Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. A level $C$ confidence interval is
   A. any interval with margin of error $\pm C$.
   B. an interval computed from sample data by a method that has probability $C$ of producing an interval containing the true value of the parameter of interest.
   C. an interval with margin of error $\pm C$ that is also correct $C\%$ of the time.
   D. an interval computed from sample data by a method that guarantees that the probability the interval computed contains the parameter of interest is $C$.
   E. an interval computed from sample data that has probability $(1 - C)$ of not containing the parameter of interest.

____ 2. A 95% confidence interval for the mean $\mu$ of a population is computed from a random sample and found to be 9 $\pm$ 3. We may conclude that
   A. there is a 95% probability that $\mu$ is between 6 and 12.
   B. 95% of values sampled are between 6 and 12.
   C. if we took many, many additional random samples and from each computed a 95% confidence interval for $\mu$, approximately 95% of these intervals would contain $\mu$.
   D. there is a 95% probability that the true mean is 9 and a 95% chance that the true margin of error is 3.
   E. all of the above are true.

____ 3. The Gallup Poll interviews 1600 people. Of these, 18% say that they jog regularly. The news report adds: "The poll had a margin of error of plus or minus three percentage points." You can safely conclude that
   A. 95% of all Gallup Poll samples like this one give answers within $\pm 3\%$ of the true population value.
   B. the percent of the population who jog is certain to be between 15% and 21%.
   C. 95% of the population jog between 15% and 21% of the time.
   D. we can be 3% confident that the sample result is true.
   E. if Gallup took many samples, 95% of them would find that exactly 18% of the people in the sample jog.

____ 4. A polling organization announces that the proportion of American voters who favor congressional term limits is 64 percent, with 95% confidence and margin of error of 3 percent. This means that
   A. if the poll were conducted again in the same way, there is a 95% chance that the fraction of voters favoring term limits in the second poll would be between 61 percent and 67 percent.
   B. there is a 95% probability that the true percentage of voters favoring term limits is between 61 and 67 percent.
   C. if the poll were conducted again the same way, there is a 95% probability that the percentage of voters favoring term limits in the second poll would be within 3 percent of the percentage favoring term limits in the first poll.
   D. among 95% of the voters, between 61 percent and 67 percent favor term limits.
   E. none of the above.

____ 5. Use Scenario 8-1. The term “95% confidence” means we can be
   A. sure that between 44% and 50% of all Americans think we should have a third party.
   B. 95% confident that 47% of all Americans think we should have a third party.
C. 95% confident that between 44% and 50% of all Americans think we should have a third party.
D. 95% confident that between 44% and 50% of the people interviewed think we should have a third party.
E. between 93% and 97% confident that 47% of all Americans think we should have a third party.

**Scenario 8-1**
A 2008 Gallup poll found that 47% of adults 18 years old or older in the United States felt that a third political party is needed to represent the American people. In the description of methods, the poll takers said: “For results based on the total sample of national adults, one can say with 95% confidence that the maximum margin of sampling error is ±3 percentage points.”

6. Use Scenario 8-1. Among the poll respondents who identified their current party affiliation as “independent,” 63% agreed that we need a third political party. The margin of error for this result is
A. less than ±3%, because only some of the people in the sample were independents, so the sample size is smaller.
B. greater than ±3%, because only some of the people in the sample were independents, so the sample size is smaller.
C. equal to ±3%, because this result comes from the same sample survey.
D. less than ±3%, because only some of the population are independents, so it’s easier to estimate facts about them.
E. greater than ±3%, because only some of the population are independents, so it’s harder to estimate facts about them.

7. The critical value used in a 95% confidence interval for a population proportion is
A. the value in a standard Normal distribution such that 95% of the scores are above that value.
B. the value in a standard Normal distribution such that 95% of the scores are less than that distance from 0.
C. the value in a t-distribution such that 95% of the scores are above that value.
D. the product of a value calculated from the standard Normal distribution for 95% and the standard error of the sample proportion.
E. the average variability of the sample proportion in all samples of size n from the population.

