

Questions on Topic Thirteen: Confidence Intervals

Multiple-Choice Questions

Directions: The questions or incomplete statements that follow are each followed by five suggested answers or completions. Choose the response that best answers the question or completes the statement.

1. Changing from a 95% confidence interval estimate for a population proportion to a 99% confidence interval estimate, with all other things being equal,
 - (A) increases the interval size by 4%.
 - (B) decreases the interval size by 4%.
 - (C) increases the interval size by 31%.
 - (D) decreases the interval size by 31%.
 - (E) This question cannot be answered without knowing the sample size.
2. In general, how does doubling the sample size change the confidence interval size?
 - (A) Doubles the interval size
 - (B) Halves the interval size
 - (C) Multiplies the interval size by 1.414
 - (D) Divides the interval size by 1.414
 - (E) This question cannot be answered without knowing the sample size.
3. A confidence interval estimate is determined from the GPAs of a simple random sample of n students. All other things being equal, which of the following will result in a smaller margin of error?
 - (A) A smaller confidence level
 - (B) A larger sample standard deviation
 - (C) A smaller sample size
 - (D) A larger population size
 - (E) A smaller sample mean

4. A survey was conducted to determine the percentage of high school students who planned to go to college. The results were stated as 82% with a margin of error of $\pm 5\%$. What is meant by $\pm 5\%$?

- (A) Five percent of the population were not surveyed.
- (B) In the sample, the percentage of students who plan to go to college was between 77% and 87%.
- (C) The percentage of the entire population of students who plan to go to college is between 77% and 87%.
- (D) It is unlikely that the given sample proportion result would be obtained unless the true percentage was between 77% and 87%.
- (E) Between 77% and 87% of the population were surveyed.

5. Most recent tests and calculations estimate at the 95% confidence level that the maternal ancestor to all living humans called mitochondrial Eve lived 273,000 $\pm 177,000$ years ago. What is meant by "95% confidence" in this context?

- (A) A confidence interval of the true age of mitochondrial Eve has been calculated using z -scores of ± 1.96 .
- (B) A confidence interval of the true age of mitochondrial Eve has been calculated using t -scores consistent with $df = n - 1$ and tail probabilities of ± 0.025 .
- (C) There is a .95 probability that mitochondrial Eve lived between 96,000 and 450,000 years ago.
- (D) If 20 random samples of data are obtained by this method, and a 95% confidence interval is calculated from each, then the true age of mitochondrial Eve will be in 19 of these intervals.
- (E) 95% of all random samples of data obtained by this method will yield intervals that capture the true age of mitochondrial Eve.

6. One month the actual unemployment rate in France was 13.4%. If during that month you took an SRS of 100 Frenchmen and constructed a confidence interval estimate of the unemployment rate, which of the following would have been true?

- (A) The center of the interval was 13.4.
- (B) The interval contained 13.4.
- (C) A 99% confidence interval estimate contained 13.4.
- (D) The z -score of 13.4 was between ± 2.576 .
- (E) None of the above are true statements.

7. In a recent Zogby International survey, 11% of 10,000 Americans under 50 said they would be willing to implant a device in their brain to be connected to the Internet if it could be done safely. What is the margin of error at the 99% confidence level?

(A) $\pm \sqrt{\frac{(1,100)(8,900)}{10,000}}$

(B) $\pm 1.96 \frac{.5}{\sqrt{10,000}}$

(C) $\pm 2.576 \frac{\sqrt{(.11)(.89)}}{10,000}$

(D) $\pm 1.96 \sqrt{\frac{(.11)(.89)}{10,000}}$

(E) $\pm 2.576 \sqrt{\frac{(.11)(.89)}{10,000}}$

8. The margin of error in a confidence interval estimate using z-scores covers which of the following?

- (A) Sampling variability
- (B) Errors due to undercoverage and nonresponse in obtaining sample survey
- (C) Errors due to using sample standard deviations as estimates for population standard deviations
- (D) Type I errors
- (E) Type II errors

9. In an SRS of 50 teenagers, two-thirds said they would rather text a friend than call. What is the 98% confidence interval for the proportion of teens who would rather text than call a friend?

