trees of the same species. The mean and the standard deviation of the surface areas for the 10 leaves in the sample were computed. Assume the distribution of surface areas of maple leaves is normal. What is the appropriate method for constructing a one-sample confidence interval to estimate the population mean surface area of the species of maple leaves, and why is the method appropriate?

(A) The *t*-interval is appropriate, because the population standard deviation is not known. ✓

(B) The *t*-interval is appropriate, because the *t*-interval is narrower than the *z*-interval.

(C) The *z*-interval is appropriate, because the *z*-interval is narrower than the *t*-interval.

(D) The *z*-interval is appropriate, because the central limit theorem applies.

(E) The *z*-interval is appropriate, because the sample standard deviation is known.

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3. A commercial for a breakfast cereal is shown during a certain television program. The manufacturer of the cereal wants to estimate the percent of television viewers who watch the program. The manufacturer wants the estimate to have a margin of error of at most 0.02 at a level of 95 percent confidence. Of the following, which is the smallest sample size that will satisfy the manufacturer's requirements?

(A) 40

(B) 50

(C) 100

(D) 1,700

(E) 2,500 ✓

Handwritten work:

$ME = 0.02$
$CL = 95\%$
$Z^* = 1.96$
$\hat{P} = \frac{1}{2}$

$.02 = 1.96\sqrt{\dfrac{(.5)(.5)}{n}}$

$\dfrac{.02\sqrt{n}}{.02} = \dfrac{1.96(.5)}{.02}$

$n = 2401$ ← this is the smallest n

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4. 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.

Handwritten work:

$PL = \dfrac{.048 + .112}{2} = 0.08$

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5. A medical center conducted a study to investigate cholesterol levels in people who have had heart attacks. A random sample of 16 people was obtained from the names of all patients of the medical center who had a heart attack in the previous year. Of the people in the sample, the mean cholesterol level was 264.70 milligrams per deciliter (mg/dL) with standard deviation 42.12 mg/dL. Assuming all conditions for inference were met, which of the following is a 90 percent confidence interval for the mean cholesterol level, in mg/dL, of all patients of the medical center who had a heart attack in the previous year?

(A) $(242.26, 287.14)$

(B) $(244.06, 285.34)$

✓ (C) $(246.24, 283.16)$ ✔

(D) $(247.38, 282.02)$

(E) $(260.09, 269.31)$

Handwritten annotations:
$n = 16$ 90% CL
$\bar{X} = 264.70$ [CALC] t-interval
$S_x = 42.12$


6. A news organization conducted a survey about preferred methods for obtaining the news. A random sample of 1,605 adults living in a certain state was selected, and 16.2 percent of the adults in the sample reported that television was their preferred method. Which of the following is an appropriate margin of error for a 90 percent confidence interval to estimate the population proportion of all adults living in the state who would report that television is their preferred method for obtaining the news?

Handwritten annotations:
$n = 1605$
$\hat{p} = 16.2\% = .162$ → $x =$
$CL = .90$
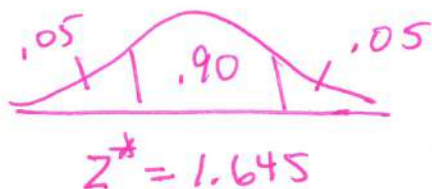
.05   .90   .05
$z^* = 1.645$ Fill in formula

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(A) $1.645\sqrt{\dfrac{(0.162)(1-0.162)}{1,605}}$ ✔

(B) $1.645\sqrt{\dfrac{(0.5)(1-0.5)}{1,605}}$

(C) $1.96\sqrt{\dfrac{(0.162)(1-0.162)}{1,605}}$

(D) $1.96\sqrt{\dfrac{(0.5)(1-0.5)}{1,605}}$

(E) $1.83\sqrt{\dfrac{(0.162)(1-0.162)}{1,605}}$

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7. 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.

95% CI [.516, .524]

(B) There is a 95% chance that Smith will win.

*Need 50% TO WIN
ITS NOT IN THIS*

(C) The poll predicts Smith will win, but there is a 5% chance that the prediction is incorrect due to *INTERVAL* 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. ✔

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8. A polling agency conducted a survey by selecting 100 random samples, each consisting of 1,200 United States citizens. The citizens in each sample were asked whether they were optimistic about the economy. For each sample, the polling agency created a 95 percent confidence interval for the proportion of all United States citizens who were optimistic about the economy. Which of the following statements is the best interpretation of the 95 percent confidence level?

