Statistics for Business and Economics, 8e **(Newbold)**
Chapter 2   Describing Data: Numerical

1) If you are interested in comparing variation in sales for small and large stores selling similar goods, which of the following is the most appropriate measure of dispersion?
A) the range
B) the interquartile range
C) the standard deviation
D) the coefficient of variation
Answer: D
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

2) Suppose you are told that the mean of a sample is below the median. What does this information suggest about the distribution?
A) The distribution is symmetric.
B) The distribution is skewed to the right or positively skewed.
C) The distribution is skewed to the left or negatively skewed.
D) There is insufficient information to determine the shape of the distribution.
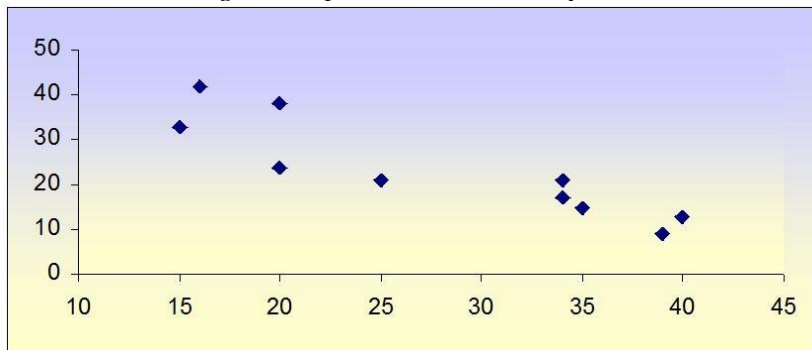Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

3) For the following scatter plot, what would be your best estimate of the correlation coefficient?

A) -0.8
B) -1.0
C) 0.0
D) -0.3
Answer: A
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

4) Given a set of 25 observations, for what value of the correlation coefficient would we be able to say that there is evidence that a relationship exists between the two variables?
A) $|r_{xy}| \geq 0.40$
B) $|r_{xy}| \geq 0.35$
C) $|r_{xy}| \geq 0.30$
D) $|r_{xy}| \geq 0.25$
Answer: A
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

5) Which of the following statements is true about the correlation coefficient and covariance?
A) The covariance is the preferred measure of the relationship between two variables since it is generally larger than the correlation coefficient.
B) The correlation coefficient is a preferred measure of the relationship between two variables since its calculation is easier than the covariance.
C) The covariance is a standardized measure of the linear relationship between two variables.
D) The covariance and corresponding correlation coefficient are represented by different signs, one is negative while the other is positive and vice versa.
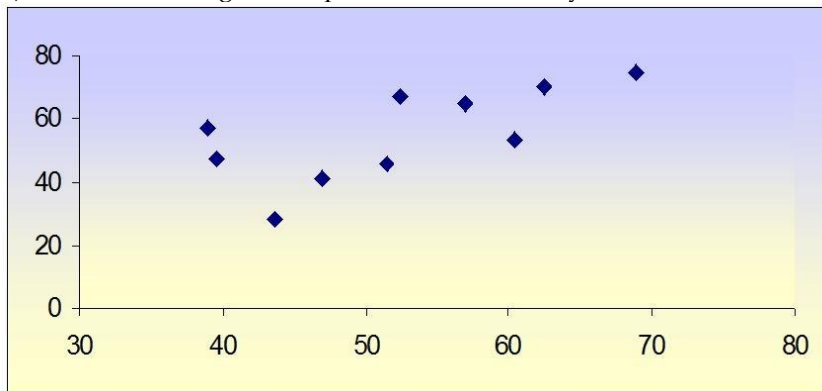Answer: C
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

6) For the following scatter plot, what would be your best estimate of the correlation coefficient?

A) 1.0
B) 0.7
C) 0.3
D) 0.1
Answer: B
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

7) Which of the following descriptive statistics is least affected by outliers?
A) mean
B) median
C) range
D) standard deviation
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

8) Which of the following statements is true?
A) The correlation coefficient is always greater than the covariance.
B) The covariance is always greater than the correlation coefficient.
C) The covariance may be equal to the correlation coefficient.
D) Neither the covariance nor the correlation coefficient can be equal to zero.
Answer: C
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

9) Which measures of central location are not affected by extremely small or extremely large data values?
A) arithmetic mean and median
B) median and mode
C) mode and arithmetic mean
D) geometric mean and arithmetic mean
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

10) Suppose you are told that sales this year are 30% higher than they were six years ago. What has been the average annual increase in sales over the past six years?
A) 5.0%
B) 4.5%
C) 4%
D) 3.5%
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

11) Suppose you are told that sales this year are 20% higher than they were five years ago. What has been the annual average increase in sales over the past five years?
A) 5.2%
B) 4.7%
C) 4.2%
D) 3.7%
Answer: D
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

12) Suppose you are told that over the past four years, sales have increased at rates of 10%, 8%, 6%, and 4%. What has been the average annual increase in sales over the past four years?
A) 7.0%
B) 6.7%
C) 6.4%
D) 6.5%
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

13) Suppose you are told that the average return on investment for a particular class of investments was 7.8% with a standard deviation of 2.3. Furthermore, the histogram of the distribution of returns is approximately bell-shaped. We would expect that 95 percent of all of these investments had a return between what two values?
A) 5.5% and 10.1%
B) 0% and 15%
C) 3.2% and 12.4%
D) 0.9% and 14.7%
Answer: C
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

14) What is the relationship among the mean, median, and mode in a positively skewed distribution?
A) They are all equal.
B) The mean is always the smallest value.
C) The mean is always the largest value.
D) The mode is the largest value.
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

15) The manager of a local RV sales lot has collected data on the number of RVs sold per month for the last five years. That data is summarized below:

# of Sales	0	1	2	3	4	5	6
# of Months	2	6	9	13	21	7	2

What is the weighted mean number of sales per month?
A) 3.31
B) 3.23
C) 3.54
D) 3.62
Answer: B
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

16) A recent survey of Fortune 500 firms found that on average, they contribute $332.54 per month for each salaried employee's health insurance. If you are told that almost all salaried employees at Fortune 500 firms receive a health insurance contribution between $220.61 and $444.47, and assuming a bell-shaped distribution, what must the standard deviation for this data be?
A) $37.31
B) $46.65
C) $55.98
D) $74.64
Answer: C
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

17) A bored carpenter counts the actual number of nails in 10 boxes of nails and records his findings as: 230, 235, 302, 287, 312, 323, 265, 319, 342, and 298. What can we say about the shape of the distribution of the number of nails?
A) symmetric
B) skewed to the right
C) approximately bell-shaped
D) skewed to the left
Answer: D
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

18) Which of the following statements is not true?
A) Measures of central tendency are numbers that describe typical values in the data.
B) The coefficient of variation is the least used measure of central tendency.
C) The mean is the most widely used measure of location.
D) All of the above
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

19) A professor collected data on the number of absences in an introductory statistics class of 100 students over the course of a semester. The data are summarized below.

Number of Absences	0	1	2	3	4	5	6
Number of Students	5	13	24	23	17	11	7

What is the weighted mean number of absences per semester?
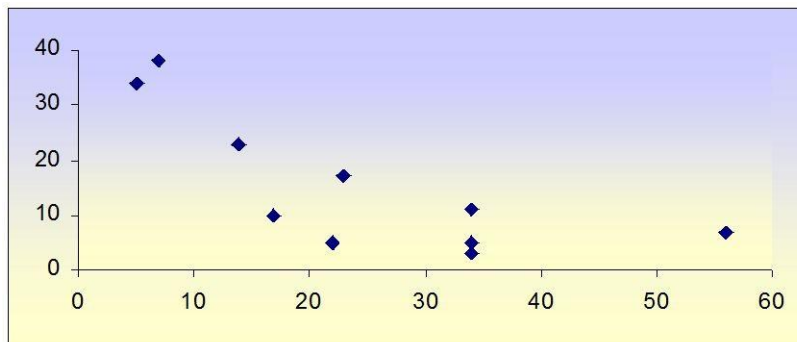A) 3.14
B) 2.0
C) 2.95
D) 3.07
Answer: C
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

20) Looking at the scatter plot below, what value would be your best estimate for the correlation coefficient?

A) -0.7
B) -0.3
C) -1.0
D) 0.0
Answer: A
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

A recent survey asked respondents about their monthly purchases of raffle tickets. The monthly expenditures, in dollars, of ten people who play the raffle are 23, 15, 11, 20, 28, 35, 13, 10, 20, and 24.

21) What can we say about the shape of the distribution of monthly purchases of raffle tickets?
A) Skewed to the left
B) Skewed to the right
C) Approximately bell-shaped
D) None of the above
Answer: C
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

22) Which of the following statements is not true?
A) The 75th percentile is equal to 23.5.
B) The median is equal to the mode.
C) The mean is 19.9.
D) The distribution is approximately symmetric.
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

23) Over the past 10 years, the return on Stock A has averaged 8.4% with a standard deviation of 2.1%. The return on Stock B has averaged 3.6% with a standard deviation of 0.9%. Which of the following statements is true?
A) Stock A has smaller relative variation than Stock B.
B) Stock B has smaller relative variation than Stock A.
C) Both stocks exhibit the same relative variation.
D) Unable to tell with the given information.
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

24) The median value of the data values 12, 32, 48, 8, 22, 9, 30, and 18 equals:
A) 20
B) 22
C) 24
D) 26
Answer: A
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
The police lieutenant in charge of the traffic division reviews the number of traffic citations issued by each of the police officers in his division. He finds that the mean number of citations written by each officer is 23.2 citations per day, with a standard deviation of 3.1. Assume that the distribution of the number of tickets issued is approximately bell-shaped.