(A) $\frac{2}{3} \pm 1.96 \sqrt{\frac{(2/3)(1/3)}{50}}$

(B) $\frac{2}{3} \pm 2.326 \sqrt{\frac{(2/3)(1/3)}{50}}$

(C) $\frac{2}{3} \pm 2.405 \sqrt{\frac{(2/3)(1/3)}{50}}$

(D) $\frac{2}{3} \pm 1.96 \sqrt{\frac{(2/3)(1/3)}{50}}$

(E) $\frac{2}{3} \pm 2.326 \sqrt{\frac{(2/3)(1/3)}{50}}$

10. In a survey funded by Burroughs-Wellcome, 750 of 1000 adult Americans said they didn't believe they could come down with a sexually transmitted disease (STD). Construct a 95% confidence interval estimate of the proportion of adult Americans who don't believe they can contract an STD.
(A) (.728, .772)
(B) (.723, .777)
(C) (.718, .782)
(D) (.713, .787)
(E) (.665, .835)
11. A 1993 *Los Angeles Times* poll of 1703 adults revealed that only 17% thought the media was doing a "very good" job. With what degree of confidence can the newspaper say that $17\% \pm 2\%$ of adults believe the media is doing a "very good" job?
(A) 72.9%
(B) 90.0%
(C) 95.0%
(D) 97.2%
(E) 98.6%
12. A politician wants to know what percentage of the voters support her position on the issue of forced busing for integration. What size voter sample should be obtained to determine with 90% confidence the support level to within 4%?
(A) 21
(B) 25
(C) 423
(D) 600
(E) 1691
13. In a *New York Times* poll measuring a candidate's popularity, the newspaper claimed that in 19 of 20 cases its poll results should be no more than three percentage points off in either direction. What confidence level are the pollsters working with, and what size sample should they have obtained?
(A) 3%, 20
(B) 6%, 20
(C) 6%, 100
(D) 95%, 33
(E) 95%, 1068

14. In an SRS of 80 teenagers, the average number of texts handled in a day was 50 with a standard deviation of 15. What is the 96% confidence interval for the average number of texts handled by teens daily?
- (A) $50 \pm 2.054(15)$
- (B) $50 \pm 2.054 \frac{15}{\sqrt{79}}$
- (C) $50 \pm 2.054 \frac{15}{\sqrt{80}}$
- (D) $50 \pm 2.088 \frac{15}{\sqrt{79}}$
- (E) $50 \pm 2.088 \frac{15}{\sqrt{80}}$
15. One gallon of gasoline is put in each of 30 test autos, and the resulting mileage figures are tabulated with $\bar{x} = 28.5$ and $s = 1.2$. Determine a 95% confidence interval estimate of the mean mileage.
- (A) (28.46, 28.54)
- (B) (28.42, 28.58)
- (C) (28.1, 28.9)
- (D) (27.36, 29.64)
- (E) (27.3, 29.7)
16. The number of accidents per day at a large factory is noted for each of 64 days with $\bar{x} = 3.58$ and $s = 1.52$. With what degree of confidence can we assert that the mean number of accidents per day at the factory is between 3.20 and 3.96?
- (A) 48%
- (B) 63%
- (C) 90%
- (D) 95%
- (E) 99%
17. A company owns 335 trucks. For an SRS of 30 of these trucks, the average yearly road tax paid is \$9540 with a standard deviation of \$1205. What is a 99% confidence interval estimate for the total yearly road taxes paid for the 335 trucks?
- (A) $\$9540 \pm \103
- (B) $\$9540 \pm \567
- (C) $\$3,196,000 \pm \606
- (D) $\$3,196,000 \pm \$35,000$
- (E) $\$3,196,000 \pm \$203,000$