8. The critical value used to construct a confidence interval for a proportion depends upon
A. The confidence level being used and the size of the sample.
B. The size of the sample and the sample proportion.
C. The confidence level, the size of the sample, and the standard deviation of the population.
D. Only on the sample size.
E. Only on the confidence level.

9. A researcher studying reaction time of drivers states that, “A 95% confidence interval for the mean time it takes for a driver to apply the brakes after seeing the brake lights on a vehicle in front of him is 1.2 to 1.8 seconds. What are the point estimate and margin of error for this interval?
A. Point estimate = 1.2 seconds; margin of error = 0.6 seconds.
B. Point estimate = 1.2 seconds; margin of error = 0.3 seconds.
C. Point estimate = 1.5 seconds; margin of error 95%.
D. Point estimate = 1.5 seconds; margin of error = 0.6 seconds.
E. Point estimate = 1.5 seconds; margin of error = 0.3 seconds.
10. A political candidate is told by his polling organization that a 90% confidence interval for the proportion of voters who support his candidacy is 0.45 to 0.53. What are the point estimate and margin of error for this interval?
   A. Point estimate = 0.50; margin of error = 0.08.
   B. Point estimate = 0.49; margin of error 90%
   C. Point estimate = 0.49; margin of error 0.08.
   D. Point estimate = 0.49; margin of error = 0.04.
   E. Point estimate = 0.49; margin or error cannot be determined without sample size.

11. An agricultural researcher plants 25 plots with a new variety of corn. A 90% confidence interval for the average yield for these plots is found to be 162.72 ± 4.47 bushels per acre. Which of the following would produce a confidence interval with a smaller margin of error than this one?
   A. Using a 95% confidence level.
   B. Reducing bias in the study design.
   C. Planting 100 plots, rather than 25.
   D. Using 25 control plots with an old variety of corn.
   E. None of the above.

12. Other things being equal, the margin of error of a confidence interval increases as
   A. the sample size increases.
   B. the sample mean increases.
   C. the population standard deviation increases.
   D. the confidence level decreases.
   E. none of the above.

13. I collect a random sample of size $n$ from a population and from the data collected compute a 95% confidence interval for the mean of the population. Which of the following would produce a wider confidence interval, based on these same data?
   A. Use a larger confidence level.
   B. Use a smaller confidence level.
   C. Use the same confidence level, but compute the interval $n$ times. Approximately 5% of these intervals will be larger.
   D. Increase the sample size.
   E. Nothing can ensure that you will get a larger interval. One can only say the chance of obtaining a larger interval is 0.05.

14. A polling organization announces that the proportion of American voters who favor congressional term limits is 64 percent, with a 95% confidence margin of error of 3 percent. If the opinion poll had announced the margin of error for 80% confidence rather than 95% confidence, this margin of error would be
   A. 3%, because the same sample is used.
   B. less than 3%, because we require less confidence.
   C. less than 3%, because the sample size is smaller.
   D. greater than 3%, because we require less confidence.
   E. greater than 3%, because the sample size is smaller.

15. A marketing company discovered the following problems with a recent poll:
   I. Some people refused to answer questions
   II. People without telephones could not be in the sample
   III. Some people never answered the phone in several calls.

Which of these sources is included in the ±2% margin of error announced for the poll?
   A. Only source I.
   B. Only source II.
C. Only source III.
D. All three sources of error.
E. None of these sources of error.

16. Which of the following sources of error is included in the margin of error
A. chance variation in choosing a random sample.
B. undercoverage.
C. some of the subjects did not understand the questions.
D. voluntary response.
E. all of the above.

