Provide an appropriate response.

1) A statistics student's presentation of the results of her study included many charts, graphs, and tables. Identify the kind of statistical study conducted.

2) A meteorologist constructs a graph showing the total precipitation in Phoenix, Arizona in each of the months of 1998. Does this involve descriptive statistics or inferential statistics?

Classify the study as either descriptive or inferential.

3) The table below shows the number of new AIDS cases in the U.S. in each of the years 1989–1994.

<table>
<thead>
<tr>
<th>Year</th>
<th>New AIDS cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>33,643</td>
</tr>
<tr>
<td>1990</td>
<td>41,761</td>
</tr>
<tr>
<td>1991</td>
<td>43,771</td>
</tr>
<tr>
<td>1992</td>
<td>45,961</td>
</tr>
<tr>
<td>1993</td>
<td>103,463</td>
</tr>
<tr>
<td>1994</td>
<td>61,301</td>
</tr>
</tbody>
</table>

A designed experiment is described. Identify the specified element of the experiment.

4) In a clinical trial, 780 participants suffering from high blood pressure were randomly assigned to one of three groups. Over a one-month period, the first group received a low dosage of an experimental drug, the second group received a high dosage of the drug, and the third group received a placebo. The diastolic blood pressure of each participant was measured at the beginning and at the end of the period and the change in blood pressure was recorded. Identify the experimental units.

Identify the study as an observational study or a designed experiment.

5) A researcher wished to assess the importance of exercise in weight-loss programs. 412 people, all considered to be at least 20 pounds overweight, volunteered to participate in a study. The participants were randomly assigned to one of two groups. Over a two-month period, the first group followed a particular diet but were instructed to perform no exercise other than walking. The second group followed the same diet but also performed aerobic exercise for one hour each day. At the end of the two months, the weight loss of each participant was recorded. The average weight loss was calculated for each group and it was found that the average weight loss for the second group was significantly greater than the average weight loss for the first group.

Preliminary data analyses indicate that you can reasonably consider the assumptions for using pooled t-procedures satisfied. Perform the required hypothesis test by using either the critical-value approach or the P-value approach.

6) A researcher was interested in comparing the resting pulse rate of people who exercise regularly and people who do not exercise regularly. Independent simple random samples of 16 people ages 30–40 who do not exercise regularly and 12 people ages 30–40 who do exercise regularly were selected and the resting pulse rate of each person was measured. The summary statistics are as follows.

<table>
<thead>
<tr>
<th>Do Not Exercise</th>
<th>Do Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x_1 = 72.8$</td>
<td>$x_2 = 69.4$</td>
</tr>
<tr>
<td>$s_1 = 10.8$</td>
<td>$s_2 = 8.0$</td>
</tr>
<tr>
<td>$n_1 = 16$</td>
<td>$n_2 = 12$</td>
</tr>
</tbody>
</table>

At the 2.5% significance level, do the data provide sufficient evidence to conclude that the mean resting pulse rate of people who do not exercise regularly is greater than the mean resting pulse rate of people who exercise regularly?
Apply the pooled t-interval procedure to obtain the required confidence interval. 

7) A researcher was interested in comparing the salaries of female and male employees at a particular company. Independent simple random samples of 8 female employees and 15 male employees yielded the following weekly salaries (in dollars).

<table>
<thead>
<tr>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>495</td>
<td>722</td>
</tr>
<tr>
<td>760</td>
<td>562</td>
</tr>
<tr>
<td>556</td>
<td>880</td>
</tr>
<tr>
<td>904</td>
<td>520</td>
</tr>
<tr>
<td>520</td>
<td>500</td>
</tr>
<tr>
<td>1005</td>
<td>1250</td>
</tr>
<tr>
<td>743</td>
<td>750</td>
</tr>
<tr>
<td>660</td>
<td>1640</td>
</tr>
</tbody>
</table>

Determine a 98% confidence interval for the difference between the mean weekly salaries of female employees and male employees at this particular company. (Note: \( \bar{x}_1 \approx 705.375, \bar{x}_2 \approx 817.067, s_1 = 183.855, s_2 = 330.146 \).)

Apply a nonpooled t-test to perform the required hypothesis test, using the P-value approach.

8) A researcher was interested in comparing the salaries of female and male employees at a particular company. Independent simple random samples of 8 female employees and 15 male employees yielded the following weekly salaries (in dollars).

<table>
<thead>
<tr>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>495</td>
<td>722</td>
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</tr>
<tr>
<td>556</td>
<td>880</td>
</tr>
<tr>
<td>904</td>
<td>520</td>
</tr>
<tr>
<td>520</td>
<td>500</td>
</tr>
<tr>
<td>1005</td>
<td>1250</td>
</tr>
<tr>
<td>743</td>
<td>750</td>
</tr>
<tr>
<td>660</td>
<td>1640</td>
</tr>
</tbody>
</table>

At the 5% significance level, do the data provide sufficient evidence to conclude that at this company the mean salary of female employees is less than the mean salary of male employees? (Note: \( \bar{x}_1 = 705.375, \bar{x}_2 = 817.067, s_1 = 183.855, s_2 = 330.146 \).)

Apply the nonpooled t-interval procedure to obtain the required confidence interval. You may presume that the assumptions for using the procedure are satisfied.

9) A researcher was interested in comparing the amount of time spent watching television by women and by men. Independent simple random samples of 14 women and 17 men were selected, and each person was asked how many hours he or she had watched television during the previous week. The summary statistics are as follows.

- Women: \( \bar{x}_1 = 12.1, s_1 = 3.9, n_1 = 14 \)
- Men: \( \bar{x}_2 = 14.1, s_2 = 5.2, n_2 = 17 \)

Determine a 99% confidence interval for the difference, \( \mu_1 - \mu_2 \), between the mean television watching times for women and men.

Preliminary data analyses indicates that use of a paired t-test is reasonable. Perform the hypothesis test by using either the critical-value approach or the P-value approach.

10) A test of abstract reasoning is given to a random sample of students before and after completing a formal logic course. The results are shown below.