25) Which of the following statements is true?
A) Almost all of the officers wrote somewhere between 20.1 and 26.3 citations per day.
B) Almost all of the officers wrote more than 17 citations per day.
C) Almost all of the officers wrote less than 15 citations per day.
D) Approximately 95% of the officers wrote between 20.1 and 26.3 citations.
Answer: B
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

26) The coefficient of variation for the number of citations is:
A) 13.36%
B) 7.48%
C) 6.68
D) Cannot be determined without the sample size
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

27) Suppose that you are also told that the median for these data was 19.3. Which of the following statements is true about the shape of the distribution?
A) It is skewed to the right.
B) It is skewed to the left.
C) It is approximately symmetric.
D) Cannot be determined without more information
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

28) What would be a reasonable estimate for the 75th percentile?
A) Between 23.2 and 26.3
B) Between 26.3 and 29.4
C) Between 29.4 and 32.5
D) Greater than 32.5
Answer: B
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

29) What would be a reasonable estimate for the 99th percentile?
A) Between 23.2 and 26.3
B) Between 26.3 and 29.4
C) Between 29.4 and 32.5
D) Greater than 32.5
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

30) What is the relationship among the mean, median, and mode in a symmetrical distribution?
A) They are all equal.
B) The mean is always the smallest value.
C) The mean is always the largest value.
D) The mode is the largest value.
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

The police lieutenant in charge of the traffic division has reviewed the number of traffic citations issued per day by each of the 10 police officers in his division. The data were: 13, 21, 12, 34, 31, 13, 22, 26, 25, and 23.

31) What is the mean number of citations issued per day?
A) 22.0
B) 22.5
C) 13.0
D) 13.5
Answer: A
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

32) What is the median number of citations issued per day?
A) 22.0
B) 22.5
C) 13.0
D) 13.5
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
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33) What is the mode of the number of citations issued per day?
A) 22.0
B) 22.5
C) 13.0
D) 13.5
Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

34) What is the first quartile of the number of citations issued per day?
A) 22.0
B) 22.5
C) 13.0
D) 27.25
Answer: C
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

35) What is the third quartile of the number of citations issued per day?
A) 22.0
B) 22.5
C) 13.0
D) 27.25
Answer: D
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

36) What would you conclude if a sample correlation coefficient is equal to -1.00?
A) All the data points must fall exactly on a straight line with a positive slope.
B) All the data points must fall exactly on a straight line with a negative slope.
C) Most of the data points must fall exactly on a straight line with a positive slope
D) Most of the data points must fall exactly on a horizontal straight line
Answer: B
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

37) Which of the following statements is true?
A) Measures of variability are numbers that describe the scatter of the data or the extent to which the data values are spread out.
B) The range is the most useful measure of variability.
C) The weighted mean is the most useful measure of variability.
D) All of the above
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

38) Which of the following is not a measure of variability?
A) interquartile range
B) variance
C) weighted mean
D) range
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

39) The standard deviation of the sample data 13, 14, 17, and 20 equals:
A) 2.74
B) 3.16
C) 7.98
D) 9.16
Answer: B
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

40) The strength of the linear relationship between two numerical variables may be measured by the:
A) correlation coefficient.
B) coefficient of variation.
C) interquartile range.
D) third quartile.
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

41) For any set of grouped or ungrouped data, which measures of central location always have only one value?
A) arithmetic mean and median
B) median and mode
C) mode and arithmetic mean
D) geometric mean and mode
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

42) Which of the following statement is true?
A) The range is found by taking the difference between the high and low values and dividing that value by 2.
B) The interquartile range is found by taking the difference between the 1st and 3rd quartiles and dividing that value by 2.
C) The standard deviation is expressed in terms of the original units of measurement but the variance is not.
D) The values of the standard deviation may be either positive or negative, while the value of the variance will always be positive.
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

43) Which of the following statements is true?
A) The mean is a measure of the deviation in a data set.
B) The standard deviation is a measure of variability.
C) The range is a measure of central location.
D) The median is a measure of variability.
Answer: B
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

44) According to the Empirical Rule, the percentage of observations in a data set (providing that the data set has a bell-shaped and symmetric distribution) that should fall within two standard deviations of their mean is approximately:
A) 90%
B) 95%
C) 97.5%
D) 100%
Answer: B
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

45) The Empirical Rule states that the percentage of observations in a data set (providing that the data set has a bell-shaped and symmetric distribution) that fall within one standard deviation of their mean is approximately:
A) 68%
B) 75%
C) 95%
D) 99%
Answer: A
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

46) For any distribution, the percent of observations that lie within four standard deviations of the mean is:
A) 93.75% or more.
B) 93.75% or less.
C) 6.25% or more.
D) 6.25% or less.
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

47) For a sample of size 5, if $x_1 - \bar{x} = -5$, $x_2 - \bar{x} = 9$, $x_3 - \bar{x} = -7$, and $x_4 - \bar{x} = -2$, then the sample standard deviation is:
A) 5.639
B) 6.782
C) 6.066
D) 6.305
Answer: D
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

48) The covariance of the following sample data of four (X, Y) pairs: (1, 5), (2, 10), (4, 7), and (5, 9) equals:
A) 1.25
B) 2.50
C) 3.75
D) 3.69
Answer: A
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
The following data represent a sample of 10 scores on a statistics quiz: 16, 16, 16, 16, 16, 18, 18, 20, 20, and 20.

49) The mean score is:
A) 17.0
B) 17.6
C) 18.0
D) 10.0
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

50) The median score is:
A) 16
B) 17
C) 18
D) 19
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

51) The modal score is:
A) 16
B) 17
C) 18
D) 20
Answer: A
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

52) The standard deviation of the scores is:
A) 0.304
B) 1.333
C) 1.744
D) 1.838
Answer: D
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

53) The range of the scores is:
A) 4
B) 6
C) 8
D) 9
Answer: A
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

54) Which of the following is used as a divisor in the sample variance s^2, where n is the sample size?
A) $n + 1$
B) n
C) $n - 1$
D) $n - 2$
Answer: C
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

55) Which of the following represents a disadvantage of using the sample range to measure spread or dispersion?
A) It produces spreads that are too large.
B) The sample range is not measured in the same units as the data.
C) The largest or smallest observation (or both) may be an outlier.
D) None of the above is correct.
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

56) The correlation coefficient of the following sample data of four (X, Y) pairs: (1, 5), (2, 10), (4, 7), and (5, 9) equals:
A) 0.263
B) 0.412
C) 0.528
D) 0.364
Answer: B
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

57) The following ten scores were obtained on a 20-point quiz: 4, 5, 8, 9, 11, 13, 15, 18, 18, and 20. The teacher computed the usual descriptive measures of center (central tendency) and variability (dispersion) for these data, and then discovered an error was made. One of the 18s should have been a 16. Which of the following measures, calculated on the corrected data, would change from the original computation?
A) median
B) arithmetic mean
C) range
D) geometric mean
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

58) A college placement office conducted a survey of 100 engineers who had graduated from Stanford University. For these engineers, the mean salary was computed to be $72,000 with a standard deviation of $8,000. The percentage of these engineers who earn more than $96,000 or less than $48,000 is:
A) approximately 0%.
B) at least 5.6% (1/18 of the engineers).
C) at most 5.6% (1/18 of the engineers).
D) at most 11.1% (1/9 of the engineers).
Answer: D
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

59) For which measure of central location will the sum of the deviations of each data value from that measure always be zero?
A) arithmetic mean
B) geometric mean
C) median
D) mode
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

60) Which one of the values below represents a lower quartile for the data set 23, 24, 21, and 20?
A) 22.0
B) 22.5
C) 20.25
D) 23.5
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

61) Which of the following statements is true for the following data values: 17, 15, 16, 14, 17, 18, and 22?
A) The mean, median and mode are all equal.
B) Only the mean and median are equal.
C) Only the mean and mode are equal.
D) Only the median and mode are equal.
Answer: A
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

62) What is the smallest measure of central tendency in a positively skewed distribution?
A) the arithmetic mean
B) the median
C) the mode
D) None of the above
Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

63) Which of the following measure of dispersion is based on deviations from the mean?
A) standard deviation
B) coefficient of variation
C) range
D) box plots
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

64) At a highway checkpoint, the average speed of a passing car was measured at 50 miles per hour with a standard deviation of 5 miles per hour. According to Chebyshev's Theorem, what percentage of cars would you expect to be traveling between 42.5 and 57.5 miles per hour?
A) at least 50%
B) at least 55.6%
C) at least 75%
D) at least 88.9%
Answer: B
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

65) Which one of the values below represents the third quartile of the data set 10, 12, 16, 7, 9, 7, 41, and 14?
A) 8.0
B) 15.5
C) 7.0
D) 24.0
Answer: B
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

66) Expressed in percentiles, the interquartile range is the difference between the:
A) 30% and 80% values.
B) 45% and 95% values.
C) 25% and 75% values.
D) 20% and 70% values.
Answer: C
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

67) What is the median of 36, 40, 37, 42, 45, 41, 34, and 39?
A) 39
B) 39.5
C) 40
D) 41
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

68) If two data sets have the same range, then:
A) the distances from the smallest to largest observations in both sets will be the same.
B) the smallest and largest observations are the same in both sets.
C) both sets will have the same variance.
D) both sets will have the same interquartile range.
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

69) A sample of eight retired persons receiving social security payments revealed the following monthly benefits: $985, $798, $1,210, $1,356, $1,087, $869, $987, and $1,045. How many observations are below the median?
A) 2
B) 3
C) 4
D) 4.5
Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

70) For a data set with 10 numerical values arranged in ascending order, the median is the arithmetic mean of the:
A) third and fourth values.
B) fourth and fifth values.
C) fifth and sixth values.
D) first and tenth values.
Answer: C
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

71) Since the population is always larger than the sample, the population mean:
A) is always larger than the sample mean.
B) is always smaller than the sample mean.
C) is always larger than or equal to or smaller than or equal to the sample mean.
D) can be smaller than, or larger than, or equal to the sample mean.
Answer: D
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

72) The average score for a class of 35 students was 70. The 20 male students in the class averaged 73. What was the average score for the 15 female students in the class?
A) 73
B) 70
C) 66
D) 60
Answer: C
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

73) Which of the following summary measures is affected most by outliers?
A) the first quartile
B) the second quartile
C) the third quartile
D) None of the above
Answer: D
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

74) When extreme values are present in a set of data, which pair of the following descriptive summary measures of central tendency and dispersion is most appropriate?
A) mean and standard deviation
B) median and interquartile range
C) range and coefficient of variation
D) mode and variance
Answer: B
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

75) Which measures of central tendency are not affected by extremely small or extremely large values?
A) arithmetic mean and median
B) arithmetic mean and mode
C) arithmetic mean and geometric mean
D) median and mode
Answer: D
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

76) If a distribution is highly skewed, what measure of central tendency should be avoided?
A) arithmetic mean
B) median
C) mode
D) all of the above
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

77) A question in a survey asks for a respondent's favorite sport. Which measure of central tendency should be used to summarize this question?
A) arithmetic mean
B) geometric mean
C) median
D) mode
Answer: D
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