17. A website asks visitors to vote for which of several user-submitted videos is funniest. After a few days they have collected 250 votes, and they would like to construct a 95% confidence interval for the proportion of visitors who prefer one of the videos. However, they recognize that their sampling method involves voluntary response, so the data may be biased. How can they compensate for this problem when constructing their confidence interval?
A. Use a lower confidence level, such as 80%.
B. Use a higher confidence level, such as 99%.
C. Collect an additional 250 or more votes using an SRS.
D. Use a $t$-procedure instead of a $z$-procedure.
E. Throw this data out...there is no way to compensate for this bias.

18. A radio talk show host with a large audience is interested in the proportion of adults in his listening area that think the drinking age should be lowered to 18. To find out, he poses the following question to his listeners: “Do you think that the drinking age should be reduced to 18 in light of the fact that 18-year-olds are eligible for military service?” He asks listeners to phone in and vote “yes” if they agree the drinking age should be lowered and “no” if not. Of the 100 people who phoned in, 70 answered “yes.” Which of the following assumptions for inference about a proportion using a confidence interval has been violated?
A. The population is at least 10 times as large as the sample.
B. $n\hat{p} \geq 10$
C. $n(1-\hat{p}) \geq 10$
D. The data are an SRS from the population of interest.
E. There appear to be no violations.

19. A quality control inspector is testing microprocessor chips made during a single day by a new machine to determine the proportion of defective chips. She selects an SRS of 80 chips from the 3000 chips produced by the machine on that day. It turns out that six of the chips are defective. Which of the following conditions for constructing a confidence interval for the proportion of defective chips has been violated?
A. $n\hat{p} \geq 10$ and $n(1-\hat{p}) \geq 10$
B. An SRS has been taken from the population of interest.
C. The population is at least 10 times the size of the sample.
D. The population is approximately Normally distributed.
E. There appear to be no violations.

20. You are told that the proportion $p$ of those who answered "yes" to a poll about internet use is $p = 0.70$, and the standard error $SE_p$ of the proportion is 0.0459. The sample size was
A. is 50.
B. is 99.
C. is 100.
D. is 200.
E. cannot be determined from the information given.

21. Eighty rats whose mothers were exposed to high levels of tobacco smoke during pregnancy were put through a simple maze. The maze required the rats make a choice between going left or going right at the outset. Sixty of the rats went right when running the maze for the first time. Assume that the eighty rats can be considered an SRS from the population of all rats born to mothers exposed to high levels of tobacco smoke during pregnancy. (Note that this assumption may or may not be reasonable, but researchers often assume lab rats are representative of such larger populations because lab rats are often bred to have very uniform characteristics.) The standard error for the proportion of those who went right the first time when running the maze is
A. 0.0023.
B. 0.0072.
C. 0.0484.
D. 0.0548.
E. 0.0559.

22. A noted psychic was tested for ESP. The psychic was presented with 200 cards face down and asked to determine if the card featured one of five symbols: star, cross, circle, square, or three wavy lines. The psychic was correct in 48 cases. If represents the proportion of correct guesses the psychic made, what is the standard error of ?
A. 0.0009
B. 0.0283
C. 0.0302
D. 0.0354
E. 0.4330

Scenario 8-2
A newspaper conducted a statewide survey concerning the 2008 race for state senator. The newspaper took a random sample (assume it is an SRS) of 1200 registered voters and found that 620 would vote for the Republican candidate. Let represent the proportion of registered voters in the state that would vote for the Republican candidate.

23. Use Scenario 8-2. A 90% confidence interval for is
A. 0.517 ± 0.014.
B. 0.517 ± 0.022.
C. 0.517 ± 0.024.
D. 0.517 ± 0.028.
E. 0.517 ± 0.249.

24. Use Scenario 8-2. Which of the following is closest to the sample size you would need in order to estimate with margin of error 0.01 with 95% confidence? Use 0.5 as an approximation of .
A. 49
B. 1500
C. 4800
D. 4900
E. 9604

Scenario 8-3
After a college’s football team once again lost a football game to the college’s arch rival, the alumni association conducted a survey to see if alumni were in favor of firing the coach. An SRS of 100 alumni from the population of all living alumni was taken. Sixty-four of the alumni in the sample were in favor of firing the coach. Let represent the proportion of all living alumni who favor firing the coach.
25. Use Scenario 8-3. A 95% confidence interval for \( p \) is
   A. 0.64 ± 0.009.
   B. 0.64 ± 0.079.
   C. 0.64 ± 0.094.
   D. 0.64 ± 0.124.
   E. 0.64 ± 0.360.