18. What sample size should be chosen to find the mean number of absences per month for school children to within ± 2 at a 95% confidence level if it is known that the standard deviation is 1.1?
- (A) 11
(B) 29
(C) 82
(D) 96
(E) 117
19. Hospital administrators wish to learn the average length of stay of all surgical patients. A statistician determines that, for a 95% confidence level estimate of the average length of stay to within ± 0.5 days, 50 surgical patients' records will have to be examined. How many records should be looked at to obtain a 95% confidence level estimate to within ± 0.25 days?
- (A) 25
(B) 50
(C) 100
(D) 150
(E) 200
20. The National Research Council of the Philippines reported that 210 of 361 members in biology are women, but only 34 of 86 members in mathematics are women. Establish a 95% confidence interval estimate of the difference in proportions of women in biology and women in mathematics in the Philippines.
- (A) $.187 \pm .115$
(B) $.187 \pm .154$
(C) $.395 \pm .103$
(D) $.543 \pm .154$
(E) $.582 \pm .051$
21. In a simple random sample of 300 elderly men, 65% were married, while in an independent simple random sample of 400 elderly women, 48% were married. Determine a 99% confidence interval estimate for the difference between the proportions of elderly men and women who are married.
- (A) $(.65 - .48) \pm 2.326 \sqrt{\frac{(.65)(.35)}{300} + \frac{(.48)(.52)}{400}}$
(B) $(.65 - .48) \pm 2.576 \sqrt{\frac{(.65)(.35)}{300} + \frac{(.48)(.52)}{400}}$
(C) $(.65 - .48) \pm 2.576 \left(\frac{(.65)(.35)}{\sqrt{300}} + \frac{(.48)(.52)}{\sqrt{400}} \right)$
(D) $\left(\frac{.65 + .48}{2} \right) \pm 2.576 \sqrt{\frac{(.65)(.35)}{300} + \frac{(.48)(.52)}{400}}$
(E) $\left(\frac{.65 + .48}{2} \right) \pm 2.807 \sqrt{(.565)(.435) \left(\frac{1}{300} + \frac{1}{400} \right)}$

22. A researcher plans to investigate the difference between the proportion of psychiatrists and the proportion of psychologists who believe that most emotional problems have their root causes in childhood. How large a sample should be taken (same number for each group) to be 90% certain of knowing the difference to within ± 0.03 ?

(A) 39
 (B) 376
 (C) 752
 (D) 1504
 (E) 3007

23. In a study aimed at reducing developmental problems in low-birth-weight (under 2500 grams) babies (*Journal of the American Medical Association*, June 13, 1990, page 3040), 347 infants were exposed to a special educational curriculum while 561 did not receive any special help. After 3 years the children exposed to the special curriculum showed a mean IQ of 93.5 with a standard deviation of 19.1; the other children had a mean IQ of 84.5 with a standard deviation of 19.9. Find a 95% confidence interval estimate for the difference in mean IQs of low-birth-weight babies who receive special intervention and those who do not.

(A) $(93.5 - 84.5) \pm 1.97 \sqrt{\frac{(19.1)^2}{347} + \frac{(19.9)^2}{561}}$

(B) $(93.5 - 84.5) \pm 1.97 \left(\frac{19.1}{\sqrt{347}} + \frac{19.9}{\sqrt{561}} \right)$

(C) $(93.5 - 84.5) \pm 1.65 \sqrt{\frac{(19.1)^2}{347} + \frac{(19.9)^2}{561}}$

(D) $(93.5 - 84.5) \pm 1.65 \left(\frac{19.1}{\sqrt{347}} + \frac{19.9}{\sqrt{561}} \right)$

(E) $(93.5 - 84.5) \pm 1.65 \sqrt{\frac{(19.1)^2 + (19.9)^2}{347 + 561}}$

24. Does socioeconomic status relate to age at time of HIV infection? For 274 high-income HIV-positive individuals the average age of infection was 33.0 years with a standard deviation of 6.3, while for 90 low-income individuals the average age was 28.6 years with a standard deviation of 6.3 (*The Lancet*, October 22, 1994, page 1121). Find a 90% confidence interval estimate for the difference in ages of high- and low-income people at the time of HIV infection.

(A) 4.4 ± 0.963
 (B) 4.4 ± 1.26
 (C) 4.4 ± 2.51
 (D) 30.8 ± 2.51
 (E) 30.8 ± 6.3

25. An engineer wishes to determine the difference in life expectancies of two brands of batteries. Suppose the standard deviation of each brand is 4.5 hours. How large a sample (same number) of each type of battery should be taken if the engineer wishes to be 90% certain of knowing the difference in life expectancies to within 1 hour?
- (A) 10
(B) 55
(C) 110
(D) 156
(E) 202
26. Two confidence interval estimates from the same sample are (16.4, 29.8) and (14.3, 31.9). What is the sample mean, and if one estimate is at the 95% level while the other is at the 99% level, which is which?
- (A) $\bar{x} = 23.1$; (16.4, 29.8) is the 95% level.
(B) $\bar{x} = 23.1$; (16.4, 29.8) is the 99% level.
(C) It is impossible to completely answer this question without knowing the sample size.
(D) It is impossible to completely answer this question without knowing the sample standard deviation.
(E) It is impossible to completely answer this question without knowing both the sample size and standard deviation.
27. Two 90% confidence interval estimates are obtained: I (28.5, 34.5) and II (30.3, 38.2).
- a. If the sample sizes are the same, which has the larger standard deviation?
b. If the sample standard deviations are the same, which has the larger size?
- (A) a. I b. I
(B) a. I b. II
(C) a. II b. I
(D) a. II b. II
(E) More information is needed to answer these questions.
28. Suppose (25, 30) is a 90% confidence interval estimate for a population mean μ . Which of the following are true statements?
- (A) There is a .90 probability that \bar{x} is between 25 and 30.
(B) 90% of the sample values are between 25 and 30.
(C) There is a .90 probability that μ is between 25 and 30.
(D) If 100 random samples of the given size are picked and a 90% confidence interval estimate is calculated from each, then μ will be in 90 of the resulting intervals.
(E) If 90% confidence intervals are calculated from all possible samples of the given size, μ will be in 90% of these intervals.

