1. Determine whether each of the following statements is true or false.
   A) The margin of error for a 95% confidence interval for the mean $\mu$ increases as the sample size increases.
   B) The margin of error for a confidence interval for the mean $\mu$, based on a specified sample size $n$, increases as the confidence level decreases.
   C) The margin of error for a 95% confidence interval for the mean $\mu$ decreases as the population standard deviation decreases.
   D) The sample size required to obtain a confidence interval of specified margin of error $m$ increases as the confidence level increases.

2. Suppose that the population of the scores of all high school seniors who took the SAT Math (SAT-M) test this year follows a Normal distribution with standard deviation $\sigma = 100$. You read a report that says, “On the basis of a simple random sample of 100 high school seniors that took the SAT-M test this year, a confidence interval for $\mu$ is found to be 512.00 $\pm$ 25.76.” What was the confidence level used to calculate this confidence interval?
   A) 90%
   B) 95%
   C) 99%
   D) 99.9%

Use the following to answer questions 3-4:

An agricultural researcher plants 25 plots with a new variety of yellow corn. Assume that the yield per acre for the new variety of yellow corn follows a Normal distribution with an unknown mean of $\mu$ and a standard deviation of $\sigma = 10$ bushels per acre.

3. If the average yield for these 25 plots is $\bar{x} = 150$ bushels per acre, what is a 90% confidence interval for $\mu$?
   A) $150 \pm 0.784$
   B) $150 \pm 2.00$
   C) $150 \pm 3.29$
   D) $150 \pm 3.92$
4. Which of the following would produce a confidence interval with a smaller margin of error than the 90% confidence interval?
   A) Plant only five plots rather than 25, because five are easier to manage and control.
   B) Plant 10 plots rather than 25, because a smaller sample size will result in a smaller margin of error.
   C) Plant 100 plots rather than 25, because a larger sample size will result in a smaller margin of error.
   D) Compute a 99% confidence interval rather than a 90% confidence interval, because a higher confidence level will result in a smaller margin of error.

5. To assess the accuracy of a laboratory scale, a standard weight that is known to weigh exactly 1 gram is repeatedly weighed a total of \( n \) times and the mean \( \bar{x} \) is computed. Suppose the scale readings are Normally distributed with an unknown mean of \( \mu \) and a standard deviation of \( \sigma = 0.01 \) g. How large should \( n \) be so that a 95% confidence interval for \( \mu \) has a margin of error no larger than \( \pm 0.0001 \)?
   A) \( n = 100 \)
   B) \( n = 196 \)
   C) \( n = 10000 \)
   D) \( n = 38416 \)

Use the following to answer questions 6-7:

A nationally distributed college newspaper conducts a survey among students nationwide every year. This year, responses from a simple random sample of 204 college students to the question “About how many CDs do you own?” resulted in a sample mean of \( \bar{x} = 72.8 \). Based on data from previous years, the editors of the newspaper will assume that \( \sigma = 7.2 \).

6. Use the information given to obtain a 95% confidence interval for the mean number of CDs owned by all college students.
   A) \((65.6, 80.0)\)
   B) \((71.8, 73.8)\)
   C) \((72.0, 73.6)\)
   D) \((72.3, 73.3)\)

7. Answer each of the following questions with yes, no, or can't tell.
   A) Does the sample mean lie in the 95% confidence interval?
   B) Does the population mean lie in the 95% confidence interval?
   C) If we were to use a 92% confidence level, would the confidence interval from the same data produce an interval wider than the 95% confidence interval?
   D) With a smaller sample size, all other things being the same, would the 95% confidence interval be wider?
8. The larger the level of confidence, \( C \), the ______ the confidence interval.
   A) smaller
   B) larger
   C) None of the above.

9. In order to obtain a small margin of error with high levels of confidence, \( C \), you will need ______ observations.
   A) a large number of
   B) a small number of
   C) 10
   D) None of the above.

10. Since confidence intervals are based on the sampling distribution of the sample mean, it is possible to form confidence intervals when sampling from slightly skewed distributions due to the central limit theorem.
   A) True
   B) False

11. How do you form a confidence interval when taking a small sample from a non-Normal population?
   A) Use the bootstrap procedure.
   B) You will not be able to form a confidence interval.
   C) Use the central limit theorem.
   D) None of the above.

12. The purpose of forming confidence intervals is to find the exact value of the true population mean based on a random sample.
   A) True
   B) False

13. As you increase the margin error of a confidence interval, _________. (Note: Assume the sample size is fixed.)
   A) the confidence level increases.
   B) the confidence level decreases.
   C) the confidence level remains the same.

14. The null and alternative hypotheses are stated in terms of the statistics from the random sample.
   A) True
   B) False
15. When we state the alternative hypothesis to look for a difference in a parameter in any direction, we are doing a ______.
   A) one-sided test
   B) two-sided test
   C) None of the above.