26. Use Scenario 8-3. Which of the following is closest to the sample size you would need to estimate \( p \) with a margin of error of 0.05 with 95% confidence? Use 0.5 as an approximation of \( p \).
   A. 269
   B. 385
   C. 538
   D. 768
   E. 1436

Scenario 8-4
A sociologist is studying the effect of having children within the first two years of marriage on the divorce rate. Using hospital birth records, she selects a random sample of 200 couples that had a child within the first two years of marriage. Following up on these couples, she finds that 80 couples are divorced within five years.

27. Use Scenario 8-4. A 90% confidence interval for the proportion \( p \) of all couples that had a child within the first two years of marriage and are divorced within five years is
   A. 0.40 ± 0.004.
   B. 0.40 ± 0.035.
   C. 0.40 ± 0.044.
   D. 0.40 ± 0.057.
   E. 0.40 ± 0.068.

28. Use Scenario 8-4. Which of the following is closest to the sample size you would need to estimate \( p \) with a margin of error of 0.02 with 90% confidence? Use 0.4 from the first sample as an approximation of \( p \).
   A. 24
   B. 600
   C. 1624
   D. 2305
   E. 3842

29. Using the same sample statistics, you calculate a 95% \( t \)-interval for a population mean and a 95% \( z \)-interval for a population mean. Which interval has a larger margin of error?
   A. The \( t \)-interval’s margin of error is larger.
   B. The \( z \)-interval’s margin of error is larger.
   C. The two intervals have the same margin of error.
   D. Which interval has the larger margin or error depends on the degrees of freedom for the \( z \)-interval.
   E. Which interval has the larger margin or error depends on the degrees of freedom for the \( t \)-interval.

30. Which of the following confidence intervals has the largest critical value?
   A. A 95% \( z \)-interval
   B. A 95% \( t \)-interval with 1 degree of freedom
   C. A 95% \( t \)-interval with 10 degrees of freedom
D. A 90% t-interval with 1 degree of freedom  
E. A 90% t-interval with 10 degrees of freedom

31. Which of the following has the lowest probability?  
   A. Selecting a random value above 1 from a t-distribution with 5 degrees of freedom.  
   B. Selecting a random value above 1 from a standard Normal distribution.  
   C. Selecting a random value above 2 from a t-distribution with 5 degrees of freedom.  
   D. Selecting a random value above 2 from a t-distribution with 10 degrees of freedom.  
   E. Selecting a random value above 2 from a standard Normal distribution.

32. What is the critical value \( t^* \) for a 90% confidence interval when \( n = 15 \)?  
   A. 1.645  
   B. 1.753  
   C. 1.761  
   D. 1.960  
   E. 2.145

33. What is the critical value \( t^* \) for a 99% confidence interval when \( n = 20 \)?  
   A. 2.086  
   B. 2.093  
   C. 2.576  
   D. 2.845  
   E. 2.861

34. What proportion of scores in a \( t \)-distribution with 6 degrees of freedom are above \( t = 2.447 \)?  
   A. 0.90  
   B. 0.10  
   C. 0.05  
   D. 0.025  
   E. 0.01

35. The weights of a sample of three adult males are (in pounds) 160, 215, and 195. The standard error of the mean of these three weights is  
   A. 190.00.  
   B. 27.84.  
   C. 22.73.  
   D. 16.07.  
   E. 9.28.

36. The heights (in inches) of males in the United States are believed to be Normally distributed with mean \( \mu \). The average height of a random sample of twenty-five American adult males is found to be \( J = 69.72 \) inches and the standard deviation of the twenty-five heights is found to be \( s = 4.15 \). The standard error of \( J \) is  
   A. 0.17.  
   B. 0.69.  
   C. 0.83.  
   D. 1.856.  
   E. 2.04.