78) According to Chebyshev's Theorem, at least what percent of the observations lie within ±1.25 standard deviations of the mean?
A) 36%
B) 56%
C) 76%
D) 96%
Answer: A
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

79) Which measure of central location is used to determine an average annual percent increase?
A) arithmetic mean
B) weighted mean
C) geometric mean
D) median
Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

80) In the calculation of the arithmetic mean for grouped data, which value is used to represent all the values in a particular class?
A) the lower limit of the class
B) the upper limit of the class
C) the frequency of the class
D) the midpoint of the class
Answer: D
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

81) A sample of college students revealed their last month income as follows: $765, $680, $623, $980, $875, and $985. How many observations are below the median?
A) 1
B) 2
C) 3
D) 4
Answer: C
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

82) A question in a market survey asks for a respondent's favorite car model. Which measure of central location should be used to summarize this question?
A) arithmetic mean
B) geometric mean
C) median
D) mode
Answer: D
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

83) The numerical measures mean, median, and mode provide information concerning the:
A) frequency of a data set.
B) evaluation of a data set.
C) location of the center of a data set.
D) direction of a data set.
Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

84) A measure of central tendency that is important in business and economics used in compound interest, population growth, and total sales growth over time is the:
A) arithmetic mean.
B) median.
C) mode.
D) geometric mean.
Answer: D
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

85) The mode is used infrequently in business applications because it:
A) is difficult to compute.
B) does not represent the true center of numerical data.
C) is too labor intensive.
D) is an accurate measure of central tendency.
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

86) Information about the frequency of sales of a business inventory product's size or color can best be described by the:
A) mode.
B) mean.
C) median.
D) geometric mean.
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

87) For which type of distribution is the mean usually less than the median when measuring continuous numerical unimodal data?
A) skewed-left
B) skewed-right
C) symmetrical
D) flat
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

88) For which type of distribution is the mean usually greater than the median when measuring continuous numerical unimodal data?
A) skewed-left
B) skewed-right
C) symmetrical
D) flat
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

89) A distribution which contains a relatively small proportion of low values is said to be:
A) skewed-left.
B) skewed-right.
C) symmetrical.
D) flat.
Answer: A
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

90) A distribution which contains a relatively small proportion of high values is said to be:
A) skewed-left.
B) skewed-right.
C) symmetrical.
D) flat.
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

91) The measures that indicate the location or positions of a value relative to the entire set of data are called the:
A) mean and median.
B) mode and geometric mean.
C) percentiles and quartiles.
D) standard deviation.
Answer: C
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

92) Percentiles and Quartiles are generally used to describe which data sets?
A) small
B) evenly distributed
C) medium
D) large
Answer: D
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

93) The measures used to describe sales data, survey data, or weights of newborn babies are called:
A) mode and geometric mean.
B) mean and median.
C) percentiles and quartiles.
D) both A and B
Answer: B
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

94) To find percentiles and quantities, data must be first arranged in:
A) descending order.
B) ascending order.
C) alphabetical order.
D) scattered order.
Answer: B
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

95) Quartiles are descriptive measures that separate large data sets into:
A) squares.
B) two halves.
C) three thirds.
D) four quarters.
Answer: D
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

96) Reference to the descriptive measures minimum, first quartile, median, third quartile, and maximum are made by the:
A) five-number summary.
B) five-member summary.
C) five-slot summary.
D) five-step summary.
Answer: A
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

97) Tukey's exploratory data analysis graph which gives information about the shape of the distribution and insight into the spread of the data is called a(n):
A) scatter-plot.
B) box-and-whiskers plot.
C) stem-and-leaf display.
D) exploded-view-plot.
Answer: B
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

98) The type of graph which describes the shape of a distribution in terms of the five-number summary is called a:
A) scatter plot.
B) box-and-whisker plot.
C) histogram.
D) bar-plot.
Answer: B
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

99) The measure that examines the location or position of a value relative to the mean of the distribution is called a:
A) mean score.
B) y-score.
C) z-score.
D) relative score.
Answer: C
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

100) A z-score is a standardized value that indicates the number of standard deviations a value is from the:
A) mean.
B) mode.
C) median.
D) frequency.
Answer: A
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

101) According to Chebyshev's Theorem, what percent of the observations lie within ±2.25 standard deviations of the mean?
A) at least 80.25%
B) at least 75.25%
C) at least 55.56%
D) at least 95.25%
Answer: A
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

102) The sample covariance must take a value between -1 and +1 inclusive.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

103) The sample covariance may never be negative.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

104) The correlation coefficient measures the strength of a linear relationship between two variables.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

105) A correlation coefficient of zero indicates a lack of relationship between the two variables of interest.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

106) The value of the correlation coefficient may be used to confirm a non-linear relationship.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

107) The mean is generally the preferred measure of central tendency to describe numerical data, but not categorical data.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

108) For any set of numerical data values arranged in an ascending or descending order, the value of the observation in the center is called the weighted mean.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

109) Categorical data are best described by the mode.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

110) The median should always be preferred to the mean when the population or sample is skewed to the right or left.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

111) One possible source of skewness is the presence of outliers, and sometimes skewness is simply inherent in the distribution.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

112) Although the range measures the total spread of the data, the interquartile range (IQR) measures only the spread of the middle 50% of the data.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

113) In a negatively skewed distribution, the mean is always greater than the median.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

114) The coefficient of variation measures variability in a positively skewed data set relative to the size of the median.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

115) When the data values are arranged in an ascending order, the third quartile (Q_3) is located at the $0.75(n + 1)^{th}$ position, and first quartile (Q_1) is located at the $0.25(n + 1)^{th}$ position.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

116) The five-number summary refers to the five descriptive measures: minimum, mean, median, mode, and maximum; therefore it is sometimes known as the five-m summary.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

117) If the interquartile range for a set of data is 10 minutes, this means that the data have a spread of only 10 minutes.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

118) Since the interquartile range takes into account only two of the data values, it is susceptible to considerable distortion if there are unusual numbers of extreme observations (outliers).
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

119) Although the range and interquartile range measure the spread of data, both measures take into account only two of the data values, regardless of the size of the data.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

120) For any symmetrical distribution, the standard deviation is equal to the variance.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

121) If the population variance σ^2 is unknown, a sample variance s^2 is a better estimator of σ^2 if the denominator is s^2 formula is (n - 1) rather than n.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

122) For any distribution, the number of values above the mean and below it is the same.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

123) Suppose that the average score on an exam is 73 with a standard deviation of 2. According to Chebyshev's theorem, at least 60% of the scores are in the interval between 70 and 76.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

124) The advantage of Chebyshev's theorem is that its applicability extends to any population regardless of its shape. However, it is within this guarantee that its major drawback lies.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

125) For any distribution, the empirical rule estimates that approximately 95% of the observations will fall with two standard deviations of the mean.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

126) The coefficient of variation (CV) is a measure of relative dispersion that expresses the standard deviation as a percentage of the mean (provided the mean is positive).
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

127) If the mean is greater than the median, then the distribution is skewed to the right.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

128) Any set of ordinal, interval or ratio level data may only have one mode.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

129) The median and the 50th percentile are always equal.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

130) The interquartile range measures the spread of the lower 50% of data values.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

131) The mode is the most useful measure of central tendency if the data is ordinal.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

132) Suppose you have a set of data which has a bell-shaped histogram. Compare the interquartile range with the range from one standard deviation below the mean to one standard deviation above the mean. The interquartile range is smaller.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

133) In a positively skewed distribution, the mode is greater than the median.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

134) A variable measured at the interval or ratio level can have more than one arithmetic mean.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

135) Consider two possible investments with the same expected rate of return. Over the past several months, investment A has had an average closing price of $14.00 and a standard deviation of $4.00. Investment B has had an average closing price of $58.00 and a standard deviation of $15.00. The market value of investment A fluctuates relatively more than investment B.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

136) For salaries of $108,000, $102,000, $52,000, $105,000, 107,000 and $101,000, the arithmetic mean would be an appropriate measure of central tendency.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

137) The mean is a better measure of central tendency than the median when there are outliers.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

138) The variance of a set of data can never be negative.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

139) Quartiles and percentiles are two of the most popular measures of dispersion.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

140) The median, the second quartile, and the 50th percentile are all the same.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

141) The first quartile, Q_1, is a number such that at most 25 of the data values are smaller in value than Q_1, and at most 75 of the data values are larger.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

142) The interquartile range is very unique in the sense that it is a measure of central tendency as well as a measure of dispersion.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

143) Percentiles are values of the variable that divide a set of ranked data into 100 equal subsets.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

144) Each set of data has 100 percentiles.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

145) The 30th percentile, P_{30}, is a value such that at most 30% of the data are smaller in value than P_{30} and at most 70% of the data are larger.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

146) The first quartile and the 25th percentile are the same.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

147) For any data set, the variance is the average of the sum of the squared deviations between each observation and the median.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

148) The mean, median, the second quartile, and the 50th percentile are all the same.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

149) The interquartile range is the average of the first and third quartiles.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

150) The 5-number summary divides a set of data into four subsets, with one quartile of the data in each subset.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

151) The interquartile range measures the spread of the middle 50% of the data.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

152) Chebyshev's Theorem says that within two standard deviations of the mean, you will always find at least 88.9% of the data.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

153) The standard deviation, as a measure of variation (dispersion), can be understood by examining two statements that tell us how the standard deviation relates to the data: the Empirical Rule and Chebyshev's Theorem.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

154) If the mean of a quantitative data set exceeds the median, the data are considered to be symmetrical.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

155) The Empirical rule is frequently applied as an interpretive guide to any mounded distribution.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

156) The Empirical rule applies to any distribution, regardless of its shape, as an interpretive guide to the distribution.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

157) A student scores 89, 75, 94, and 88 on four exams during the semester and 97 on the final exam. If the final is weighted double and the four others weighted equally, the student's final average would be 90.
Answer: TRUE
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

158) In a bell-shaped distribution, there is no difference in the values of the mean, and median.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

159) A variable measured at the interval or ratio level can only have one arithmetic mean.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

160) The covariance measures the direction and strength of any relationship between two variables.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

161) In an accounting exam, the standard deviation of the scores of female students is six and the standard deviation of the scores of male students is ten with means for each scores being 80. These statistics indicate that there is less spread in the scores of the female students.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

