1. In a random sample of 1,250 adult drivers, 450 said that they would cut their driving by 10 percent if this significantly helped the environment. Find a 95 percent confidence interval estimate of the proportion of adult drivers who are willing to cut their driving by 10 percent to help the environment.

(A) $0.36 \pm 1.96 \dfrac{(0.10)(0.36)}{\sqrt{1,250}}$

(B) $0.36 \pm 1.96 \sqrt{\dfrac{(0.10)(0.90)}{1,250}}$

(C) $0.36 \pm 1.96 \dfrac{(0.10)(0.90)}{\sqrt{1,250}}$

(D) $0.36 \pm 1.96 \sqrt{\dfrac{(0.36)(0.64)}{1,250}}$

(E) $0.36 \pm 1.96 \dfrac{\sqrt{(0.36)(0.64)}}{1,250}$

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 2007 survey of 980 American drivers concluded that 38 percent of the driving population would be willing to pay higher gas prices to protect the environment. Which of the following best describes what is meant by the poll having a margin of error of 3 percent?
(A) Three percent of those surveyed refused to participate in the poll.
(B) It would not be unexpected for 3 percent of the population to readily agree to the higher gas prices.
(C) Between 343 and 402 of the 980 drivers surveyed responded that they would be willing to pay higher gas prices to protect the env1ronment.
(D) If a similar survey of 980 American drivers was taken weekly, a 3 percent change in each week's results would not be unexpected.
(E) It is likely that between 35 percent and 41 percent of the driving population would be willing to pay higher gas pr1ces to protect the environment.

4. A guidance counselor wishes to determine the mean number of changes in academic major by college students to within ±0.1 at a 90 percent confidence level. What sample size should be chosen if it is known that the standard deviation is 0.45?
(A) 8
(B) 54
(C) 55
(D) 78
(E) 110

5. A confidence interval estimate is determined from the summer earnings of an SRS of n students. All other things being equal, which of the following will result in a smaller margin of error?
(A) A greater confidence level
(B) A larger sample standard deviation
(C) A larger sample size
(D) Accepting less precision
(E) Introducing bias into sampling

6. Two confidence interval estimates from the same sample are (72.2, 77.8) and 71.3, 78.7). One estimate is at the 95 percent level, and the other is at the 99 percent level. Which is which?
(A) (72.2, 77.8) is the 95 percent level.
(B) (72.2, 77.8) is the 99 percent level.
(C) This question cannot be answered without knowing the sample size.
(D) This question cannot be answered without knowing the sample standard deviation.
(E) This question cannot be answered without knowing both the sample size and standard deviation.

7. The acceptance rate at a particular college is 58 percent. If one takes an SRS of applicants to this college and constructs a confidence interval estimate of the acceptance rate, which of the following statements is true?
(A) The center of the interval would be 58 percent.
(B) The interval would contain 58 percent.
(C) A 99 percent confidence interval estimate would contain 58 percent.
(D) All of the above are true statements.
(E) None of the above are true statements.

8. Should there be more restrictions on handguns? In a 1995 pre-Columbine survey, 255 out of 1,020 adults answered in the affirmative; in a 2000 post-Columbine survey, 352 out of 1,100 answered affirmatively. Establish a 90 percent confidence interval estimate of the difference between the proportions of adults in 1995 and 2000 who support more restrictions on handguns.

(A) $(0.25-0.32)\pm1.645\sqrt{\dfrac{0.25(0.75)}{1,020}+\dfrac{0.32(0.68)}{1,100}}$

(B) $(0.25-0.32)\pm1.645\left(\dfrac{0.25(0.75)}{\sqrt{1,020}}+\dfrac{0.32(0.68)}{\sqrt{1,100}}\right)$

(C) $(0.25-0.32)\pm1.96\sqrt{\dfrac{0.25(0.75)}{1,020}+\dfrac{0.32(0.68)}{1,100}}$

(D) $(0.25-0.32)\pm1.96\left(\dfrac{0.25(0.75)}{\sqrt{1,020}}+\dfrac{0.32(0.68)}{\sqrt{1,100}}\right)$

(E)