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>73</td>
</tr>
<tr>
<td>83</td>
<td>77</td>
</tr>
<tr>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>88</td>
<td>77</td>
</tr>
<tr>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>63</td>
<td>67</td>
</tr>
<tr>
<td>93</td>
<td>95</td>
</tr>
<tr>
<td>81</td>
<td>85</td>
</tr>
<tr>
<td>77</td>
<td>75</td>
</tr>
<tr>
<td>79</td>
<td>77</td>
</tr>
</tbody>
</table>

At the 5% significance level, do the data provide sufficient evidence to conclude that the mean score after the course differs from the mean score before the course?
Use the paired t-interval procedure to obtain the required confidence interval. You may presume that the assumptions for using the procedure are satisfied.

11) A test of writing ability is given to a random sample of students before and after completing a formal writing course. The results are shown below.

<table>
<thead>
<tr>
<th>Before</th>
<th>70 80 92 99 93 97 76 63 71 74</th>
</tr>
</thead>
<tbody>
<tr>
<td>After</td>
<td>69 79 90 96 91 95 75 64 62 76</td>
</tr>
</tbody>
</table>

Determine a 99% confidence interval for the mean difference in score before and after completing the writing course.

Provide an appropriate response.

12) Suppose that you wish to estimate a population proportion and want to determine a sample size that will ensure a given margin of error for a 95% confidence interval. Suppose further that an educated guess of 0.3 is used for \( \hat{p} \) when determining the sample size. What values of the observed value of \( \hat{p} \) will yield a larger margin of error than the one specified?

13) In a poll of 2500 voters in a certain city, 75% said that they backed a bill which would limit growth and development in their city. The margin of error in the poll was reported as 2 percentage points (with a 95% degree of confidence). Which statement is correct?

A) The reported margin of error is consistent with the sample size  
B) There is not enough information to determine whether the margin of error is consistent with the sample size  
C) The sample size is too small to achieve the stated margin of error  
D) For the given sample size, the margin of error should be smaller than stated

Find the indicated confidence interval.

14) Of 296 employees selected randomly from one company, 8.11% of them commute by carpooling. Construct a 90% confidence interval for the true percentage of all employees of the company who carpool.

Find the indicated margin of error.

15) In a clinical test with 2213 subjects, 1230 showed improvement from the treatment. Find the margin of error for the 95% confidence interval used to estimate the population proportion.

Assume that you wish to estimate a population proportion, \( \hat{p} \). For the given margin of error and confidence level, determine the sample size required.

16) A researcher wishes to estimate the proportion of people within a certain population who are HIV positive. Obtain a sample size that will ensure a margin of error of at most 3.7 percentage points for a 90% confidence interval. Assume that it is reasonable to presume that the percentage of those sampled who are HIV positive will be between 3% and 7%.

Find the required sample size without making a guess for the observed value of \( \hat{p} \).

17) A researcher wishes to estimate the true proportion of all drivers who exceed the speed limit on a certain stretch of road where accidents frequently happen. How large should the sample be so that, with 98 percent confidence, the sample proportion will not differ from the true proportion by more than 0.026?

Perform a hypothesis test for a population proportion using the critical value approach.

18) A research group claims that less than 28% of students at one medical school plan to go into general practice. It is found that among a random sample of 120 of the school’s students, 20% of them plan to go into general practice. At the 0.10 significance level, test the research group’s claim.

Find the P-value for the indicated hypothesis test.

19) In a sample of 47 adults selected randomly from one town, it is found that 9 of them have been exposed to a particular strain of the flu. Find the P-value for a test of the claim that the proportion of all adults in the town that have been exposed to this strain of the flu is 8%.
Provide an appropriate response.

20) Determine whether the following statement regarding a hypothesis test for two population proportions is true or false:

However small the difference between two population proportions, for sufficiently large sample sizes, the null hypothesis of equal population proportions is likely to be rejected.

21) Suppose the proportion of sophomores at a particular college who purchased used textbooks in the past year is \( p_s \) and the proportion of freshmen at the college who purchased used textbooks in the past year is \( p_f \). A study found a 90% confidence interval for \( p_s - p_f \) to be (0.232, 0.429). Does this interval suggest that sophomores are more likely than freshmen to buy used textbooks? Explain.

Use a two-sample z-test for two population proportions to perform the required hypothesis test. Use the P-value approach.

22) A researcher finds that of 1,000 people who said that they attend a religious service at least once a week, 31 stopped to help a person with car trouble. Of 1,200 people interviewed who had not attended a religious service at least once a month, 22 stopped to help a person with car trouble. At the 0.05 significance level, do the data provide sufficient evidence to conclude that the two population proportions are different?

Construct the indicated confidence interval for the difference between population proportions \( p_1 - p_2 \).

Assume that the samples are independent and that they have been randomly selected.

23) \( x_1 = 13, n_1 = 50 \) and \( x_2 = 25, n_2 = 56 \); Construct a 90% confidence interval for the difference between population proportions \( p_1 - p_2 \).

Perform the indicated goodness-of-fit test using the P-value method. Be sure to state the hypotheses and the significance level, to compute the value of the test statistic, to obtain the P-value, and to state your conclusion.

24) A die is rolled 180 times and the following data are obtained.

<table>
<thead>
<tr>
<th>Number</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
</tr>
</tbody>
</table>

Do the data provide sufficient evidence to conclude that the die is loaded (i.e., that the six numbers are not equally likely)? Perform the hypothesis test at the 1% level of significance.

Preliminary data analyses indicate that it is reasonable to consider the assumptions for one-way ANOVA satisfied. Perform the required hypothesis test using the critical-value approach.

25) A consumer magazine wants to compare the lifetimes of ballpoint pens of three different types. The magazine takes a random sample of pens of each type in the following table.

<table>
<thead>
<tr>
<th>Brand 1</th>
<th>Brand 2</th>
<th>Brand 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>260</td>
<td>181</td>
<td>238</td>
</tr>
<tr>
<td>218</td>
<td>240</td>
<td>257</td>
</tr>
<tr>
<td>184</td>
<td>162</td>
<td>241</td>
</tr>
<tr>
<td>219</td>
<td>218</td>
<td>213</td>
</tr>
</tbody>
</table>

Do the data indicate that there is a difference in mean lifetime for the three brands of ballpoint pens? Use \( \alpha = 0.01 \).