162) Three persons earn $9 an hour, five earn $10 an hour, and one earns $13 an hour. The weighted mean hourly wage is $10.
Answer: TRUE
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

163) A distribution that has the same shape on either side of the center is said to be symmetrical.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

164) For a set of numerical data values arranged in ascending order, the value of the observation in the center is called the geometric mean.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

165) The geometric mean of a set of 10 positive numbers is the 10th root of the product of the 10 values.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

166) A negatively skewed distribution is not symmetrical. The long tail is to the right.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

167) If the mean of a symmetrical data set is less than the median, the data are considered to be negatively skewed.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

168) Measures of central tendency provide numerical information about a "typical" observation in the data.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

169) For a set of numerical data, the geometric mean is the nth root of the sum of the n observations.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

170) The median can be determined for any set of ordinal, interval or ratio-level data.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

171) Extremely small or large values in a data set affect the value of the median as well as the mode.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

172) The sum of the deviations from the mean and the median for the set of numbers 1, 3, and 5 will equal zero.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

173) The mean, median, and mode address questions concerning the location of the center of a data set.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

174) Measures of central tendency provide information about atypical observations in data.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

175) Questions concerning the location or position of a value relative to the entire set of data are answered by examining measures of location such as percentiles and quartiles.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

176) Measures of central tendency are usually computed from population data rather than from sample data.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

177) A valuable use of median and mode would be in a business where inventory contains items of different sizes.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

178) In describing numerical data, the data is usually best described by the mean because it is not affected by outliers.
Answer: FALSE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

179) The theoretical development of inferential procedures is based on the mean because it is considerably more straightforward than developmental procedures based on the median.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

180) To find percentiles and quartiles, data must first be arranged in ascending order.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

181) Percentiles separate large ordered data sets into tenths so that the fifth percentile is the median.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

182) A graphical representation of the five-number summary is called a box-and-whisker plot.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

183) A box-and-whisker plot provides information about the shape of the distribution and the spread of the data.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

184) The measure that examines the location of a data value relative to the mean of the distribution is called a z-score.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

185) A z-score is a standardized value that indicates the number of standard deviations a value is from the mode.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

186) Calculating GPA, determining average stock recommendations, and approximating the mean of grouped data requires the use of a weighted mean.
Answer: TRUE
Difficulty: Easy
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

187) Age categories, such as 20-29, or cost categories, such as $2 to under $4, provide exact values of the mean and variance.
Answer: FALSE
Difficulty: Easy
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

188) Minitab, Excel, SPSS, SAS, and other statistical programs can be used to compute descriptive measures such as the sample covariance and the sample correlation coefficient.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Relationships Between Variables
AACSB: Reflective Thinking Skills
Course LO: Use a modern software tool to perform statistical calculations

189) In nearly all situations, we would compute skewness with a statistical software package or Excel.
Answer: TRUE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Use a modern software tool to perform statistical calculations

190) Positive skewness results if a distribution is skewed to the left.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

191) A random sample of 250 students results in a grade point average mean of 3.24 and the median grade point average was 3.42. This data indicates positive skewness.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

192) For continuous numerical unimodal data, the mean is usually less than the median in a skewed-left distribution, and greater than the median in a skewed-right distribution.
Answer: TRUE
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Compare and contrast methods of summarizing and describing data

193) For any distribution, there are an equal number of observations above and below the mean.
Answer: FALSE
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

194) Why do we have so many different measures of central tendency? Are all really necessary or do they essentially provide the same information?
Answer: For certain types of well-behaved data, all the measures will provide very similar information. However, because much data is not well-behaved, it is often beneficial to look at a number of measures of central tendency and report the one that best describes the location and average of the data. Wherever possible, the mean is the preferred measure of location, because it uses all the data values. However, for certain types of data that contain severe outliers (like income data), the median is the preferable measure of central tendency because the outliers do not distort it.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

195) Why is it necessary for a measure of variation to accompany a measure of central tendency?
Answer: A measure of central tendency alone does not give a complete picture of the data set. The object of summary measures is to visualize the data set based on these measures. Hence, the measure of central tendency locates the data set, but a measure of variation completes the picture by describing the dispersion in the data about the location measure.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

196) In spite of its advantage in discounting extreme observations, the median is used less frequently than the mean. Why?
Answer: In spite of its advantage in discounting extreme observations, the median is used less frequently than the mean. The reason is that the theoretical development of inferential procedures based on the mean, and measures related to it, is considerably more straightforward than the development of procedures based on the median.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

197) Give an example to illustrate that the median should not always be preferred to the mean when the population or sample is skewed.
Answer: There are times when the mean would still be the preferred measure even if the distribution were skewed. Consider an insurance company that most likely faces a right-skewed distribution of claims. If the company wants to know the most typical claim size, the median is preferred. However, suppose the company wants to know how much money needs to be budgeted to cover claims, then the mean is preferred.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

198) The management at a small manufacturing plant has noticed that the price of steel has increased significantly over the past several years. Looking over their records, they find that over the four-year period, prices have increased by 40%. They expect this same trend in prices for next year. In budgeting for next year, by how much should they expect prices to increase?
Answer: $(1 + K)^4 = 1.4 \Rightarrow 1 + K = (1.4)^{0.25} \Rightarrow K = 0.0878$ or 8.78%
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
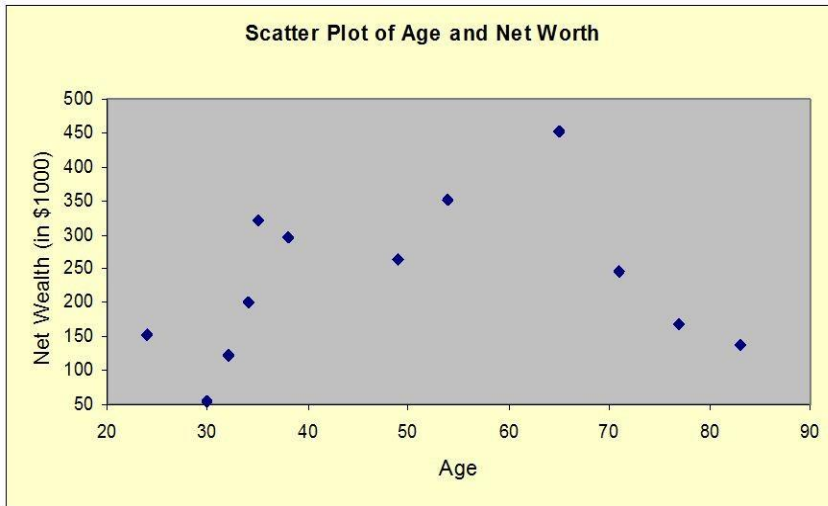AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

A researcher is interested in examining how the net wealth of individuals changes over the course of their lifetimes. She has collected the following data regarding the age X, in years, and net worth Y, measured in thousands of dollars, of 12 individuals in the form of (x, y) pairs: (24, 153), (34, 201), (38, 297), (83, 139), (77, 167), (32, 123), (71, 247), (49, 263), (54, 352), (35, 321), (65, 453), and (30, 54).

199) Prepare a scatter plot of this data.
Answer:

Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

200) What conclusions can you draw about the relationship between age and net wealth?
Answer: It appears that as you get older, at first your wealth increases until the age of 65, then starts to decrease.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Compare and contrast methods of summarizing and describing data

201) Calculate the correlation coefficient between the age and net worth of individuals.
Answer: $r = 0.207$
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

202) Determine if there exists a relationship between the age and net worth of individuals.
Answer: A useful rule of thumb is that a relationship exists if $|r| \geq 2/\sqrt{n}$. Since $2/\sqrt{n} = 2/\sqrt{12} = 0.577$ and $|r| = 0.207$, we may conclude that no linear relationship exists between the age and net worth of individuals.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
The police lieutenant in charge of the traffic division has reviewed the number of traffic citations issued per day by each of the 10 police officers in his division. The data were: 13, 21, 12, 34, 31, 13, 22, 26, 25, and 23.

203) What is the standard deviation for the number of citations issued per day?
Answer: $s^2 = \sum (x - \bar{x})^2 / (n - 1) = 514/9 = 57.11 \Rightarrow s = 7.56$
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

204) What is the interquartile range for the number of citations issued per day?
Answer: Location of $Q_3 = 0.75(n + 1) = 0.75(11) = 8.25$; Value of $Q_3 = 26 + 0.25(31 - 26) = 27.25$
Location of $Q_1 = 0.25(n + 1) = 0.25(11) = 2.75$; Value of $Q_1 = 13 + 0.75(3 - 3) = 13.0$
IQR = $Q_3 - Q_1 = 27.25 - 13.0 = 14.25$
Difficulty: Moderate
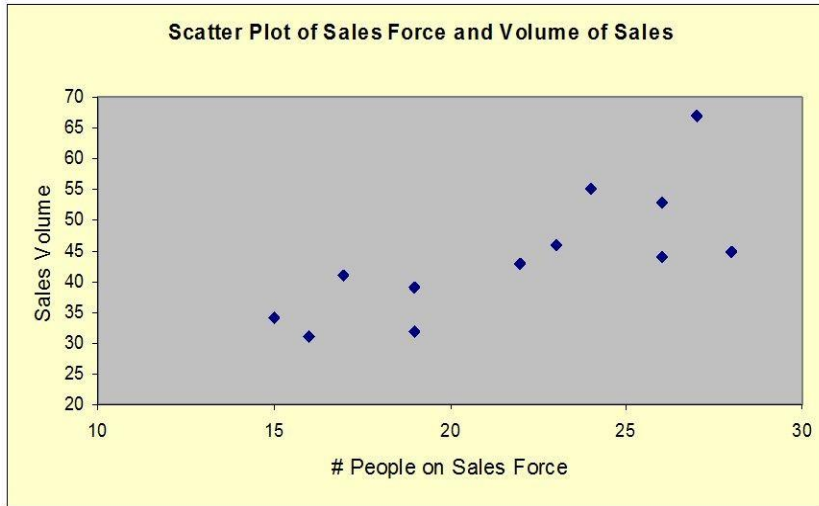Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
You are interested in looking at the relationship between the number of people on the sales force and the dollar volume of sales. The following data show gross sales, Y, measured in millions of dollars, and the number of people on the sales force, X, in the form of (x, y) pairs for 12 people: (15, 34), (24, 55), (27, 67), (16, 31), (19, 32), (26, 44), (19, 39), (23, 46), (26, 53), (22, 43), (28, 45), and (17, 41).