$(0.25-0.32)\pm2.576\left(\dfrac{\sqrt{0.25(0.75)}}{1,020}+\dfrac{\sqrt{0.32(0.68)}}{1,100}\right)$

9. 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 $(n\geq30)$
(C) If a higher level of confidence is desired
(D) If the population is truly random
(E) Never

10. The number of 911 calls per day in a small Midwestern town is noted for a sample of 60 days with $\bar{x}=23.4$ and $s=3.7$. With what degree of confidence can we assert that the mean number of 911 calls per day in this town is between 22.4 and 24.4?
(A) 48 percent
(B) 90 percent
(C) 95 percent
(D) 96 percent
(E) 99 percent

11. A survey is to be taken to estimate the proportion of voters who favor stem cell research. Among the following proposed sample sizes, which is the smallest that will still guarantee a margin of error of at most 0.035 for a 96 percent confidence interval?
(A) 30
(B) 784
(C) 841
(D) 900
(E) 961

12. Two 95 percent confidence interval estimates are obtained: I (78.5, 84.5) and II (80.3, 88.2).
    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.

13. Four math majors received the following salary offers upon graduation: $48,000, $55,000, $42,000, and $51,000. Assuming all assumptions are met, establish a 95 percent confidence interval for the population mean.

(A) $49,000\pm1.96\left(\dfrac{5,477}{\sqrt{3}}\right)$

(B) $49,000\pm2.776\left(\dfrac{5,477}{\sqrt{3}}\right)$

(C) $49,000\pm3.182\left(\dfrac{5,477}{\sqrt{3}}\right)$

(D) $49,000\pm2.776\left(\dfrac{5,477}{\sqrt{4}}\right)$

(E) $49,000\pm3.182\left(\dfrac{5,477}{\sqrt{4}}\right)$

14. A telephone survey of 400 registered voters showed that 256 had not yet made up their minds 1 month before the election. At what confidence level can we say that between 60 percent and 68 percent of the electorate were still undecided at that time?
(A) 2.4 percent
(B) 64.0 percent
(C) 90.4 percent
(D) 95.3 percent
(E) 96.7 percent

15. Suppose (48, 65) is a 95 percent confidence interval estimate for a population mean μ. Which of the following is a true statement?
(A) There is a 0.95 probability that μ is between 48 and 65.
(B) If 100 random samples of the given size are picked and a 95 percent confidence interval estimate is calculated from each, then μ will be in 95 of the resulting intervals.
(C) If 95 percent confidence intervals are calculated from all possible samples of the given size, μ will be in 95 percent of these intervals.
(D) The probability that μ is in any particular confidence interval can be any value between 0 and 1.
(E) Confidence *level* cannot be interpreted until after data is obtained.

16. In a random survey of 450 adults, 28 percent said that they felt that their credit card debt is too high. With what degree of confidence can the pollster say that 28 ± 4 percent of adults believe that their credit card debt is too high?
(A) 70.0 percent
(B) 91.0 percent
(C) 94.1 percent
(D) 95.0 percent
(E) 96.0 percent

17. The school superintendent wants to know what percentage of property owners are willing to support an increase in school taxes. What size sample should be obtained to determine with 90 percent confidence the support level to within 5 percent?
(A) 17
(B) 33
(C) 271
(D) 289
(E) 1,083

18. When an online news magazine asked viewers to click their agreement or disagreement, 300 out of 1,200 respondents agreed with a statement that the most practical way of becoming a millionaire is winning a lottery. Immediate feedback stated that 25 percent of the viewers, with a margin of error of ± 2.5 percent, agreed with the statement. Fine print claimed 95 percent confidence. What is the proper conclusion?
(A) We are 95 percent confident that the proportion of viewers who believe that the most practical way of becoming a millionaire is winning a lottery is between 0.225 and 0.275.
(B) Without knowing whether both *np* and n(1 - *p)* are> 10, the calculation is inappropriate.

(C) Without knowing whether or not the 1,200 respondents are 10 percent of all viewers, the calculation is inappropriate.
(D) The z-distribution was inappropriately used instead of the t-distribution.
(E) The data was not an SRS, so the calculation is inappropriate.