16. When we state the alternative hypothesis to look for a difference in a parameter in one direction, we are doing a ______.
   A) one-sided test
   B) two-sided test
   C) None of the above.

17. Confidence intervals and two-sided significance tests are linked in the sense that a two-sided test at a significance level $\alpha$ can be carried in the form of a confidence interval with confidence level $1 - \alpha$.
   A) True
   B) False

18. Given that a test of significance was done for a two-sided test and the $P$-value obtained was .02, what would be the $P$-value for a one-sided significance test?
   A) 0.02
   B) 0.04
   C) 0.01
   D) 0

19. Given that a test of significance was done for a one-sided test and the $P$-value obtained was 0.02, what would be the $P$-value for a two-sided significance test?
   A) 0.02
   B) 0.04
   C) 0.01
   D) 0

20. Typically, the null hypothesis in a test of significance is a statement of “no difference” in the true means.
   A) True
   B) False
21. Is the mean height for all adult American males between the ages of 18 and 21 now over 6 feet? Let $\mu$ represent the population mean height of all adult American males between the ages of 18 and 21. What are the appropriate null and alternative hypotheses to answer this question?
   A) $H_0: \mu = 6$ vs. $H_a: \mu < 6$
   B) $H_0: \mu = 6$ vs. $H_a: \mu \neq 6$
   C) $H_0: \mu = 6$ vs. $H_a: \mu > 6$

22. In a test of statistical hypotheses, what does the $P$-value tell us?
   A) If the null hypothesis is true.
   B) If the alternative hypothesis is true.
   C) The largest level of significance at which the null hypothesis can be rejected.
   D) The smallest level of significance at which the null hypothesis can be rejected.

23. The test statistic for a two-sided significance test for a population mean is $z = -2.12$. What is the corresponding $P$-value?
   A) 0.017
   B) 0.034
   C) 0.483
   D) 0.983

24. The tail area above a test statistic value of $z = 1.812$ is 0.035. Determine whether each of the following statements is true or false.
   A) If the alternative hypothesis is of the form $H_a: \mu > \mu_0$, the data are statistically significant at significance level $\alpha = 0.05$.
   B) If the alternative hypothesis is of the form $H_a: \mu > \mu_0$, the data are statistically significant at significance level $\alpha = 0.10$.
   C) If the alternative hypothesis is of the form $H_a: \mu \neq \mu_0$, the data are statistically significant at significance level $\alpha = 0.05$.
   D) If the alternative hypothesis is of the form $H_a: \mu \neq \mu_0$, the data are statistically significant at significance level $\alpha = 0.10$. 
25. A college student is doing some research on the cost of one-bedroom apartments in town. He has randomly selected 25 apartments for which the price was published. The average price for these apartments is $\bar{x} = $652. He will assume that price follows roughly a Normal distribution. Based on prices from previous years, a real estate agent gives him the information that $\sigma$ is approximately $55. A 95% confidence interval for $\mu$ is found to be $652 \pm 21.56 = ($630.44, $673.56). Determine which of the following statements is true.

A) A test of the hypotheses $H_0: \mu = 650$ vs. $H_a: \mu \neq 650$ would be rejected at the 0.05 level.
B) A test of the hypotheses $H_0: \mu = 650$ vs. $H_a: \mu > 650$ would be rejected at the 0.05 level.
C) A test of the hypotheses $H_0: \mu = 675$ vs. $H_a: \mu \neq 675$ would be rejected at the 0.05 level.
D) All of the above.

26. A simple random sample of six male patients over the age of 65 is being used in a blood pressure study. The standard error of the mean blood pressure of these six men was 22.8. What is the standard deviation of these six blood pressure measurements?

A) 9.31
B) 50.98
C) 55.85
D) 136.8

27. A simple random sample of five female basketball players is selected. Their heights (in cm) are 170, 175, 169, 183, and 177. What is the standard error of the mean of these height measurements?

A) 2.538
B) 2.837
C) 5.075
D) 5.675

28. A sample of size $n = 27$ is used to conduct a significance test for $H_0: \mu = 75$ versus $H_a: \mu > 75$. The test statistic is $t = 3.45$. What are the degrees of freedom for this test statistic?

A) 26
B) 27
C) 74
D) 75
29. The hypotheses $H_0: \mu = 350$ versus $H_a: \mu < 350$ are examined using a sample of size $n = 20$. The one-sample $t$ statistic has the value $t = -1.68$. What do we know about the $P$-value of this test?
A) $P$-value < 0.01
B) 0.01 < $P$-value < 0.025
C) 0.025 < $P$-value < 0.05
D) $P$-value > 0.05

30. Scores on the SAT Mathematics test are believed to be Normally distributed. The scores of a simple random sample of five students who recently took the exam are 550, 620, 710, 520, and 480. What is a 95% confidence interval for $\mu$, the population mean score on the SAT Math test?
A) (456.7, 695.3)
B) (463.4, 688.6)
C) (480.8, 671.2)
D) (496.5, 655.5)

Use the following to answer question 31:

We wish to see if the dial indicating the oven temperature for a certain model oven is properly calibrated. Four ovens of this model are selected at random. The dial on each is set to 300°F, and after one hour, the actual temperature of each is measured. The temperatures measured are 305°, 310°, 300°, and 305°. Assume that the distribution of the actual temperatures for this model when the dial is set to 300° is Normal. To test if the dial is properly calibrated, we will test the following hypotheses: $H_0: \mu = 300$ versus $H_a: \mu \neq 300$.