37. Scores on the SAT Mathematics test (SAT-M) are believed to be Normally distributed with mean \( \mu \). The scores of a random sample of three students who recently took the exam are 550, 620, and 480. A 95% confidence interval for \( \mu \) based on these data is  
   A. 550.00 ± 401.11.
B. 550.00 ± 173.88.
C. 550.00 ± 142.00.
D. 550.00 ± 128.58.
E. 550.00 ± 105.01.

38. An SRS of 100 postal employees found that the average time these employees had worked for the postal service was \( \bar{X} = 7 \) years with standard deviation \( s = 2 \) years. Assume the distribution of the time the population of employees have worked for the postal service is approximately Normal. A 95% confidence interval for the mean time \( \mu \) the population of postal service employees have spent with the postal service is
A. 7 ± 2.
B. 7 ± 1.984.
C. 7 ± 0.525.
D. 7 ± 0.4.
E. 7 ± 0.2.

39. Do students tend to improve their SAT Mathematics (SAT-M) score the second time they take the test? A random sample of four students who took the test twice received the following scores.

<table>
<thead>
<tr>
<th>Student</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Score</td>
<td>450</td>
<td>520</td>
<td>720</td>
<td>600</td>
</tr>
<tr>
<td>Second Score</td>
<td>440</td>
<td>600</td>
<td>720</td>
<td>630</td>
</tr>
</tbody>
</table>

Assume that the change in SAT-M score (second score – first score) for the population of all students taking the test twice is approximately Normally distributed with mean \( \mu \). A 90% confidence interval for \( \mu \) is
A. 25.0 ± 118.03.
B. 25.0 ± 64.29.
C. 25.0 ± 47.56.
D. 25.0 ± 43.08.
E. 25.0 ± 33.24.

40. To estimate \( \mu \), the mean salary of full professors at American colleges and universities, you obtain the salaries of a random sample of 400 full professors. The sample mean is \( \bar{X} = \$73,220 \) and the sample standard deviation is \( s = \$4400 \). A 99% confidence interval for \( \mu \) is
A. $73,220 ± 11,440.$
B. $73,220 ± 567.$
C. $73,220 ± 431.$
D. $73,220 ± 28.6.$
E. none of these.

41. The heights of young American women, in inches, are approximately Normally distributed with mean \( \mu \) and standard deviation \( \sigma = 2.4 \). If I want to construct a 99% confidence interval with a margin of error of no more than \( ± 1 \) inch, the smallest sample I can take is closest to
A. 2.
B. 7.
C. 16.
D. 38.
E. 39.
42. Suppose we want a 90% confidence interval for the average amount spent on books by freshmen in their first year at a major university. The interval is to have a margin of error of no more than $2, and the amount spent has an approximately Normal distribution with a standard deviation $\sigma = $30. The number of observations required is closest to
A. 25.
B. 30.
C. 568.
D. 609.
E. 865.

43. A corporation with several thousand employees wants to estimate the mean commute time for all employees. They would like to construct a 95% confidence interval with a margin of error of no more than 4 minutes. Preliminary interviews with a small sample suggest that a reasonable estimate of the population standard deviation is $\sigma = 10$ minutes. Which of the following is the smallest sample the company can take to achieve the desired margin or error?
A. 5
B. 24
C. 25
D. 41
E. 42

44. Suppose a 99% confidence interval for the mean weight of high school girls in pounds is (102.3, 106.5). If we had measured the weights of each of the girls in kilograms (2.2 pounds = 1 kilogram) then the confidence interval for the mean weight of high school girls in kilograms would have been
A. (104.5, 106.7).
B. (46.5, 48.4).
C. (225.06, 234.3).
D. (100.1, 104.3).
E. (45.55, 49.35).