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8. **(A)** With 100 confidence intervals, we can be 95% confident that the sample proportion of citizens of the United States who are optimistic about the economy is correct. ✗

   (B) We would expect about 95 of the 100 confidence intervals to contain the proportion of all citizens of the United States who are optimistic about the economy. ✓

   (C) We would expect about 5 of the 100 confidence intervals to <u>not</u> contain the sample proportion of citizens of the United States who are optimistic about the economy. ✗

   (D) Of the 100 confidence intervals, 95 of the intervals will be identical because they were constructed from samples of the same size of 1,200. ✗

   (E) The probability is 0.95 that 100 confidence intervals will yield the same information about the sample proportion of citizens of the United States who are optimistic about the economy. ✗

9. A polling agency reported that 66 percent of adults living in the United States were satisfied with their health care plans. The estimate was taken from a random sample of 1,542 adults living in the United States, and the 95 percent confidence interval for the population proportion was calculated as (0.636, 0.684). Which of the following statements is a correct interpretation of the 95 percent confidence level?

   BY DEFINITION

   (A) The probability is 0.95 that the percent of adults living in the United States who are satisfied with their health care plans is between 63.6% and 68.4%.

   (B) Approximately 95% of random samples of the same size from the population will result in a confidence interval that includes the proportion of all adults living in the United States who are satisfied with their health care plans. ✓

   (C) Approximately 95% of random samples of the same size from the population will result in a confidence interval that includes the proportion of all adults in the sample who are satisfied with their health care plans.

   (D) Approximately 95% of all random samples of adults living in the United States will indicate that between 63.6% and 68.4% of the adults are satisfied with their health care plans.

   (E) Approximately 95% of all random samples of adults living in the United States will result in a sample proportion of 0.66 adults living in the United States who are satisfied with their health care plans.

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10. 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) $0.4 \pm 2.33 \sqrt{\dfrac{(0.4)(0.6)}{300}}$

$\hat{p} = \dfrac{180}{300} = .60$

(B) $0.4 \pm 1.96 \sqrt{\dfrac{(0.4)(0.6)}{300}}$

(C) $0.6 \pm 2.33 \sqrt{\dfrac{(0.6)(0.4)}{300}}$ ✓

(D) $0.6 \pm 1.96 \sqrt{\dfrac{(0.6)(0.4)}{300}}$

(E) $0.6 \pm 2.05 \sqrt{\dfrac{(0.6)(0.4)}{300}}$

.01   .98   .01

$z^* = \pm 2.326$

11. A random sample of 50 students at a large high school resulted in a 95 percent confidence interval for the mean number of hours of sleep per day of (6.73, 7.67). Which of the following statements best summarizes the meaning of this confidence interval?

DEFINITION

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(A) About 95% of all random samples of 50 students from this population would result in a 95% confidence interval of (6.73, 7.67).

(B) About 95% of all random samples of 50 students from this population would result in a 95% confidence interval that covered the population mean number of hours of sleep per day. ✓

(C) 95% of the students in the survey reported sleeping between 6.73 and 7.67 hours per day.

(D) 95% of the students in this high school sleep between 6.73 and 7.67 hours per day.

(E) A student selected at random from this population sleeps between 6.73 and 7.67 hours per day for 95% of the time.

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12. A random sample of the costs of repair jobs at a large muffler repair shop produces a mean of $127.95. and a standard deviation of $24.03. If the size of this sample is 40, which of the following is an approximate 90 percent confidence interval for the average cost of a repair at this repair shop?

$\overline{X} = \$127.95$ $CL = 90\%$

$S_X = \$24.03$ $n = 40$ $df = 39$

(A) $127.95 ± $4.87

(B) $127.95 ± $6.25 ✓

(C) $127.95 ± $7.45

$t^* = ±1.68$

(D) $127.95 ± $30.81

$ME = 1.68 \left(\dfrac{24.03}{\sqrt{40}} \right) = 6.383$ ✓

(E) $127.95 ± $39.53

$z^* = 1.645?$

---

13. 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?

DEFINITION

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(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.