Tell whether the statement is true or false.

26) The set of possible values that a variable can take constitutes the data.

Classify the data as either discrete or continuous.

27) An athlete runs 100 meters in 10.7 seconds.

Identify the following variable as either qualitative or quantitative.

28) A person’s political affiliation.
For the given data, identify the variable under consideration.
 29) Anne is 69 inches tall and Lisa is 62 inches tall.
   A) Height   B) Anne, Lisa
   C) Tall, short   D) 69, 62

Provide an appropriate response.
30) When constructing a grouped-data table, what is the disadvantage of having too many classes? What is the disadvantage of having too few classes?

Construct a frequency distribution for the given qualitative data.
31) The blood types for 40 people who agreed to participate in a medical study were as follows.

   O A A O O AB O B A O
   A O A B O O O AB A A
   A B O A A O O B O O
   O A O O A B O O A AB

Construct a frequency distribution for the data.

Construct a grouped-data table for the given data. Use the symbol "<" to mean "up to, but not including".
32) A medical research team studied the ages of patients who had strokes caused by stress. The ages of 34 patients who suffered stress strokes were as follows.

29 30 36 41 45 50 57 61 28 50 36 58
60 38 36 47 40 32 58 46 61 40 55 32
61 56 45 46 62 36 38 40 50 27

Construct a frequency table for these ages. Use 8 classes beginning with a lower class limit of 25.

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
</tr>
</thead>
</table>

Construct the specified histogram.
33) In a survey, 20 voters were asked their age. The results are summarized in the frequency table below. Construct a frequency histogram corresponding to the frequency table.

<table>
<thead>
<tr>
<th>Age of voters</th>
<th>Number of voters</th>
</tr>
</thead>
<tbody>
<tr>
<td>20&lt;30</td>
<td>5</td>
</tr>
<tr>
<td>30&lt;40</td>
<td>5</td>
</tr>
<tr>
<td>40&lt;50</td>
<td>6</td>
</tr>
<tr>
<td>50&lt;60</td>
<td>0</td>
</tr>
<tr>
<td>60&lt;70</td>
<td>4</td>
</tr>
</tbody>
</table>

A nurse measured the blood pressure of each person who visited her clinic. Following is a relative-frequency histogram for the systolic blood pressure readings for those people aged between 25 and 40. Use the histogram to answer the question. The blood pressure readings were given to the nearest whole number.

34) Given that 600 people were aged between 25 and 40, approximately how many had a systolic blood pressure reading between 140 and 149 inclusive?
   A) 8   B) 5
   C) 48   D) 480
35) The following data show the number of laps run by each participant in a marathon.

46 65 55 43 51 48 57 30 43 49 32 56

36) A stem-and-leaf diagram is given below for the annual precipitation in one U.S. city for 28 consecutive years. Precipitation data are in inches.

0 \mid 9
1 \mid 142
2 \mid 0203
3 \mid 01472832
4 \mid 13487
5 \mid 1748
6 \mid 36
7 \mid 1

37) Find the mean for the given sample data. Unless otherwise specified, round your answer to one more decimal place than that used for the observations.

16, 14, 15, 16, 11

38) The salaries of ten randomly selected doctors are shown below.

$127,000 $128,000 $180,000 $200,000 $227,
$108,000 $144,000 $731,000 $249,000 $188,

Find the median salary.

39) The speeds (in mi/h) of the cars passing a certain checkpoint are measured by radar. The results are shown below.

42.9 42.7 42.2 45.0 40.9
40.9 42.7 41.5 43.2 45.0
42.9 41.5 45.0 41.9 42.7
42.5 42.5 42.2 40.8 42.9

40) To get the best deal on a microwave oven, Jeremy called six appliance stores and asked the cost of a specific model. The prices he was quoted are listed below.

$112 $465 $139 $606 $431 $288

41) To get the best deal on a CD player, Tom called eight appliance stores and asked the cost of a specific model. The prices he was quoted are listed below:

$238 $143 $296 $112 $134 $373 $166 $4

42) Heights of adult women are known to have a bell-shaped distribution. Draw a boxplot to illustrate the results.

43) The weights (in pounds) of 30 newborn babies are listed below. Construct a boxplot for the data set.

5.5 5.7 5.8 5.9 6.1 6.1 6.3 6.4 6.5 6.6
6.7 6.7 6.7 6.9 7.0 7.0 7.1 7.2 7.2
7.4 7.5 7.7 7.7 7.8 8.0 8.1 8.3 8.7

44) The normal annual precipitation (in inches) is given below for 21 different U.S. cities. Find the third quartile, Q3.

19.1 34.5 10.2 39.0 22.4 9.1 12.6
33.8 20.6 37.2 30.1 39.5 17.3 24.5
31.2 13.6 27.7 15.0 22.3 26.9 11.7

45) The ages of the 21 members of a track and field team are listed below.

15 18 18 19 22 23 24
24 24 24 25 26 26 27
28 28 30 32 33 40 42
Obtain the five-number summary for the given data.
46) The test scores of 15 students are listed below.

42  44  49  53  59
63  67  68  75  78
85  87  90  94  95

Obtain the population standard deviation, $\sigma$, for the given data. Assume that the data represent population data. Round your final answer to one more decimal place than that used for the observations.
47) The weekly salaries (in dollars) of seven government workers are listed below

539  608  724  658  499  668  715

Solve the problem.
48) A meteorological office keeps records of the annual precipitation in different cities. For one city, the mean annual precipitation is 22.7 and the standard deviation of the annual precipitation amounts is 4.3. Let $x$ represent the annual precipitation in that city. Determine the standardized version of $x$.

Use the regression equation to predict the $y$-value corresponding to the given $x$-value. Round your answer to the nearest tenth.
49) The regression equation relating attitude rating ($x$) and job performance rating ($y$) for ten randomly selected employees of a company is $\hat{y} = 11.7 + 1.02x$. Predict the job performance rating for an employee whose attitude rating is 68.