29. Under what conditions would it be meaningful to construct a confidence interval estimate when the data consist of the entire population?
- (A) If the population size is small ($n < 30$)
 - (B) If the population size is large ($n \geq 30$)
 - (C) If a higher level of confidence is desired
 - (D) If the population is truly random
 - (E) Never
30. A social scientist wishes to determine the difference between the percentage of Los Angeles marriages and the percentage of New York marriages that end in divorce in the first year. How large a sample (same for each group) should be taken to estimate the difference to within ± 0.07 at the 94% confidence level?
- (A) 181
 - (B) 361
 - (C) 722
 - (D) 1083
 - (E) 1443
31. What is the critical t -value for finding a 90% confidence interval estimate from a sample of 15 observations?
- (A) 1.341
 - (B) 1.345
 - (C) 1.350
 - (D) 1.753
 - (E) 1.761
32. Acute renal graft rejection can occur years after the graft. In one study (*The Lancet*, December 24, 1994, page 1737), 21 patients showed such late acute rejection when the ages of their grafts (in years) were 9, 2, 7, 1, 4, 7, 9, 6, 2, 3, 7, 6, 2, 3, 1, 2, 3, 1, 1, 2, and 7, respectively. Establish a 90% confidence interval estimate for the ages of renal grafts that undergo late acute rejection.
- (A) 2.024 ± 0.799
 - (B) 2.024 ± 1.725
 - (C) 4.048 ± 0.799
 - (D) 4.048 ± 1.041
 - (E) 4.048 ± 1.725

33. Nine subjects, 87 to 96 years old, were given 8 weeks of progressive resistance weight training (*Journal of the American Medical Association*, June 13, 1990, page 3032). Strength before and after training for each individual was measured as maximum weight (in kilograms) lifted by left knee extension:

Before:	3	3.5	4	6	7	8	8.5	12.5	15
After:	7	17	19	12	19	22	28	20	28

Find a 95% confidence interval estimate for the strength gain.

- (A) 11.61 ± 3.03
 (B) 11.61 ± 3.69
 (C) 11.61 ± 3.76
 (D) 19.11 ± 1.25
 (E) 19.11 ± 3.69
34. A catch of five fish of a certain species yielded the following ounces of protein per pound of fish: 3.1, 3.5, 3.2, 2.8, and 3.4. What is a 90% confidence interval estimate for ounces of protein per pound of this species of fish?
- (A) 3.2 ± 0.202
 (B) 3.2 ± 0.247
 (C) 3.2 ± 0.261
 (D) 4.0 ± 0.202
 (E) 4.0 ± 0.247
35. In a random sample of 25 professional baseball players, their salaries (in millions of dollars) and batting averages result in the following regression analysis:

The regression equation is $\text{Batting} = 0.234 + 0.00805 \text{ Salary}$

Predictor	Coef	SE Coef	T	P
Constant	0.233577	0.005883	39.70	0.000
Salary	0.008051	0.001058	7.61	0.000

$S = 0.0169461$ $R\text{-Sq} = 71.6\%$ $R\text{-Sq}(\text{adj}) = 70.3\%$

Which of the following gives a 98% confidence interval for the slope of the regression line?

- (A) $0.008051 \pm 2.326(0.001058)$
 (B) $0.008051 \pm 2.326(0.0169461)$
 (C) $0.008051 \pm 2.485 \left(\frac{0.001058}{\sqrt{25}} \right)$
 (D) $0.008051 \pm 2.492 \left(\frac{0.0169461}{\sqrt{25}} \right)$
 (E) $0.008051 \pm 2.500(0.001058)$