205) Prepare a scatter plot of this data.
Answer:

Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

206) What conclusions can you draw about the relationship between the size of the sales force and gross sales?
Answer: In general, there is a positive relationship between the two variables; that is, as the number of people on the sales force increases, so do sales.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

207) Calculate the correlation coefficient between the size of the sales force and gross sales.
Answer: $r = 0.765$
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

208) Determine if there exists a relationship between the size of the sales force and gross sales.
Answer: A useful rule of thumb is that a relationship exists if $|r| \geq 2/\sqrt{n}$. Since $2/\sqrt{n} = 2/\sqrt{12} = 0.577$, and $|r| = 0.765$, we may conclude that a positive linear relationship exists between the size of the sales force and gross sales.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
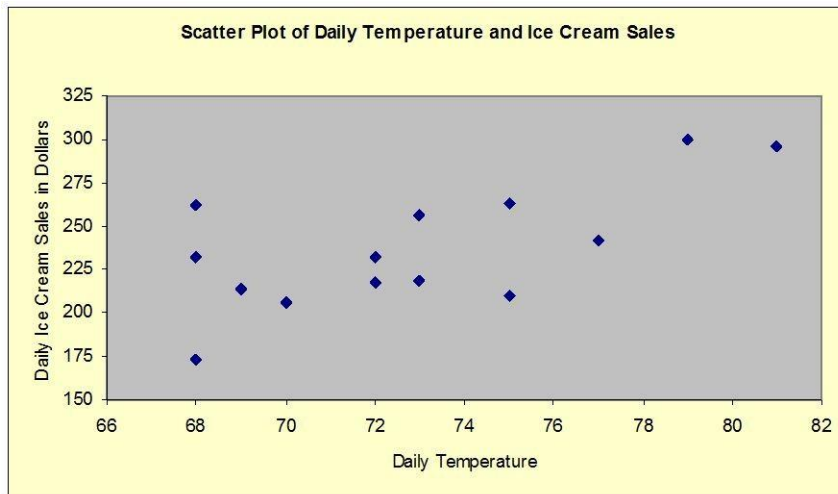AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
Ahmed is trying to figure out the relationship between daily sales from his ice cream truck and the daily temperature in Dearborn, Michigan during the month of August. He has collected data on sales Y, measured in dollars, and temperature X, measured in Fahrenheit degrees, over the past 14 days in the form of (x, y) pairs: (72, 232), (77, 242), (73, 219), (69, 214), (68, 262), (72, 218), (75, 263), (70, 206), (79, 300), (73, 256), (68, 173), (75, 210), (81, 296), and (68, 232).

209) Prepare a scatter plot of this data.
Answer:

Scatter Plot of Daily Temperature and Ice Cream Sales

Daily Ice Cream Sales in Dollars (vertical axis: 150, 175, 200, 225, 250, 275, 300, 325)
Daily Temperature (horizontal axis: 66, 68, 70, 72, 74, 76, 78, 80, 82)

Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

210) What conclusions can you draw about the relationship between ice cream sales and daily temperature?
Answer: There appears to be a slight positive relationship between daily temperature and ice cream sales.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

211) Calculate the correlation coefficient between ice cream sales and temperature.
Answer: $r = 0.679$
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

212) Determine if there exists a relationship between ice cream sales and temperature.
Answer: A useful rule of thumb is that a relationship exists if $|r| \geq 2/\sqrt{n}$. Since $2/\sqrt{n} = 2/\sqrt{14} = 0.535$, and $|r| = 0.679$, we may conclude that a positive linear relationship exists between ice cream sales and temperature.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
A set of data is mounded, with a mean of 500 and a variance of 576.

213) Approximately what proportion of the observations is greater than 476?
Answer: The value 476 is one standard deviation below the mean; hence the empirical rule implies that the area between 476 and the mean is approximately 0.68 / 2 = 0.34. Therefore the proportion of the observations greater than 476 is approximately 0.84.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

214) Approximately what proportion of the observations is less than 548?
Answer: The value 548 is two standard deviations above the mean; hence the Empirical Rule implies that the area between the mean and 548 is approximately 0.95 / 2 = 0.475. Therefore the proportion of the observations less than 548 is approximately 0.975.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

215) Approximately what proportion of the observations is greater than 572?
Answer: The value 572 is three standard deviations above the mean; hence the Empirical Rule implies that the area between the mean and 572 is approximately 1.00 / 2 = 0.50. Therefore the proportion of the observations greater than 572 is approximately 0.0.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

216) Approximately what proportion of the observations is between 452 and 548?

Answer: The values 452 and 548 are within ± two standard deviations of the mean; hence the Empirical Rule implies that the proportion of the observations between these two values is approximately 0.95

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

217) Approximately what proportion of the observations is between 428 and 572?

Answer: The values 428 and 572 are within ± three standard deviations of the mean; hence the Empirical Rule implies that the proportion of the observations between these two values is approximately 1.0. That is, almost all the observations are contained between 428 and 572.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

218) Approximately what proportion of the observations is between 476 and 524?

Answer: The values 476 and 524 are within ± one standard deviation of the mean; hence the Empirical Rule implies that the proportion of the observations between these two values is approximately 0.68

Difficulty: Moderate

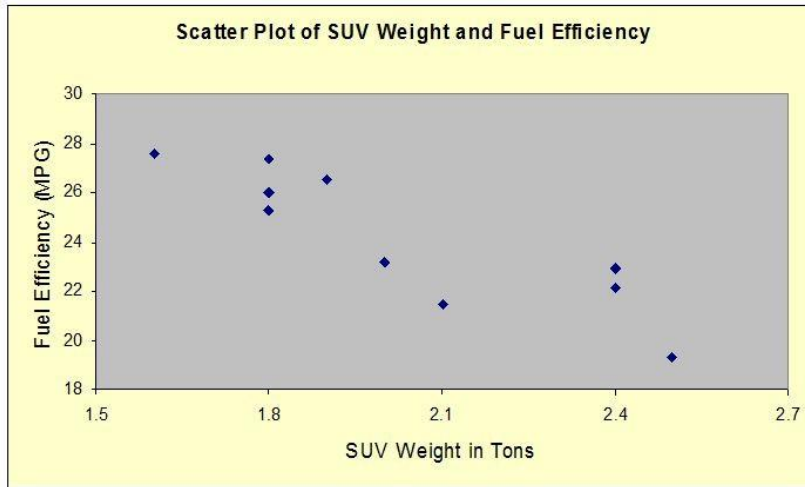Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
Some people would argue that the trend of consumers toward purchasing large sport utility vehicles (SUVs) has been detrimental to the environment. The following data show the vehicle weight X, measured in tons, and the corresponding fuel efficiency Y, measured by the average miles per gallon (mpg), in the form of (x,y) pairs for 10 vehicles: (1.9, 26.5), (2, 23.2), (2.4, 22.1), (1.8, 26), (2.4, 22.9), (2.1, 21.5), (1.8, 25.3), (2.5, 19.3), (1.8, 27.4), and (1.6, 27.6).

219) Prepare a scatter plot of this data.
Answer:

Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

220) What conclusions can you draw about the relationship between weight and fuel efficiency?
Answer: In general, there is a negative relationship between the two variables; that is, as the weight of the SUV increases, the gas mileage per gallon (SUV efficiency) decreases.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

221) Calculate the correlation coefficient between vehicle weight and fuel efficiency.
Answer: $r = -0.887$
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

222) Determine if there exists a relationship between vehicle weight and fuel efficiency.

Answer: A useful rule of thumb is that a relationship exists if $|r| \geq 2/\sqrt{n}$. Since $2/\sqrt{n} = 2/\sqrt{10} = 0.632$ and $|r| = 0.887$, we may conclude that a negative linear relationship exists between vehicle weight and fuel efficiency.

Difficulty: Moderate

Topic: Measures of Relationships Between Variables

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

Chebyshev's theorem is used to approximate the proportion of observations for any data set, regardless of the shape of the distribution. Assume that a distribution has a mean of 255 and standard deviation of 20.

223) Approximately what proportion of the observations is between 195 and 315?

Answer: $k = 3$; hence at least 88.89% of the observations are in the interval between 195 and 315.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

224) Approximately what proportion of the observations is between 215 and 295?

Answer: $k = 2$; hence at least 75% of the observations are in the interval between 215 and 295.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

225) Approximately what proportion of the observations is between 225 and 285?

Answer: $k = 1.5$; hence at least 55.56% of the observations are in the interval between 225 and 285.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

The annual percentage returns on two stocks over a 7-year period were as follows:

Stock A:	4.01%	14.31%	19.01%	-14.69%	-26.49%	8.01%	5.81%
Stock B:	6.51%	4.41%	3.81%	6.91%	8.01%	5.81%	5.11%

226) Compare the means of these two population distribution.

Answer: $\mu_A = 1.42\%$ and $\mu_B = 5.80\%$

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

227) Compare the standard deviations of these two population distributions.
Answer: $\sigma_A = 0.163\%$ and $\sigma_B = 1.47\%$

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

228) Compute an appropriate measure of dispersion for both stocks to measure the risk of these investment opportunities. Which stock is more volatile?
Answer: The coefficients of variation are computed for both stocks to measure and compare the risk of these two investment opportunities. Since $CV_A = 11.41\%$ and $CV_B = 0.253\%$, we conclude that stock A is more volatile than stock B.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

229) Calculate the coefficient of variation for the following sample data: 13.2, 14.7, 17.2, 12.1, 21.8, 8.4, 14.3, 11.0, 9.3, and 8.7
Answer: $\bar{x} = \sum x/n = 13.07$
$s^2 = \sum (x - \bar{x})^2 / (n - 1) = 17.5334 \Rightarrow s = 4.1873$
$CV = (s/\bar{x}) \cdot 100\% = (4.1879/13.07) \cdot 100\% = 32.04\%$
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
The following numbers represent the distance, in miles, that randomly selected ten employees of a firm must travel each way to work from home: 6.5, 14.8, 18.6, 6.5, 17.4, 12.3, 1.9, 12.9, 11.1, and 8.0.

230) Calculate the mean number of miles driven by the ten employees.
Answer: 11.0
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

231) The standard deviation of the number of miles driven by the ten employees is:
Answer: 5.28
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

In a recent survey, 12 students at a local university were asked approximately how many hours per week they spend on the Internet. Their responses were: 13, 0, 5, 8, 22, 7, 3, 0, 15, 12, 13, and 17.