Obtain the linear correlation coefficient for the data. Round your answer to three decimal places.
50) Managers rate employees according to job performance ($x$) and attitude ($y$). The results for several randomly selected employees are given below.

<table>
<thead>
<tr>
<th>$x$</th>
<th>59</th>
<th>63</th>
<th>65</th>
<th>69</th>
<th>58</th>
<th>77</th>
<th>76</th>
<th>69</th>
<th>70</th>
<th>64</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>72</td>
<td>67</td>
<td>78</td>
<td>82</td>
<td>75</td>
<td>87</td>
<td>92</td>
<td>83</td>
<td>87</td>
<td>78</td>
</tr>
</tbody>
</table>

Provide an appropriate response.
51) A study was conducted to compare the number of hours spent in the computer lab on an assignment ($x$) and the grade on the assignment ($y$), for each of eight randomly selected students in a computer class. The results are recorded in the table below.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>96</td>
</tr>
<tr>
<td>11</td>
<td>51</td>
</tr>
<tr>
<td>16</td>
<td>62</td>
</tr>
<tr>
<td>9</td>
<td>58</td>
</tr>
<tr>
<td>7</td>
<td>89</td>
</tr>
<tr>
<td>15</td>
<td>81</td>
</tr>
<tr>
<td>16</td>
<td>46</td>
</tr>
<tr>
<td>10</td>
<td>51</td>
</tr>
</tbody>
</table>

52) Three random variables $X$, $Y$, and $Z$, are described below. In which of these situations would it be acceptable to use the binomial distribution?
A: A bag contains 4 blue marbles and 8 red marbles. Five marbles are drawn at random with replacement. The random variable $X$ is the number of blue marbles drawn.
B: A bag contains 4 blue marbles and 8 red marbles. Six marbles are drawn at random without replacement. The random variable $Y$ is the number of blue marbles drawn.
C: A bag contains 30 blue marbles and 38 red marbles. Three marbles are drawn at random without replacement. The random variable $Z$ is the number of blue marbles drawn.

53) List the four requirements for a binomial distribution. Describe an experiment which is binomial and discuss how the experiment fits each of the four requirements.

54) A group of potential jurors consists of 15 women and 18 men. Suppose that 12 people are picked at random from this group, without replacement. Let $X$ represent the number of women among those selected. Since the sample size exceeds 5% of the population size, $X$ does not have an approximate binomial distribution. Explain in your own words why $X$ does not have a binomial distribution. Which of the requirements for a binomial distribution does it not satisfy?
Find the specified probability distribution of the binomial random variable.

55) 41% of the murder trials in one district result in a guilty verdict. Five murder trials are selected at random from the district. Determine the probability distribution of X, the number of trials among the five selected in which the defendant is found guilty.

Find the mean of the binomial random variable.

56) A die is rolled 8 times and the number of times that two shows on the upper face is counted. If this experiment is repeated many times, find the mean for the random variable X, the number of twos.

Find the indicated probability.

57) The participants in a television quiz show are picked from a large pool of applicants with approximately equal numbers of men and women. Among the last 13 participants there have been only 2 women. If participants are picked randomly, what is the probability of getting 2 or fewer women when 13 people are picked?

58) A car insurance company has determined that 9% of all drivers were involved in a car accident last year. Among the 13 drivers living on one particular street, 3 were involved in a car accident last year. If 13 drivers are randomly selected, what is the probability of getting 3 or more who were involved in a car accident last year?

Find the indicated binomial probability.

59) A cat has a litter of 7 kittens. Find the probability that exactly 3 of the little furballs are female. Assume that male and female births are equally likely.

60) A company manufactures calculators in batches of 64 and there is a 4% rate of defects. Find the probability of getting exactly 3 defects in a batch.

Find the standard deviation of the binomial random variable.

61) A die is rolled 21 times and the number of twos that come up is tallied. If this experiment is repeated many times, find the standard deviation for the random variable X, the number of twos.

Provide an appropriate response.

62) How does the standard normal distribution differ from a nonstandard normal distribution? Why is it necessary to standardize in order to find percentages for nonstandard normal variables?

63) A variable is normally distributed. 42% of the possible observations of the variable lie between 20 and 28. What information does this give you about the graph of the normal curve for this variable?

64) On the same axes sketch normal distributions with
   a. $\mu = 6$, $\sigma = 4$
   b. $\mu = 6$, $\sigma = 2$
   c. $\mu = -6$, $\sigma = 2$.

65) A variable is normally distributed with a mean of 100 and a standard deviation of 10. Which is larger, the percentage of observations between 80 and 90 or the percentage of observations between 120 and 130? Explain your reasoning.

Fill in the blanks by standardizing the normally distributed variable.

66) The amount of time that customers wait in line during peak hours at one bank is normally distributed with a mean of 15 minutes and a standard deviation of 4 minutes. The percentage of time that the waiting time is less than 10 minutes is equal to the area under the standard normal curve that lies to the ___ of ___.

Provide an appropriate response.

67) Suppose that you know the area under the standard normal curve to the right of $-1.7$. How could you use this to find the area under the standard normal curve to the right of 1.7? Explain your reasoning.
68) Which of the following statements concerning areas under the standard normal curve is/are true?

a. If a z-score is negative, the area to its right is greater than 0.5
b. If the area to the right of a z-score is less than 0.5, the z-score is negative.
c. If a z-score is positive, the area to its left is less than 0.5

69) Sketch a standard normal curve and shade the area to the right of the z-score 1.6.

Use a table of areas to find the specified area under the standard normal curve.

70) The area that lies to the right of 0.59

Use a table of areas for the standard normal curve to find the required z-score.

71) Find the z-score for which the area under the standard normal curve to its left is 0.40

Provide an appropriate response.

72) True or false, areas under the standard normal curve cannot be negative, whereas z-scores can be positive or negative.

73) Most problems involving normally distributed variables are one of two types.

Type A: Find a probability or percentage, e.g., find the probability that X lies in a specified range.

Type B: Find the observation corresponding to a given probability or percentage.