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14. A survey was conducted to determine what percentage of college seniors would have chosen to attend a different college if they had known then what they know now. In a random sample of 100 seniors, 34 percent indicated that they would have attended a different college. A 90 percent confidence interval for the percentage of all seniors who would have attended a different college is

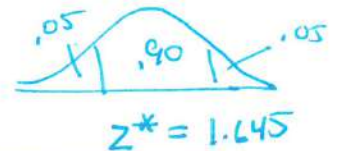(A) 24.7% to 43.3%

(B) 25.8% to 42.2%

(C) 26.2% to 41.8% ✓

(D) 30.6% to 37.4%

(E) 31.2% to 36.8%

$n = 100$

$\hat{p} = .34 \quad x = 34$

$CL = .90$

$z^* = 1.645$

CALC   1 PROP Z INTERVAL

$[.262, .418]$

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15. Ecologists wanted to estimate the mean biomass (amount of vegetation) of a certain forested region. The ecologists divided the region into plots measuring 1 square meter each, and they selected a random sample of 9 plots. The mean biomass of the 9 plots was 4.3 kilograms per square meter (kg/m^2) and the standard deviation was 1.5 kg/m^2 . Assuming all conditions for inference are met, which of the following is a 95 percent confidence interval for the population mean biomass, in kg/m^2 ?
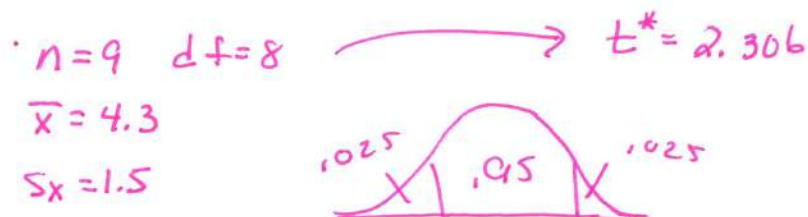
$n=9$ $df=8$ $\longrightarrow$ $t^* = 2.306$
$\bar{x} = 4.3$
$S_x = 1.5$

.025   .025   .95

(A) $4.3 \pm 1.96 \left(\frac{\sqrt{1.5}}{3} \right)$

(B) $4.3 \pm 1.96 \left(\frac{1.5}{3} \right)$

(C) $4.3 \pm 2.306 \left(\frac{\sqrt{1.5}}{9} \right)$

(D) $4.3 \pm 2.306 \left(\frac{1.5}{9} \right)$

(E) $4.3 \pm 2.306 \left(\frac{1.5}{3} \right)$ ✓

$\sqrt{9}$

16. 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?

$CL = .98$
$ME = 2.5\% = .025$
use $\hat{p} = .79$

.01   .98   .01

$Z^* = \pm 2.326$
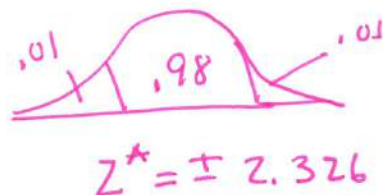
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(A) $1.96\sqrt{\dfrac{(0.5)}{n}} \le 0.025$ ✓

(B) $1.96\sqrt{\dfrac{(0.5)(0.5)}{n}} \le 0.025$

(C) $2.33\sqrt{\dfrac{(0.5)(0.5)}{n}} \le 0.05$

(D) $2.33\sqrt{\dfrac{(0.79)(0.21)}{n}} \le 0.025$ ✓ ✓ ✓ ✓

(E) $2.33\sqrt{\dfrac{(0.79)(0.21)}{n}} \le 0.05$

---

17. Jessica wanted to determine if the proportion of males for a certain species of laboratory animal is less than 0.5. She was given access to appropriate records that contained information on 12,000 live births for the species. To construct a 95 percent confidence interval, she selected a simple random sample of 100 births from the records and found that 31 births were male.

Based on the study, which of the following expressions is an approximate 95 percent confidence interval estimate for p, the proportion of males in the 12,000 live births?
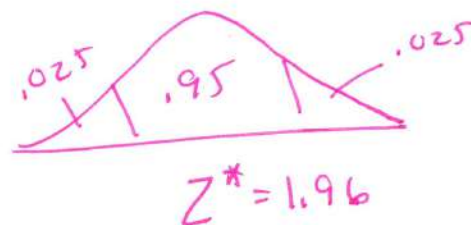
$N = 1,200$ $CL = .95$

$n = 100$

$x = 31$

$\hat{p} = .31$

$.025 \quad .95 \quad .025$
$Z^* = 1.96$

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(A) $0.31 \pm 1.96\sqrt{\dfrac{(0.31)(0.69)}{12,000}}$