232) What are the mean and standard deviation for this data?

Answer: $\bar{x} = \sum x/n = 9.58$

$s^2 = (x - \bar{x})^2 /(n-1) = 47.7197 \Rightarrow s = 6.91$

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

233) What is the coefficient of variation for this data?

Answer: $CV = (s/\bar{x}) \cdot 100\% = (6.91/9.58) \cdot 100\% = 72.13\%$

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

234) From the data presented above, calculate the interquartile range.

Answer: Location of $Q_3 = 0.75(n + 1) = 0.75(13) = 9.75$; Value of $Q_3 = 13 + 0.75(15 - 13) = 14.5$

Location of $Q_1 = 0.25(n + 1) = 0.25(13) = 3.25$; Value of $Q_1 = 3 + 0.25(5 - 3) = 3.5$

$IQR = Q_3 - Q_1 = 14.5 - 3.5 = 11.0$

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

In a recent survey, 200 top executives were asked how many hours they spend each year in community service. The data are presented below.

# of Hours	0 but < 20	20 but < 40	40 but < 60	60 but < 80	80 but < 100	100 but < 120	120 but < 140
# of Executives	11	27	33	53	47	22	7

235) Calculate the quantities $\sum f_i$, $\sum f_i m_i$, and $\sum f_i (m_i - \bar{x})^2$.

Answer:

# of Hours	# of Executives (frequency)	midpoint (m_i)	$f_i m_i$	$(m_i - \bar{x})$	$(m_i - \bar{x})^2$	$f_i (m_i - \bar{x})^2$
0 but < 20	11	10	110	-59.20	3504.64	38551.04
20 but < 40	27	30	810	-39.20	1536.64	41489.28
40 but < 60	33	50	1650	-19.20	368.64	12165.12
60 but < 80	53	70	3710	0.80	0.64	33.92
80 but < 100	47	90	4230	20.80	432.64	20334.08
100 but < 120	22	110	2420	40.80	1664.64	36622.08
120 but < 140	7	130	910	60.80	3696.641	25876.48
	200		13,840			175,072

$\bar{x} = 13{,}840/200 = 69.2$; $\sum f_i = n = 200$, $\sum f_i m_i = 13{,}840$, $\sum f_i (m_i - \bar{x})^2 = 175{,}072$

Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

236) What is the estimated mean amount of time spent by these executives in community service?
Answer: $\bar{x} = \sum f_i m_i / n = 13{,}840/200 = 69.2$ hours

Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

237) What is the estimated standard deviation for this data?
Answer: $s^2 = \sum f_i (m_i - \bar{x})^2 / (n - 1) = 175{,}072/199 = 879.7588$

Then $s = 29.66$ hours.
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

The number of students eating breakfast at the school dining commons was recorded over 110 days last semester. These data are presented below.

	160 but < 190	190 but < 220	220 but < 250	250 but < 280	280 but < 310
# of Students					
# of Days	11	27	42	23	7

238) Calculate the quantities $\sum f_i$, $\sum f_i m_i$, and $\sum f_i(m_i - \bar{x})^2$.

Answer:

# of Students	# of Days (frequency)	midpoint (m_i)	$f_i m_i$	$(m_i - \bar{x})$	$(m_i - \bar{x})^2$	$f_i(m_i - \bar{x})^2$
160 but < 190	11	175	1,925	-58.64	3438.22	37820.45
190 but < 220	27	205	5,535	-28.64	820.04	22141.12
220 but < 250	42	235	9,870	1.36	1.86	78.10
250 but < 280	23	265	6,095	31.36	983.68	22624.59
280 but < 310	7	325	2,275	91.36	8347.31	58431.20
	110		25,700			141,095.45

$\bar{x} = 25,700/110 = 233.64$

$\sum f_i = n = 110$, , $\sum f_i m_i = 25,700$, $\sum f_i(m_i - \bar{x})^2 = 141,095.45$

Difficulty: Moderate

Topic: Weighted Mean and Measures of Grouped Data

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

239) What is the estimated mean number of students showing up for breakfast?

Answer: $\bar{x} = \sum f_i m_i /n = 25,490/110 = 231.73$

Difficulty: Moderate

Topic: Weighted Mean and Measures of Grouped Data

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

240) What is the estimated standard deviation for this data?

Answer: $s^2 = \sum f_i(m_i - \bar{x})^2 /(n-1) = 108,621.819/109 = 996.53 \Rightarrow s = 31.57$

Difficulty: Moderate

Topic: Weighted Mean and Measures of Grouped Data

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

A small accounting office is trying to determine its staffing needs for the coming tax season. The manager has collected the following data: 46, 27, 79, 57, 99, 75, 48, 89, and 85. These values represent the number of returns the office completed each year over the entire nine years it has been doing tax returns.

241) For this data, what is the mean number of tax returns completed each year?

Answer: $\mu = \sum x/N = 605/9 = 67.22$

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

242) For this data, what is the median number of tax returns completed each year?

Answer: Ranked data: 27, 46, 48, 57, 75, 79, 85, 89, 99

Location of median $= 0.50(n + 1) = 0.50(10) = 5^{th}$ position. Hence, median $= 75$
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

243) For this data, what is the variance of the number of tax returns completed each year?

Answer: $\sigma^2 = \sum(x - \mu)^2 /N = 4541.56/9 = 504.62$

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

244) For this data, what is the interquartile for the number of tax returns completed each year?

Answer: Location of $Q_1 = 0.25(n + 1) = 0.25(10) = 2.5$; Value of $Q_1 = (46 + 48)/2 = 47$

Location of $Q_3 = 0.75(n + 1) = 0.75(10) = 7.5$; Value of $Q_3 = (85 + 89)/2 = 87$

$IQR = Q_3 - Q_1 = 87 - 47 = 40$
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

245) For this data, what is the coefficient of variation for the number of tax returns completed each year?
Answer: $\sigma = \sqrt{504.62} = 22.46$

$CV = (\sigma/\mu) \cdot 100\% = (22.46/67.22) \cdot 100\% = 33.41\%$
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

246) Compute the mean, standard deviation and interquartile range for the following sample data: 12.2, 15.9, 8.1, 19.2, 13.7, 7.2, 12.2, 10.9, 5.4, and 16.8.

Answer: Location of $Q_1 = 0.25(n + 1) = 0.25(11) = 2.75$; Value of $Q_1 = (7.2 + 8.1)/2 + 0.225 = 7.875$

Location of $Q_3 = 0.75(n + 1) = 0.75(11) = 8.25$; Value of $Q_3 = (15.9 + 16.8)/2 - 0.225 = 16.35$

Mean = 12.16, standard deviation = 4.42, and IQR = $Q_3 - Q_1$ = 16.125 - 7.875 = 8.25.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

247) The manager of 45 sales people examined their monthly expenditures on entertaining clients. He found that the mean amount was $237.50 with a standard deviation of $27.40. Assuming the data is bell-shaped, would a claim for the amount of $300 be considered unlikely? Why or why not?

Answer: We would expect that virtually all of the sales people had expenses within ± 3 standard deviations of the mean. Although not very likely, it is possible that a sales person will have expenses in the amount of $300. Less than 2.5% of the sales people would have sales expenses of this amount or more.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

248) A researcher interested in determining the average monthly expenditures of college students on DVDs finds that for a sample of 25 students, the mean expenditure was $24.40, and the median expenditure was $21.76. Specify the shape of the histogram for this data. Does this shape make sense? Why?

Answer: The distribution is skewed to the right, implying that there are a few students (outliers) who spend a lot of money on DVDs, raising the average above the typical or median student.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

249) The following values represent the annual snowfall, measured in inches, at a local ski resort over the past 10 years: 123, 87, 143, 133, 182, 176, 96, 104, 201, and 152. What is the mean snowfall over the past 10 years? What is the standard deviation?

Answer: Mean = 139.7, standard deviation = 38.46.

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

250) The shift supervisor at a local manufacturing plant collected data on the number of defects coming off an assembly line over the past eight weeks (40 work days). She summarized the data in the following frequency table.

# of Errors	0	1	2	3	4	5
# of Weeks	1	4	7	16	10	2

What is the weighted average number of errors per night?
Answer: Weighted mean = 2.9
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
An investment councilor recently reviewed the account activity of a sample of 10 of his clients and calculated the average number of stock trades per month over the past year for each client. He obtained the following data values: 10.2, 2.5, 11.4, 3.2, 1.1, 3.4, 8.4, 9.7, 11.2, and 2.4

251) Calculate the average number of trades per month for these 10 clients.
Answer: Mean = 6.35
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

252) Calculate the standard deviation.
Answer: Standard deviation = 4.16.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

253) Calculate the median number of trades per month for these 10 clients.
Answer: Median = (3.4 + 8.4)/2 = 5.9
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

254) Describe the shape of the distribution of the number of trades per month for these 10 clients. Justify your answer.
Answer: The distribution is skewed to the right (or positively skewed) since mean = 6.35 > median = 5.9.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

255) The manager of the help-line at a local software manufacturing firm collected data on the number of calls the help desk received per shift for the last 100 days. The data is summarized in the table below.

# of Calls	80 but < 120	120 but < 160	160 but < 200	200 but < 240	240 but < 280	280 but < 320
# of Days	1	21	29	32	15	2

What is the estimated mean number of calls per night? What is the estimated standard deviation?
Answer: Mean = 198, standard deviation = 43.06.
Difficulty: Moderate
Topic: Weighted Mean and Measures of Grouped Data
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

256) For a particular aptitude test, the mean score was 83.2. Suppose you were told that your score of 87 placed you in the 85th percentile. Assuming the data is bell-shaped, provide an estimate of the standard deviation of the test.

Answer: At the 85th percentile, you outperformed more than 68% of the class, so we know that you scored more than 1 standard deviation above the mean. Therefore the standard deviation must be less than 87 - 83.2 or 3.8 points.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

257) The supervisor of a tourist information desk at a local airport is interested in how long it takes an employee to serve a customer. Using a stopwatch, he measures the amount of time it takes for each of 10 customers. These times, measured in minutes, are reported as follows: 2.3, 1.5, 3.9, 0.6, 2.7, 3.1, 2.8, 0.9, 1.4, and 2.6. Calculate the standard deviation and the interquartile range.
Answer: Standard deviation = 1.046, IQR = Q_3 - Q_1 = 2.875 - 1.275 = 1.6.