Suppose that scores on a test are normally distributed with a mean of 80 and a standard deviation of 8. Which of the following questions below are of type B?

a. Find the 80th percentile.
b. Find the cutoff for the A grade if the top 10% get an A.
c. Find the percentage scoring more than 90.
d. Find the score that separates the bottom 30% from the top 70%.
e. Find the probability that a randomly selected student will score more than 80.

Find the indicated probability or percentage for the normally distributed variable.

74) The lengths of human pregnancies are normally distributed with a mean of 268 days and a standard deviation of 15 days. What is the probability that a pregnancy lasts at least 300 days?

Find the specified percentile, quartile, or decile.

75) Scores on an English test are normally distributed with a mean of 35.1 and a standard deviation of 7.8. Find the 41st percentile.
Construct a normal probability plot of the given data.

76) The weekly incomes (in dollars) of a sample of 12 nurses working at a Los Angeles hospital are given below.

500 750 630 480
550 650 720 780
820 960 1200 770

Draw the specified dotplot.

77) The heights (in inches) of 5 players on a basketball team are given in the table.

<table>
<thead>
<tr>
<th>Player</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (inches)</td>
<td>65</td>
<td>78</td>
<td>72</td>
<td>68</td>
<td>57</td>
</tr>
</tbody>
</table>

Draw a dotplot for the sampling distribution of the sample mean for samples of size 2.

Find the requested probability.

78) The test scores of 5 students are under consideration. The following is the dotplot for the sampling distribution of the sample mean for samples of size 2.

Find the probability, expressed as a percent, that the sample mean will be within 3 points of the population mean.

Provide an appropriate response.

79) A population of people has a mean height of 65 inches. Andrew picks a person at random from the population and records his or her height. He repeats this procedure 49 times more. Bob picks a sample of 30 people at random from the population and records the mean height of the sample. He repeats this procedure 49 times more. Which set of numbers - those recorded by Andrew or those recorded by Bob - do you think will have more variability? Explain your reasoning.

80) The mean height for a population is 65 inches. Let \( \bar{x} \) denote the mean height for a sample of people picked randomly from the population. True or false, the standard deviation of \( \bar{x} \) for samples of size 30 is smaller than the standard deviation, \( \sigma \), of the population?

81) The mean height for a population is 65 inches and the standard deviation is 3 inches. Let A and B denote the events described below.

Event A: The mean height of a random sample of 16 people will be within 1 inch of the population mean.

Event B: The mean height of a random sample of 50 people will be within 1 inch of the population mean.

True or false, the probability of event A is greater than the probability of event B?

Find the indicated probability or percentage for the sampling error.

82) Scores on an aptitude test are normally distributed with a mean of 220 and a standard deviation of 10. Determine the percentage of samples of size 25 that have a mean score within 3 points of the population mean score of 220.
Identify the distribution of the sample mean. In particular, state whether the distribution of \( \bar{x} \) is normal or approximately normal and give its mean and standard deviation.

83) The heights of people in a certain population are normally distributed with a mean of 66 inches and a standard deviation of 3.6 inches. Determine the sampling distribution of the mean for samples of size 39.

Find the requested confidence interval.

84) The data below consists of the pulse rates (in beats per minute) of 32 students. Construct a 95.44% confidence interval for the population mean.

\[
\begin{align*}
80 & \quad 74 & \quad 61 & \quad 93 & \quad 69 & \quad 74 & \quad 80 & \quad 64 \\
51 & \quad 60 & \quad 66 & \quad 87 & \quad 72 & \quad 77 & \quad 84 & \quad 96 \\
60 & \quad 67 & \quad 71 & \quad 79 & \quad 89 & \quad 75 & \quad 66 & \quad 70 \\
57 & \quad 76 & \quad 71 & \quad 92 & \quad 73 & \quad 72 & \quad 68 & \quad 74
\end{align*}
\]

Find the requested value.

85) A long-distance phone company wishes to estimate the mean duration of long-distance calls originating in California. A random sample of 15 long-distance calls originating in California yields the following call durations, in minutes.

\[
\begin{align*}
5 & \quad 4 & \quad 3 & \quad 1 & \quad 2 \\
34 & \quad 29 & \quad 40 & \quad 24 & \quad 12 \\
1 & \quad 19 & \quad 12 & \quad 2 & \quad 37
\end{align*}
\]

Use the data to obtain a point estimate of the mean call duration for all long-distance calls originating in California.

Provide an appropriate response.

86) If the sample size is small (less than 15), under what conditions is it reasonable to use the z-interval procedure to obtain a confidence interval for the population mean? If the sample size is moderate (between 15 and 30), under what conditions is it reasonable to use the z-interval procedure to obtain a confidence interval for the population mean?

Find the confidence interval specified.

88) 30 people are selected randomly from a certain town. If their mean age is 70.6 and \( \sigma = 5.5 \), find a 95% confidence interval for the true mean age, \( \mu \), of everyone in the town.

Provide an appropriate response.

89) A sample mean is used to estimate a population mean. To obtain a margin of error of 1.5 at a confidence level of 95%, a sample size of 120 is needed. Would the required sample size be larger or smaller if the researcher wished to

(a) increase the confidence level while keeping the same margin of error?
(b) decrease the margin of error while keeping the same confidence level?

Explain your answers.

Determine the margin of error in estimating the population mean, \( \mu \).

90) A sample of 57 eggs yields a mean weight of 1.66 ounces. Assuming that \( \sigma = 0.37 \) ounces, find the margin of error in estimating \( \mu \) at the 95% level of confidence.

Find the necessary sample size.

91) The drying times for a certain type of cement are normally distributed with a standard deviation of 42 minutes. A researcher wishes to estimate the mean drying time for this type of cement. Find the sample size needed to assure with 68.26 percent confidence that the sample mean will not differ from the population mean by more than 3 minutes.

Find the confidence interval specified. Assume that the population is normally distributed.

92) The principal randomly selected six students to take an aptitude test. Their scores were:

\[
89.8 \quad 76.3 \quad 79.4 \quad 87.6 \quad 79.4 \quad 70.9
\]

Determine a 90% confidence interval for the mean score for all students.
Provide an appropriate response.