19. A principal is informed that among the 1,250 students in her high school, the average GPA is 2.13 with a standard deviation of 0.61. With what margin of error is the mean GPA of these students known?
(A) 0
(B) 0.61
(C) $\dfrac{0.61}{\sqrt{1,250}}$
(D) $1.96\left(\dfrac{0.61}{\sqrt{1,250}}\right)$
E) None of the above gives the correct answer.

20. Which of the following would result in the widest confidence interval?
(A) Small sample size and 95 percent confidence
(B) Small sample size and 99 percent confidence
(C) Large sample size and 95 percent confidence
(D) Large sample size and 99 percent confidence
(E) This cannot be answered without knowing an appropriate standard deviation.

21. Men and women were surveyed as to the ideal number of children a family should have. For 500 men, the mean was 2.95 with a standard deviation of 1.65; for 450 women, the mean was 3.05 with a standard deviation of 1.80. Assuming all assumptions are met, establish a 90 percent confidence interval for the difference in population means.
(A) $-0.10 \pm 1.96\sqrt{\dfrac{2.95^2}{500} + \dfrac{3.05^2}{500}}$
(B) $-0.10 \pm 1.645\left(\dfrac{1.65}{\sqrt{500}} + \dfrac{1.80}{\sqrt{450}}\right)$
(C) $-0.10 \pm 1.645\sqrt{\dfrac{1.65^2}{500} + \dfrac{1.80^2}{500}}$
(D) $-0.10 \pm 1.96\left(\dfrac{2.95}{\sqrt{500}} + \dfrac{1.80}{\sqrt{450}}\right)$
(E) $-0.10 \pm 3.29\left(\dfrac{1.65}{\sqrt{500}} + \dfrac{1.80}{\sqrt{450}}\right)$

22. There are 50,000 high school students in an extended metropolitan region. As each of their students came in to register for classes, guidance counselors were instructed to use a calculator to pick a random number between 1 and 100. If the number 50 was picked, the student was included in a survey. For one of the many survey questions, 30 percent of the students said they couldn't live without instant messaging. Are all conditions met for constructing a confidence interval of the proportion of this region's teenagers who believe they couldn't live without instant messaging?
(A) No, there is no guarantee that a representative random sample is chosen.
(B) No, the sample size is not less than 10 percent of the population.
(C) No, np and $n(1 - p)$ are not both greater than 10.
(D) No, there is no reason to assume that the population has a normal distribution.
(E) Yes, all conditions are met, and a confidence interval can be constructed.

23. For a given large sample size, which of the following gives the smallest margin of error in calculating a confidence interval for a population proportion?
(A) 90 percent confidence with $p = 0.15$
(B) 95 percent confidence with $p = 0.15$
(C) 99 percent confidence with $p = 0.15$
(D) 90 percent confidence with $p = 0.23$
(E) 95 percent confidence with $p = 0.23$

24. What is the critical t-value for finding a 96 percent confidence interval estimate from a sample of 18 observations?
(A) 2.054
(B) 2.205
(C) 2.214
(D) 2.224
(E) 2.235

25. A researcher plans to investigate the difference between the proportion of children of smokers and the proportion of children of nonsmokers who take up smoking while in high school. How large a sample should be taken (same number for each group) to be 90 percent certain of knowing the difference to within ± .03?
(A) 39
(B) 376
(C) 752
(D) 1,504
(E) 3,007

26. In a random sample of 25 high school students, each was interviewed as to GPA and weekly hours worked at part-time jobs. What is the critical t-value in calculating a 90 percent confidence interval estimate for the slope of the resulting least squares regression line.
(A) 1.645
(B) 1.703
(C) 1.708
(D) 1.711
(E) 1.714

27. To determine the average spent on entertainment during a year in college, a simple random sample of 35 students is interviewed, showing a mean of $825 with a standard deviation of $240. Which of the following is the best interpretation of a 90 percent confidence interval estimate for the average spent on entertainment during a year in college?
(A) 90 percent of college students spend between $756 and $894 on entertainment yearly.
(B) 90 percent of college students spend a mean dollar amount on entertainment yearly that is between $756 and $894.
(C) We are 90 percent confident that college students spend between $756 and $894 on entertainment yearly.
(D) We are 90 percent confident that college students spend a mean dollar amount between $756 and $894 on entertainment yearly.
(E) We are 90 percent confident that in the chosen sample, the mean dollar amount spent on entertainment yearly by college students is between $756 and $894.