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

258) For the sample data shown below, compute the five-number summary, and sketch out the Box-and-Whisker plot.

34	76	29	59	71	43	24	92	82	79
49	62	34	92	87	23	64	37	54	27

Answer: The five-number summary values are:

Minimum = 23, Q_1 = 34, Q_2 = 56.5, Q_3 = 78.25, Maximum = 92

NOTE: You obtain different results for some or all values of the quartiles if you use Excel and the syntax method or Minitab.
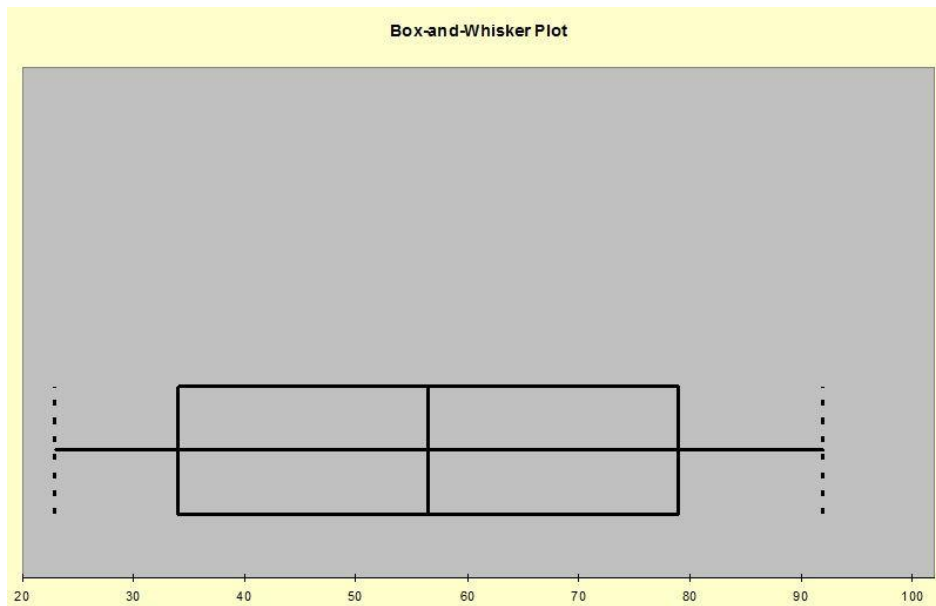
Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

Consider the following (x, y) sample data: (40, 13), (15, 33), (16, 42), (39, 9), (20, 38), (35, 15), (25, 21), (34, 17), (20, 24), and (34, 21).

Box-and-Whisker Plot

259) Calculate the variances s_x^2 and s_y^2, and the covariance s_{xy} of the sample data.

Answer: s_x^2 = 92.844, s_y^2 =121.122, and s_{xy} = -95.267.

Difficulty: Moderate

Topic: Measures of Relationships Between Variables

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

260) Calculate the correlation coefficient sample data.
Answer: $r = Cov(x,y)/(s_x \cdot s_y) = -0.898$
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
Starting with a sample of two values 70 and 100, add three data values to your sample to obtain a new sample with certain statistics.

261) What are the three data values such that the new sample has a mean of 100? Justify your answer.
Answer: Many different answers are possible. The sum of the five numbers needs to be 500; therefore we need any three numbers that total 330, such as 110. 110. 110 or as 100, 110,120. Thus, the new sample mean $\bar{x} = 500/5 = 100$.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

262) What are the three data values such that the new sample has a median of 70? Justify your answer.
Answer: Many different answers are possible. Need two numbers smaller than 70 and one number larger than 70. For example, we may choose 50, 60, and 80. Thus the five numbers are 50, 60, 70, 80, 100, and the median is 70.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

263) What are the three data values such that the new sample has a mode of 87? Justify your answer.
Answer: Many different answers are possible. Need multiple 87s. For example, we may choose 87, 87, and 95. Thus, the five numbers are 70, 87, 87, 95, 100, and the mode = 87.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

264) What are the three data values such that the new sample has a mean of 100 and a median of 70?
Justify your answer.
Answer: Many different answers are possible. Need two numbers smaller than 70 and one number larger than 70 so that their total is 330. For example, we may choose the numbers 65, 65, and 200. Thus the five numbers are 65, 65, 70, 100, and 200. Hence, $\bar{x} = 500/5 = 100$, and the median is 70.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

265) What are the three data values such that the new sample has a mean of 100 and a mode of 87? Justify your answer.

Answer: Need two numbers of 87 and one number so that the total of all five numbers is 500. The five numbers are 70, 87, 87, 100 = 344, then 500 - 344 = 156. Thus the mode = 87, and $\bar{x}$ = 500/5 = 100.

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

266) What are the three data values such that the new sample has a mean of 100, a median of 70, and a mode of 87? Justify your answer.

Answer: Not possible. There must be two 87s in order to have a mode of 87, and there can only be two data values larger than 70 in order for 70 to be the median, which is impossible since 100 is one of the numbers, and that makes three of the five numbers larger than 70.

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

Consider the following (x, y) sample data: (53, 37), (34, 26), (10, 29), (63, 55), (28, 36), (58, 48), (28, 41), (50, 42), (39, 21), and (35, 46).

267) Calculate the variances s_x^2 and s_y^2 and the covariance s_{xy} of the sample data.

Answer: s_x^2 = 263.511, s_y^2 = 110.767, and s_{xy} = 100.578.

Difficulty: Moderate

Topic: Measures of Relationships Between Variables

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

268) Calculate the correlation coefficient sample data.

Answer: $r = Cov(x, y)/(s_x \cdot s_y)$ = 0.589

Difficulty: Moderate

Topic: Measures of Relationships Between Variables

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

269) In general, which of the covariance and the sample correlation coefficient is a more useful measure of the relationship between the two variables?

Answer: The sample correlation coefficient is generally a more useful measure, as it provides both the direction and the strength of the relationship.

Difficulty: Moderate

Topic: Measures of Relationships Between Variables

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

270) Consider the following sample data: 153, 178, 203, 410, 310, 231, 190, and 225. Compute the mean and median. Is the distribution of these numbers skewed to the right, skewed to the left or symmetric? Why?
Answer: Mean = 237.5, median = (203 + 225)/2 = 214. Since mean > median, the distribution of these numbers is skewed to the right.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

271) Since 1985, the daily temperature in Daytona Beach, Florida during spring break week has a mean of 74.6 degrees and a standard deviation of 2.2 degrees. Assuming that the distribution of temperatures is bell-shaped, how likely is it that the average daily temperature this year will be above 71 degrees? Explain.
Answer: The probability is higher than 95%. This means that 95% of the time, the temperature should be between 70.2 and 79.0.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
Production records for an automobile manufacturer show the following figures for production per shift (maximum production is 720 cars per shift):

693	716	630	706	693	672	699	635	552	708	693	702	708
661	682	705	707	693	696	669	693	684	713	704	672	708

272) Would the mode be a useful summary statistic for these data? Why?
Answer: The mode is defined to be the most common value, and is most often used to describe qualitative data. Here, the data are quantitative. The mode is not very useful for such data.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

273) Find the median.
Answer: There are $n = 26$ data values; the median is the $(26 + 1) / 2 = 27 / 2 = 13.5$th value, the average of the 13th and 14th ordered values. When we arrange the data in order from low to high, the 13th and 14th values are both 693, so the median is 693.
Difficulty: Easy
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

274) Find the mean.

Answer: $\bar{x} = \sum x_i / n = 17794/26 = 684.38$

Difficulty: Easy

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

275) What does the relation between the mean and median indicate about the shape of the data?

Answer: Since the mean is less than the median, this indicates that the distribution of the data is skewed to the left (negatively skewed).

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Reflective Thinking Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

276) Find the standard deviation.

Answer: The deviation is $s = 34.83$.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

277) How well does the Empirical Rule work for the fraction of data actually falling within ± one standard deviation of the mean?

Answer: Recall that the Empirical Rule says that about 68% of the data should fall within ± one standard deviation of the mean. This rule works best for well-behaved data, without skewness or outliers.

$\bar{x} \pm 1s = 684.38 \pm 34.83 = 649.55$ to 719.21

This range includes all but three of the 26 measurements, missing only 630, 635, and 552 values. So the interval includes 23 / 26 = .885 or 88.5% of the data, much more than the 68% indicated by the Empirical Rule. (Presumably, the reason why the rule works badly here is that the 552 outlier makes the standard deviation very big).

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

278) Find the IQR.

Answer: To find the IQR, we must obtain the 1st and 3rd quartiles. The 1st quartile Q_1 is located in the 0.25(25 + 1)th ordered position = 6.5th ordered position. Thus, $Q_1 = (669 + 672)/2 = 670.50$. The 3rd quartile is located in the 0.75(25 + 1)th ordered position = 19.5th ordered position. Thus, $Q_3 = (705 + 706)/2 = 705.5$. Therefore IQR = 705.5 - 670.5 = 34.5.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

279) Suppose that you are working with a data set and want to check for any outliers. What should you do? Suppose you detect an outlier. What are some of your options, and how would you make your decision?

Answer: Inspect the data using either graphical tools or descriptive statistics. If the mean is quite a bit different from the median, there may be an outlier or outliers. We would want to examine the outlier to make sure that it was a legitimate value. If so, we should keep it in the data set. Otherwise we may want to remove it from the data set.

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

280) For data that has a bell-shaped distribution, will the interquartile range span a larger set of values than the range from one standard deviation below the mean to one standard deviation above the mean? Explain why or why not.

Answer: Interquartile range contains the middle 50%. The mean ± 1 standard deviation captures the middle 68% of the observations. Therefore the interquartile range has to be smaller.

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

281) Summarize the Empirical Rule.

Answer: For distributions that are bell-shaped and symmetrical:
a) Approximately 68% of observations will fall within ± 1 standard deviation of the mean.
b) Approximately 95% of observations will fall within ± 2 standard deviations of the mean.
c) Practically all observations will fall within ± 3 standard deviations of the mean

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

282) For a particular sample of 50 scores on a statistics exam, the following results were obtained:

Mean = 78	Median = 80	Mode = 84	Range = 52
First quartile = 68	Third quartile = 94	Standard deviation = 11	

What score was earned by more students than any other score? Why?