93) Suppose that you wish to conduct a hypothesis test concerning a population mean. How would you decide whether to conduct a right-tailed, a left-tailed, or a two-tailed test? Is it acceptable to decide what type of test to conduct by examining the sample data?

A hypothesis test is to be performed. Determine the null and alternative hypotheses.

94) The manufacturer of a refrigerator system for beer kegs produces refrigerators that are supposed to maintain a true mean temperature, \( \mu \), of 39°F, ideal for a certain type of German pilsner. The owner of the brewery does not agree with the refrigerator manufacturer, and claims he can prove that the true mean temperature is incorrect.

Classify the conclusion of the hypothesis test as a Type I error, a Type II error, or a correct decision.

95) A health insurer has determined that the "reasonable and customary" fee for a certain medical procedure is $1200. They suspect that the average fee charged by one particular clinic for this procedure is higher than $1200. The insurer wants to perform a hypothesis test to determine whether their suspicion is correct. The hypotheses are:

\[
H_0 : \mu = 1200 \\
H_a : \mu > 1200
\]

Suppose that the results of the sampling lead to rejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision, if in fact the average fee charged by the clinic is $1200.

96) The average diastolic blood pressure of a group of men suffering from high blood pressure is 100 mmHg. During a clinical trial, the men receive a medication which it is hoped will lower their blood pressure. After three months, the researcher wants to perform a hypothesis test to determine whether the average diastolic blood pressure of the men has decreased. The hypotheses are:

\[
H_0 : \mu = 100 \text{ mmHg} \\
H_a : \mu < 100 \text{ mmHg}
\]

Suppose that the results of the sampling lead to nonrejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision, if in fact the average diastolic blood pressure of the men has not decreased.

For the given hypothesis test, explain the meaning of a Type I error, a Type II error, or a correct decision as specified.

97) A manufacturer claims that the mean amount of juice in its 16 ounce bottles is 16.1 ounces. A consumer advocacy group wants to perform a hypothesis test to determine whether the mean amount is actually less than this. The hypotheses are:

\[
H_0 : \mu = 16.1 \text{ ounces} \\
H_a : \mu < 16.1 \text{ ounces}
\]

Explain the meaning of a Type I error.

Perform a hypothesis test for the population mean. Assume that preliminary data analyses indicate that it is reasonable to apply the z-test.

98) A manufacturer makes steel bars that are supposed to have a mean length of 50 cm. A retailer suspects that the bars are running short. A sample of 54 bars is taken and their mean length is determined to be 51 cm. Using a 1% level of significance, perform a hypothesis test to determine whether the population mean is less than 50 cm. Assume that the population standard deviation is 3.6 cm.
99) A brochure claims that the average maximum height a certain type of plant is 0.7 m. A gardener suspects that this estimate is not accurate locally due to soil conditions. A random sample of 44 mature plants is taken. The mean height of the plants in the sample is 0.65 m. Using a 1% level of significance, perform a hypothesis test to determine whether the population mean is different from 0.7 m. Assume that the population standard deviation is 0.2 m.

Provide an appropriate response.

100) A one-sample z-test for a population mean is to be performed. Let \( z_0 \) denote the observed value of the test statistic, \( z \). Assume that a two-tailed test is being performed. True or false, if \( z_0 \) is negative, the P-value is twice the area under the standard normal curve to the right of \( z_0 \)?

101) A manufacturer claims that the mean weight of flour in its 32-ounce bags is 32.1 ounces. A z-test is performed to determine whether the mean weight is actually less than this. The hypotheses are
\[
H_0: \mu = 32.1 \text{ ounces} \\
H_a: \mu < 32.1 \text{ ounces}.
\]
The mean weight for a sample of 45 bags of flour was 30.7 ounces. Suppose that the P-value corresponding to this sample data is 0.001. Give an interpretation of the P-value. Would you feel confident in concluding that the mean weight is less than 32.1 ounces?

Perform a one-sample z-test for a population mean using the P-value approach. Be sure to state the hypotheses and the significance level, to compute the value of the test statistic, to obtain the P-value, and to state your conclusion.

102) In the past, the mean running time for a certain type of flashlight battery has been 8.5 hours. The manufacturer has introduced a change in the production method which he hopes has increased the mean running time. The mean running time for a random sample of 40 light bulbs was 8.7 hours. Do the data provide sufficient evidence to conclude that the mean running time of all light bulbs, \( \mu \), has increased from the previous mean of 8.5 hours? Perform the appropriate hypothesis test using a significance level of 0.05. Assume that \( \sigma = 0.5 \) hours.

Provide an appropriate answer.

103) DuraBurn claims that its light bulbs have at least twice the average lifetime of SuperGlo’s bulbs. The mean lifetime of the SuperGlo bulbs is \( \mu = 487 \) hours. A sample of 12 DuraBurn bulbs exhibited an average lifetime \( \bar{x} = 1052 \) hours with a standard deviation \( s = 201 \) hours. Using the hypotheses
\[
H_0: \mu = 974 \\
H_a: \mu < 974,
\]
compute the value of the test statistic, and find the P-value for the sample. State your conclusions about DuraBurn’s claim.

A) Test statistic: \( t = 1.3443 \). P-Value: \( P = 0.89704 \). Accept \( H_0: \mu = 974 \). Since \( P > \alpha \), there is not sufficient evidence to conclude that DuraBurn’s claim is false.

B) Test statistic: \( t = 1.3443 \). P-Value: \( P = 0.89704 \). Reject \( H_0: \mu = 974 \). Since \( P > \alpha \), there is sufficient evidence to conclude that DuraBurn’s claim is false.

C) Test statistic: \( t = 1.3443 \). P-Value: \( P = 0.44852 \). Accept \( H_0: \mu = 974 \). Since \( P > \alpha \), there is not sufficient evidence to conclude that DuraBurn’s claim is false.

D) Test statistic: \( t = 1.3443 \). P-Value: \( P = 0.89704 \). Accept \( H_0: \mu = 974 \). Since \( P > \alpha \), there is sufficient evidence to conclude that DuraBurn’s claim is false.
1) The purpose of the study may have been completely descriptive or it might have been inferential.