31. Are the data statistically significant at the 5% significance level?
A) Yes, because the $P$-value is less than 0.05.
B) Yes, because the sample mean $\bar{x} = 305°$, which is much higher than 300°.
C) No, because a difference of 5° (between $\bar{x}$ and $\mu$) as compared to 300° is very small (insignificant).
D) No, because the $P$-value is greater than 0.05.

Use the following to answer questions 32-33:

A one-sample $t$ test of $H_0: \mu = 125$ against $H_a: \mu > 125$ is carried out based on sample data from a Normal population. The SRS of size $n = 15$ produced a mean $\bar{x} = 132.8$ and $s = 12.6$. 

32. What is the value of the appropriate test statistics?
   A) $z = 2.40$
   B) $t = 2.32$
   C) $t = 2.40$
   D) $z = 2.32$
   E) $t = 1.76$

33. What is the $P$-value of the test in this situation?
   A) $P = 0.008$
   B) $P > 0.02$
   C) $0.02 < P < 0.04$
   D) $0.01 < P < 0.02$
   E) $0.02 < P < 0.025$

Use the following to answer question 34:

Assume that sample data, based on two independent samples of size 25, give us $\bar{x}_1 = 505$, $\bar{x}_2 = 515$, $s_1 = 23$, and $s_2 = 28$.

34. What is a 95% confidence interval (use the conservative value for the degrees of freedom) for $\mu_2 - \mu_1$?
   A) $(-2.40, 22.40)$
   B) $(-4.57, 24.57)$
   C) $(-4.96, 24.96)$
   D) $(5.79, 14.21)$

35. Two sample $t$ procedures are used when _______.
   A) subjects are the same in both samples
   B) subjects in one sample are completely unrelated to the subjects in the other sample
   C) Subjects are similar in both samples
   D) None of the above.

36. An instructor is teaching two sections of the same basic statistics course. The instructor is giving the same exams, homework assignments, and quizzes in both sections. Which $t$ procedure should be used to determine if there is a difference in the academic performance between the two course sections?
   A) One-sample $t$ test.
   B) Matched-pairs $t$ procedure.
   C) Two-sample $t$ test.
   D) None of the above.
37. When performing a two-sample \( t \) procedure, which of the following methods will help determine the degrees of freedom?
   A) Take the smaller of the two samples and subtract 1.
   B) Take the larger of the two samples and subtract 1.
   C) Take the smaller of the two samples and add 1.

38. The two-sample \( z \) statistic is used when the population mean is known from both samples.
   A) True
   B) False

39. When testing the hypothesis of equal means of two independent random samples, which distribution is used?
   A) Normal distribution
   B) \( t \) distribution
   C) F distribution
   D) Binomial distribution

40. Two independent random samples were selected from Normally distributed populations with unknown means and standard deviations. Sample 1 with a sample size of 20 gave the following results: \( \bar{x}_1 = 163.8 \) and \( s_1 = 6.2 \). Sample 2 of size 17 produced: \( \bar{x}_2 = 179.6 \) and \( s_2 = 7.1 \). If a 95% confidence interval were constructed for the population mean difference, \( \mu_1 - \mu_2 \), what would be the approximate margin of error?
   A) \[ 2.093 \sqrt{ \frac{(6.2)^2}{20} + \frac{(7.1)^2}{17} } \]
   B) \[ 2.120 \sqrt{ \frac{(6.2)^2}{20} + \frac{(7.1)^2}{17} } \]
   C) \[ \sqrt{ \frac{(6.2)^2}{20} + \frac{(7.1)^2}{17} } \]
   D) \[ (163.8 - 179.6) \pm 2.093 \sqrt{ \frac{(6.2)^2}{20} + \frac{(7.1)^2}{17} } \]
   E) \[ (163.8 - 179.6) \pm 2.120 \sqrt{ \frac{(6.2)^2}{20} + \frac{(7.1)^2}{17} } \]
Answer Key

1. A) False, B) False, C) True, D) True
2. C
3. C
4. C
5. D
6. B
7. A
8. B
9. A
10. A
11. B
12. B
13. B
14. B
15. B
16. A
17. A
18. C
19. B
20. A
21. C
22. D
23. B
24. A) True, B) True, C) False, D) True
25. C
26. C
27. A
28. A
29. D
30. B
31. D
32. C
33. D
34. C
35. B
36. C
37. A
38. B
39. B
40. B