28. We are interested in the proportion p of people who drive pick-up trucks in a large city. Seven percent of a simple random sample of 760 people say they drive pick-ups. What is the midpoint for a 99 percent confidence interval estimate of p?
(A) 0.005
(B) 0.495
(C) 0.5
(D) p
(E) None of the above

29. A survey was conducted involving 50 of the 12,000 families living in a town. In, 2006, the average amount of medical expenses paid per family in the sample was $1,525 with a standard deviation of $430. Establish a 95 percent confidence interval estimate for the total medical expenses paid by all families in the town.
    (A) $1,525 ± $122
    (B) $76,250 ± $122
    (C) $76,250 ± $6,110
    (D) $18,300,000 ± $6,110
    (E) $18,300,000 ± $1,470,000

30. An HR executive wishes to know the difference in job satisfaction rating (on a standard satisfaction test) between employees who exercise regularly and those who don't. Suppose the standard deviation of each group is known to be 4.5. How large a sample (same number) from each group should be interviewed if the executive wishes to be 90 percent certain of knowing the difference in ratings to within 1 point?
    (A) 10
    (B) 55
    (C) 110
    (D) 156
    (E) 202

31. The prescription drugs Lipitor and Zetia are both known to lower blood cholesterol levels. In one double-blind study Lipitor outperformed Zetia. The 95 percent confidence interval estimate of the difference in mean cholesterol level lowering was (21, 37). Which of the following is a reasonable conclusion?
    (A) Zetia lowers cholesterol an average of 21 points, while Lipitor lowers cholesterol an average of 37 points.
    (B) There is a .95 probability that Lipitor will outperform Zetia in lowering the cholesterol level of any given individual.
    (C) There is a .95 probability that Lipitor will outperform Zetia by at least 16 points in lowering the cholesterol level of any given individual.
    (D) We should be 9S percent confident that Lipitor will outperform Zetia as a cholesterol-lowering drug.
    (E) None of the above

32. In an SRS of 16S pet owners who do not use herbicides around the house, 23 had pets with lymphomas; in an SRS of 212 pet owners who do use herbicides, 87 had pets with lymphomas. A 90 percent confidence interval of the difference is reported to be −0.271 ± 0.071. Which of the following is a proper conclusion?
    (A) The interval is invalid because it does not contain zero.
    (B) The interval is invalid because probabilities cannot be negative.
    (C) Pet owners who use herbicides are approximately 27.1 percent more likely to have pets with lymphomas than are pet owners who do not use herbicides.
    (D) Ninety percent of pet owners who use herbicides are approximately 27.1 percent more likely to have pets with lymphomas than are pet owners who do not use herbicides.
    (E) None of the above are proper conclusions.

33. A political action group wishes to learn the government approval rating on the environment. From a past study, they know that they will have to poll 270 people for their desired level of confidence. If they want to keep the same level of confidence but divide the margin of error in third, how many people will they have to poll?
    (A) 30
    (B) 90
    (C) 468
    (D) 810
    (E) 2,430

34. Changing from a 95 percent confidence interval estimate for a population proportion to a 99 percent confidence interval estimate, with all other things being equal,
    (A) increases the interval size by 4 percent
    (B) decreases the interval size by 4 percent
    (C) increases the interval size by 31 percent
    (D) decreases the interval size by 31 percent
    (E) This question cannot be answered without knowing the sample size.

Answer
1. D
2. D
3. E
4. C
5. C
6. A
7. E

8. A
9. E
10. D
11. D
12. C
13. E
14. C

15. C
16. C
17. C
18. E
19. A
20. B
21. C

22. E
23. A
24. D
25. D
26. E
27. D
28. E

29. E
30. C
31. E
32. E
33. E
34. C