Objective: (1.1) *Know Concepts:
Two Kinds of Statistics

2) Descriptive statistics

Objective: (1.1) *Know

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3) Descriptive

Objective: (1.1) Clas

Objective: (1.5) Ide

Clas

Objective: (1.1) *Know

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9) -6.52 to 2.52 hours
Objective: (10.3)
Find Confidence Interval Using Nonpooled t-Interval Procedure

10) $H_0: \mu_1 = \mu_2$
$H_a: \mu_1 \neq \mu_2$
$\alpha = 0.05$
t = 2.366
Critical values = ±2.262
Reject $H_0$. At the 5% significance level, the data provide sufficient evidence to conclude that the mean score after the course differs from the mean score before the course.

11) -0.5 to 4.5
Objective: (10.4)
Find Confidence Interval Using Pooled t-Interval Procedure

12) $0.3 < p < 0.7$
Objective: (11.4)
*Per for m Pair ed t-Test st to Co mp are Tw o Pop ulation Means

13) A
Objective: (11.1)
*Kn ow Con cept s: Mar gin of Erro r

14) From 5.50% to 10.7%
Objective: (11.1)
Pair ed t-Interval Procedure

15) 0.0207
Objective: (11.1)
Find Mar gin of Erro r

16) 129
Objective: (11.1)
18) \( H_0: p = 0.28 \)  
\( H_a: p < 0.28 \)  
\( \alpha = 0.10 \)  
Test statistic: \( z = -1.95 \)  
P-Value = 0.0255  
Reject the null hypothesis. 
There is sufficient evidence at the 10% significance level to conclude that the proportion of students at this school planning to go into general practice is less than 28%.  
Objective: (11.2) *Per for m Hy pot hesi s Test (P-Val ue Ap pro ach)

19) 0.0048  
Objective: (11.2) Solv e Ap ps: Find P-V alue 

20) True  
Objective: (11.3) *Kn ow Con cept s: Infe rences for Tw o Pro port ions I

21) Yes. Since the interval lies entirely above 0, there is evidence that \( p_s - p_f \) is greater than zero. In other words, there is evidence that \( p_s > p_f \), that the proportion of sophomores who buy used textbooks is greater than the proportion of freshmen who buy used textbooks.  
Objective: (11.3) *Kn ow Con cept s: Infe rences for Tw o Pro port ions II

22) \( H_0: p_1 = p_2 \)  
\( H_a: p_1 \neq p_2 \)  
\( \alpha = 0.05 \)  
Test statistic: \( z = 1.93 \)  
P-Value = 0.0536  
Fail to reject the null hypothesis. 
There is not sufficient evidence at the 5% significance level to conclude that the two population proportions are different.  
Objective: (11.3) *Per for m Hy pot hesi s Test (P-Val ue Ap pro ach)

23) \(-0.336 < p_1 - p_2 < -0.037\)  
Objective: (11.3) *Kn ow Con cept s: Infe rences for Diff eren ce in Pro port ions
24) \( H_0 \): The die is fair.  
\( H_1 \): The die is loaded.  
\( \alpha = 0.01 \)  
Test statistic: \( \chi^2 = 11.8 \).  
0.025 \(< \) P-value \(< \) 0.05.  
Do not reject \( H_0 \). At the 1% significance level, the data do not provide sufficient evidence to conclude that the die is loaded.  

Objective: (12.2)  
\*Per for m Chi-Sq uare e Goodness of Fit Test (P-Val ue)
33) Constructure

34) C

35) 3 0 2
    4 6 3 8 3 9
    5 5 1 7 6
    6 5

36) Bell-shaped
    Objective: (2.5)
    Frequency
    Objective: (3.3)
    $114.6
    37) 14.4
    Objective: (3.1)
    Check students’ drawings.
    Students should draw a boxplot for a bell-shaped distribution (a symmetric boxplot with long whiskers relative to the width of the box).

38) $184,000
    Objective: (2.5)
    Construct
    histogram (class grouped data)
    39) 42.9 mi/hr,
        45.0 mi/hr,
        42.7 mi/hr
    Objective: (3.1)
    *Know concept
    40) $494
        Objective: (2.4)
        Construct
        stem-and-leaf
        diagram

41) $114.6
    Objective: (3.3)
    Find distribution
    of
    Deviation
    42) Check students’ drawings.
    43) 5.5 6.4
    Objective: (3.4)
    Obtain
    Five-number summary
    44) 31.2 in.
    Objective: (3.4)
    Find
    Quartile
    Interquartile
    Range
    45) 40, 42
    Objective: (3.4)
    Obtain
    Five-number summary
    46) 42, 56, 68, 86,
        95
    Objective: (3.4)
    Use
    Regression
    Equation to predict
    47) $79.5
    Objective: (3.5)
    Find standard deviation
    48) $z = \frac{x - 22.7}{4.3}$
50) 0.863
Objective: (4.4)
Obtain Linear Correlation Coefficient
51) -0.335
Objective: (4.4)
Obtain Linear Correlation Coefficient
52) A only
Objective: (5.6)
Know Concepts:
The Binomial Distribution
53) The four requirements are:
1) The experiment must have a fixed number of trials.
2) The trials must be independent.
3) Each trial must have all outcomes classified into two categories.
4) The probabilities must remain constant for each trial.

Answers will vary for the experiment.
Objective: (5.6)
Know Concepts:
The Binomial Distribution
54) Answers will vary. After each selection, the pool from which the next person will be selected contains one person fewer. This means that the success probability is not constant from one trial to the next. Furthermore, the trials are not independent since the probability of picking a woman at any given trial depends on the number of women already selected.