(B) $0.31 \pm 1.645\sqrt{\dfrac{(0.31)(0.69)}{12,000}}$

(C) $0.31 \pm 1.96\sqrt{\dfrac{(0.5)(0.5)}{12,000}}$

(D) $0.31 \pm 1.645\sqrt{\dfrac{(0.5)(0.5)}{100}}$

(E) $0.31 \pm 1.96\sqrt{\dfrac{(0.31)(0.69)}{100}}$ ✓

18. Monthly rent was determined for each apartment in a random sample of 100 apartments. The sample mean was $820 and the sample standard deviation was $25. An approximate 95 percent confidence interval for the true mean monthly rent for the population of apartments from which this sample was selected is ($815, $825). Which of the following statements is a correct interpretation of the 95 percent confidence level?

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(A) In this population, about 95 percent of all rental prices are between $815 and $825.

(B) In this sample, about 95 percent of the 100 rental prices are between $815 and $825.

✓ (C) In repeated sampling, the method produces intervals that include the population mean approximately 95 percent of the time. ✓

(D) In repeated sampling, the method produces intervals that include the sample mean approximately 95 percent of the time.

(E) There is a probability of 0.95 that the true mean is between $815 and $825.

---

19. The management team of a company with 10,000 employees is considering installing charging stations for electric cars in the company parking lots. In a random sample of 500 employees, 15 reported owning an electric car. Which of the following is a 99 percent confidence interval for the proportion of all employees at the company who own an electric car?
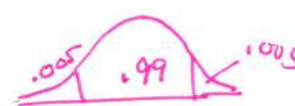
(A) $0.03 \pm 2.326\sqrt{\dfrac{(0.03)(0.97)}{500}}$

$n = 500$ $\hat{p} = \dfrac{15}{500} = .03$

$X = 15$

(B) $0.15 \pm 2.326\sqrt{\dfrac{(0.15)(0.85)}{500}}$

$CL = .99$

✓ (C) $0.03 \pm 2.576\sqrt{\dfrac{(0.03)(0.97)}{500}}$ ✓

$Z^* = 2.576$

(D) $0.15 \pm 2.576\sqrt{\dfrac{(0.15)(0.85)}{500}}$

(E) $0.03 \pm 2.576\sqrt{\dfrac{(0.03)(0.97)}{500} + \dfrac{(0.03)(0.97)}{10,000}}$

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20. 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?
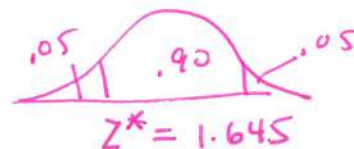
$ME = .06$ $CL = .90$

(A) 100

(B) 125

$$.06 = 1.645 \sqrt{\frac{(.5)(.5)}{n}}$$

$Z^* = 1.645$

(C) 150

$$\frac{.06\sqrt{n}}{.06} = \frac{1.645(.5)}{.06}$$

(D) 200 $n = 187.9$ ✓

(E) 275

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21. The National Honor Society at Central High School plans to sample a random group of 100 seniors from all high schools in the state in which Central High School is located to determine the average number of hours per week spent on homework. A 95 percent confidence interval for the mean number of hours spent on homework will then be constructed using the sample data. Before selecting the sample, the National Honor Society decides that it wants to decrease the margin of error. Which of the following is the best way to decrease the margin of error?

(A) Increase the confidence level to 99%

(B) Use the population standard deviation

(C) Use the sample standard deviation

(D) Increase the sample size ✓

(E) Decrease the sample size

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22. *USA Today* reported that speed skater Bonnie Blair had "won the USA's heart," according to a *USA Today*/CNN/Gallup poll conducted on the final Thursday of the 1994 Winter Olympics. When asked who was the hero of the Olympics, 65 percent of the respondents chose Blair, who won five gold medals. The poll of 615 adults, done by telephone, had a margin of error of 4 percent. Which of the following statements best describes what is meant by the 4 percent margin of error?

(A) About 4 percent of adults were expected to change their minds between the time of the poll and its publication in *USA Today*.

(B) About 4 percent of adults did not have telephones.

(C) About 4 percent of the 615 adults polled refused to answer.

(D) Not all of the 615 adults knew anything about the Olympics.

(E) The difference between the sample percentage and the population percentage is likely to be less than 4 percent. ✓