45. You are thinking of using a $t$ procedure to estimate the mean of a population using a 95% confidence level. You suspect that the distribution of the population is not normal and may be moderately skewed. Which of the following statements is correct?
A. You should not use the $t$ procedure because the population does not have a normal distribution.
B. You may use the $t$ procedure provided your sample size is large, say at least thirty.
C. You may use the $t$ procedure, but you should probably claim only use a confidence level of 80%.
D. You may not use the $t$ procedure. $t$ procedures are robust to random sampling but not to non-normality.
E. You may use the $t$ procedure provided that your sample size is less than thirty.

46. Twenty-five seniors from a large metropolitan area school district volunteer to allow their Math SAT test scores to be used in a study. These twenty-five seniors had a mean Math SAT score of $J = 450$. Suppose we know that the standard deviation of the population of Math SAT scores for seniors in the district is $\sigma = 100$. Assuming that the population of Math SAT scores for seniors in the district is approximately normally distributed, a 90% confidence interval for the mean Math SAT score $\mu$ for the population of seniors computed from these data is
A. $450 \pm 32.9$.
B. $450 \pm 39.2$.
C. $450 \pm 164.5$.
D. not trustworthy because the conditions for this inference procedure have not been met.
E. 90% likely to contain the unknown mean math SAT score of all seniors in the district.

47. An SRS of 100 postal employees found that the average time these employees had worked for the postal service was $J = 7$ years with standard deviation $s = 2$ years. Suppose we are not sure if the population distribution is normal. In which of the following circumstances would use of the $t$ procedure yield misleading results?
   A. A histogram of the data shows moderate skewness.
   B. A stemplot of the data shows a uniform distribution.
   C. The sample standard deviation is large.
   D. A histogram of the data shows strong skewness.
   E. None of the above.

48. Bags of a certain brand of tortilla chips claim to have a net weight of 14 ounces. A representative of a consumer advocate group wishes to see if there is any evidence that the mean net weight is less than advertised and plans to construct a 95% confidence interval for the mean, using an SRS of 16 bags. Suppose he is not sure if the distribution of net weights is Normal. In which of the following circumstances would he not be safe to use a $t$ procedure?
   A. The mean and median of the data are nearly equal.
   B. A histogram of the data shows moderate skewness.
   C. A stemplot of the data has a large outlier.
   D. The sample standard deviation is large.
   E. None of these circumstances would prevent us from using $t$ procedures.

49. In checking conditions for constructing confidence intervals for a population mean, it’s important to plot the distribution of sample data. Below are dot plots describing samples from three different populations. For which of the three samples would it be safe to construct a $t$-interval?

   A. Plot X only
   B. Plot Y only
   C. Plot Z only
   D. Plots Y and Z
   E. None of the plots.

50. The scores of a certain population on the Wechsler Intelligence Scale for Children (WISC. are thought to be approximately Normally distributed. A simple random sample of 10 children from this population is taken, and each is given the WISC. The 95% confidence interval for the mean is computed from these scores. A histogram of the 10 WISC scores is given.
Based on this histogram, we would conclude that
A. we can be 95% confident that the true mean WISC score in this population is in this interval.
B. the 95% confidence interval computed from these data is not very reliable.
C. the 95% confidence interval computed from these data should actually be considered a 99% confidence interval.
D. the 95% confidence interval computed from these data should actually be considered a 90% confidence interval.
E. only one student’s score should fall outside the 95% confidence interval.
AP Stat Confidence Intervals Review
Answer Section

MULTIPLE CHOICE

1. B
2. C
3. A
4. E
5. C
6. B
7. B
8. E
9. E
10. D
11. C
12. C
13. A
14. B
15. E
16. A
17. E
18. D
19. A
20. C
21. C
22. C
23. C
24. E
25. C
26. B
27. D
28. C
29. A
30. B
31. E
32. C
33. E
34. D
35. D
36. C
37. B
38. D
39. C
40. B
41. E
42. D
43. C
44. C
45. B
46. D
47. E
48. C
49. D
50. B