55)

<table>
<thead>
<tr>
<th>x</th>
<th>P(X = x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0715</td>
</tr>
<tr>
<td>1</td>
<td>0.2484</td>
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<tr>
<td>2</td>
<td>0.3452</td>
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<td>0.2399</td>
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<td>4</td>
<td>0.0834</td>
</tr>
<tr>
<td>5</td>
<td>0.0116</td>
</tr>
</tbody>
</table>

Objective: (5.6)
Determine Probability Distribution of Binomial Random Variable
56) 1.33
Objective: (5.6)
Solve

<table>
<thead>
<tr>
<th>x</th>
<th>P(X = x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.1053</td>
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</table>

Objective: (5.6)
Solve

<table>
<thead>
<tr>
<th>x</th>
<th>P(X = x)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>0.1053</td>
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</table>

57) 0.0112
Objective: (5.6)
Solve

<table>
<thead>
<tr>
<th>x</th>
<th>P(X = x)</th>
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<tbody>
<tr>
<td>0</td>
<td>0.0112</td>
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</table>
59) 0.27344
   Objective: (5.6)
   Solve
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   babi
   lity
   of
   Exa
   ctly
   x
   Suc
   cess
   es

61) 1.708
   Objective: (5.6)
   Solve
   e
   App
   s:
   Fin
   d
   Pro
   babi
   lity
   of
   Exa
   ctly
   x
   Suc
   cess
   es

62) Answers will vary. Possible answer: The
   Objective: (6.1)
   *Know Concepts:
   
63) The area under the normal curve between
   20 and 28 is 0.42.
   Objective: (6.1)
   *Know Concepts:
   
64) Responses can vary, but a correct response
   should resemble the following:

65) Answers will vary. Possible answer: The percentage of observations between 80 and 90 is larger. Both intervals have the same length, but the interval (80, 90) is closer to the mean than the interval (120, 130).
   Objective: (6.1)
   *Know Concepts:

66) left, -1.25
   Objective: (6.1)
   Standardize Normally Distributed Variables

20
67) By symmetry, the area under the standard normal curve to the right of 1.7 is equal to the area under the standard normal curve to the left of -1.7 which can be found by subtracting the given area from 1.

**Objective:** (6.2)

*Know Concepts:

- Area as Under Standard
d Normal Curve

68) a. Objective: (6.2)

*Know

- Ow
- Concept

- As
- Under
- Standard
d Normal Curve

69) A correct response should resemble the following:

70) 0.2776

**Objective:** (6.2)

*Find Areas Under Standard Normal Curve

71) -0.25

**Objective:** (6.2)

*Find

- d
- z-score
- Core
- Given
- Area

72) TRUE

**Objective:** (6.3)

*Know

- Ow
- Concept

- As
- Under
- Standard
d Normal Curve

73) a, b, d

**Objective:** (6.3)

*Know

- Ow
- Concept

- As
- Under
- Standard
d Normal Curve

74) 0.0166

**Objective:** (6.3)

*Find Percentile/Quartile/Decile

75) 33.3

**Objective:** (6.3)

*Find

- d
- Percentile
- Entil
- e/Q
- uart
- ile/Dec
dile

76) Normal Score

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<tr>
<td>-2</td>
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</tbody>
</table>

**Objective:** (6.4)

*Construct Normal Probability Plot

77) Objective: (7.1)

*Draw

- Dot plot

60 61
78) 60%  
Objective: (7.1)  
Find numbers recorded by Andrew will have greater variability. The standard deviation of sample means $(\sigma/\sqrt{n})$ is smaller than the standard deviation of individual observations $(\sigma)$.

79) Answers will vary. Possible answer: The numbers recorded by Andrew will have greater variability. The standard deviation of sample means $(\sigma/\sqrt{n})$ is smaller than the standard deviation of individual observations $(\sigma)$.

80) TRUE  
Objective: (7.2)  
*Kn ow Con cept s: Mea n/St and ard Dev iati on of Sam ple Mea n

81) FALSE  
Objective: (7.2)  
*Kn ow Con cept s: Mea n/St and ard Dev iati on of Sam ple Mea n

82) 86.64%  
Objective: (7.3)  
Fin d Con cept s: Mea n/St and ard Dev iati on of Sam ple Mea n

83) Normal, mean = 66 inches, standard deviation = 0.58 inches

84) 69.77 to 77.24  
Objective: (8.1)  
Find Con fide nce Inte rval for Me an

85) 15.0 minutes  
Objective: (8.1)  
Find Con fide nce Inte rval for Me an

86) When the sample size is small, the $z$-interval procedure should be used only when the variable under consideration is normally distributed or very close to being so. When the sample size is moderate, the $z$-interval procedure can be used unless the data contain outliers or the variable under consideration is far from being normally distributed.
Objective: (8.2)

87) 100(1 - α)

Objective: (8.2)

88) 68.63 to 72.57

Objective: (8.2)

89) In both cases, a larger sample would be needed.

Objective: (8.2)

90) 0.10 oz

Objective: (8.3)

91) 196

Objective: (8.3)

92) 74.76 to 86.37

Objective: (8.4)

93) Answers will vary. Possible answer: The nature of the test depends on what you are trying to determine. If you want to decide whether the population mean is greater than a specified value, the test will be right-tailed. If you want to decide whether the population mean is smaller than a specified value, the test will be left-tailed. If you want to decide whether the population mean differs from a specified value, the test will be two-tailed.

94) H₀: μ = 39°

Hₐ: μ ≠ 39°

Objective: (9.1)

95) Type I error

Objective: (9.2)

96) Correct decision

Objective: (9.2)
97) Concluding that $\mu < 16.1$ ounces when in fact $\mu = 16.1$ ounces
Objective: (9.2)

99) $H_0 : \mu = 0.7$
m
$H_a : \mu \neq 0.7$
m
Test statistic: $z = -1.66$. Critical values: $z = \pm 2.575$. Fail to reject $H_0$; $\mu = 0.7$ m. There is not sufficient evidence to warrant rejection of the claim that the mean length is 0.7 m.

101) If the null hypothesis were true (i.e., if the mean weight really were 32.1 ounces), the probability of observing a sample mean as small or smaller than 30.7 ounces would be 0.001. Since the P-value is so small, the evidence against the null hypothesis is overwhelming.

102) $H_0 : \mu = 8.5$

103) A

Objective: (9.5)

100) FALSE

Objective: (9.4)