Answer: 84; since it is the mode

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

283) For a particular sample, the mean is 3.7 and the standard deviation is 1.2. A new sample is formed by adding 6.3 to every item of data in the original sample. Find the mean and standard deviation of the new sample.

Answer: $\bar{x}_{new}$ = 10.0 and s_{new} = 1.2

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

284) For the following three samples, for which sample is the data most closely grouped about the sample mean? Give a written explanation that supports your conclusion.

Sample 1: 15, 16, 19, 21, 28;
Sample 2: 44, 49, 50, 51, 57; and
Sample 3: 122.8, 123.7, 124.6, 130.5, 135.8.

Answer: Since the coefficient of variation, CV, measures relative dispersion about the mean, we first compute the x-bar and s of each sample: x-bar$_1$ = 19.8 and s_1 = 5.17, CV_1 = 26.11%; x-bar$_2$ = 50.2 and s_2 = 4.66, CV_2 = 9.28%; x-bar$_3$ = 127.48 and and s_3 = 5.54, CV_3 = 4.35%. Sample 3 has the smallest CV and the data most closely grouped about its mean.

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

285) Consider the following two sets of data:

Set 1:	45	55	50	48	52
Set 2:	35	50	65	47	53

Compare the following measures for both sets: $\sum x$, $\sum(x - \bar{x})$, $\sum(x - \bar{x})^2$, and the range. Comment on the meaning of these comparisons.

Answer: Set 1: x-bar = 50; Set 2: x-bar = 50

x	$x - \bar{x}$	$(x - \bar{x})^2$
45	-5	25
5	+5	25
50	0	0
48	-2	4
52	+2	4
250	0	58

x	$x - \bar{x}$	$(x - \bar{x})^2$
35	-15	225
50	0	0
65	+15	225
47	-3	9
53	+3	9
250	0	468

Comparisons:

	$\sum x$	$\sum(x - \bar{x})$	$\sum(x - \bar{x})^2$	Range
Set1	250	0	58	10
Set2	250	0	468	30

The values of $\sum(x - \bar{x})^2$ and the range reflect the fact that there is more variability in data set 2 than in data set 1.

$\sum x$ is the same for both sets and reflects the fact that both sets have the same mean $\bar{x} = 50$

$\sum(x - \bar{x})$ = 0 for both sets of data (in fact this is always true for any data).

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

Consider the following (x, y) sample data:
(24, 24), (19, 33), (21, 31), (10, 36), (22, 30), (13, 36), (21, 32), (23, 26), (20, 26), and
(21, 31).

286) Calculate the variances s_x^2 and s_y^2 and the covariance s_{xy}.

Answer: s_x^2 =19.822, s_y^2 =16.944, and s_{xy} = -14.889.

Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

287) Compute and interpret the sample correlation coefficient.
Answer: The sample correlation coefficient $r = Cov(x, y)/(s_x . s_y)$ = - 0.812. This indicates that there is a strong negative linear relationship between the two variables.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

288) Compute and interpret b_1; the slope of the least squares regression line.

Answer: $b_1 = Cov(x, y)/s_x^2$ = -14.889/19.822 = -0.7511

This means that for every unit increase in x, y is expected to decrease on average by about 0.75 units.
Difficulty: Moderate
Topic: Measures of Relationships Between Variables
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

289) The following subscripted xs represent a sample of size $n = 67$ which has been ranked from smallest (x_1) to largest (x_{67}) : $x_1, x_2, x_3,...x_{65}, x_{66}, x_{67}$. Prepare a 5-number summary for this sample in terms of the subscripted xs.
Answer: Minimum = x_1, $Q_1 = x_{17}$, Median = x_{34}, $Q_3 = x_{51}$, Maximum = x_{67}
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

290) A sample has a mean of 100.0 and a standard deviation of 15.0. According to Chebyshev's Theorem, at least 8/9 of all of the data will lie between what two values?
Answer: 55.0 and 145.0
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

291) A sample of size 50 has a mean of 60.0 and a standard deviation of 10.0. According to Chebyshev's Theorem, at least what percent of the data is between 10 and 110?
Answer: 96%
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

292) A sample of size 100 from a bell-shaped population has a mean of 110 and a standard deviation of 10.0. Using the Empirical Rule, about how many items of the sample will be above 130?
Answer: Approximately 2 to 3 items
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
A sample of 26 offshore oil workers took part in a simulated escape exercise, resulting in the accompanying data on time (sec) to complete the escape:

373	370	364	366	364	325	339	393	356	359	363	375
424	325	394	402	392	369	374	359	356	403	334	397

293) Calculate the values of the sample mean and median.
Answer: The sample mean $\bar{x}$ = 8876/24 = 369.83, and sample median = (366 + 369)/2=367.50.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

294) By how much could the largest time, currently 424, be increased without affecting the value of the sample median? By how much could this value be decreased without affecting the value of the sample median?

Answer: The largest value (currently 424) could be increased by any amount. Doing so will not change the fact that the middle two observations are 366 and 369, and hence, the median will not change. However, the value x = 424 cannot be changed to a number less than 369 (a change of 424 - 369 = 53 since that *will* lower the values(s) of the two middle observations.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

295) What are the values of $\bar{x}$ and the median when the observations are re-expressed in minutes?

Answer: Expressed in minutes, the mean is (369.83 sec)/(60 sec) = 6.16 min; and the median is (367.50 sec) / (60 sec) = 6.13 min.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

Consider the following observations on shear strength of a joint bonded in a particular manner:

30.0	4.4	33.1	66.7	81.5	22.2	40.4	16.4	73.7	36.6	109.9

296) Determine the value of the sample mean.

Answer: The sum of the n = 11 data points is 514.90, so $\bar{x}$ = 514.90/11 = 46.81.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

297) Determine the value of the sample median.

Answer: The sample size n = 11 is odd, so there will be a middle value. Sorting the data values from smallest to largest produce the following; 4.4, 16.4, 22.2, 30.0, 33.1, 36.6, 40.4, 66.7, 73.7, 81.5, and 109.9. The sixth value, 36.6 is the middle, or median, value.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

298) Why is the median so different from the mean?

Answer: The mean differs from the median because the largest sample observations are much farther from the median than are the smallest values.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Reflective Thinking Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

2-71

299) The first four deviations from the mean in a sample of $n = 5$ reaction times were .6, .9, 1.0, and 1.5. What is the fifth deviation from the mean? Provide a sample for which these are the five deviations from the mean.

Answer: Let d denote the fifth deviation. Then .6 + .9+1.0 + 1.5 + d = 0 or 4.0 + d = 0, so d = 4.0. One sample for which these are the deviations is x_1= 4.6, x_2 = 4.9, x_3 = 5.0, x_4 = 5.5, x_5 = 0. (Obtained by adding 4.0 to each deviation; adding any other number will produce a different sample with the desired property).

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
Calculate the following sample observations on fracture strength:
128, 131, 142, 168, 87, 93, 105, 114, 96, and 98.

300) Calculate and interpret the value of the sample mean

Answer: The sample mean, $\bar{x} = \sum x_i/n$ = 1,162/10 = 116.2

On average, we would expect fracture strength of 116.2.

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

301) Calculate and interpret the value of the sample standard deviation,

Answer: $s = \sqrt{\dfrac{\sum(x_i - \bar{x})^2}{n-1}} = \sqrt{\dfrac{5967.6}{9}}$ = 25.75

In general, the size of a typical deviation from the sample mean (116.2) is about 25.75. Some observations may deviate from 116.2 by more than this and some by less.

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
A sample of eight doctors was asked how many flu shots they had given to patients this fall. The numbers of flu shots were 6, 3, 5, 24, 2, 6, 0, and 8.

302) Find the sample mean.
Answer: $\bar{x}$ = 6.75

Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

303) Find the median time to learn this task.
Answer: Median = 5.5 flu shots
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

304) Based on the values of the mean and median in the previous two questions, are the measurements symmetric or skewed? Why?
Answer: Since the mean is larger than the median, we conclude that the measurements are positively skewed (skewed to the right.)
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
The following data represent scores on a 15 point aptitude test: 8, 10, 15, 12, 14, and 13.

305) Subtract 5 from every observation and compute the sample mean for the original data and the new data.
Answer: $\bar{x}_{org}$ = 12, and $\bar{x}_{new}$ = 7.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

306) Subtract 5 from every observation and complete the sample variance for the original data and the new data.
Answer: s^2_{org} = 6.80, and s^2_{new} = 6.80

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

307) What effect, if any, does subtracting 5 from every observation have on the sample mean and sample variance?
Answer: The sample mean $\bar{x}$ is shifted to the left (decreased) by 5, but the sample variance remains unchanged.
Difficulty: Moderate
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

308) A large sample is selected from a bell-shaped distribution. The middle 99.7% of the sample data falls between 24.2 and 69.2. Estimate the sample mean and the sample standard deviation.

Answer: $\bar{x} - 3s = 24.2$, and $\bar{x} + 3s = 69.2 \Rightarrow$

$2\bar{x} = 93.4$; $\bar{x} = 46.7$

Substituting for $\bar{x} = 46.7$ in any of the equations, we solve for s.

Therefore, $\bar{x} = 46.7$, and $s = 7.5$

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

A sample of 33 students was asked to rate themselves on whether they were outgoing or not using this five point scale: 1 = extremely extroverted, 2 = extroverted, 3 = neither extroverted nor introverted, 4 = introverted, or 5 = extremely introverted. The results are shown in the table below:

Rating x_i	1	2	3	4	5
Frequency f_i	1	7	20	5	0

309) Calculate the sample mean.

Answer: $\bar{x} = 2.88$

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

310) Calculate the median.

Answer: Median = 3

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

311) Calculate the sample standard deviation.

Answer: $s = 0.70$

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

312) Find the percentage of measurements in the intervals $\bar{x} \pm s$ and $\bar{x} \pm 2s$. Compare these results with the Empirical Rule percentages, and comment on the shape of the distribution.

Answer: Sixty-one percent of the observations are in the interval $\bar{x} \pm s$ = (2.18, 3.58); the Empirical Rule says if the data set is bell-shaped, we should expect to see approximately 68% of the data within ± one standard deviation of the mean.

Ninety-seven percent of the observations are in the interval $\bar{x} \pm 2s$ = (1.49, 4.27); the Empirical Rule says that if the data set is bell-shaped, we should expect to see approximately 95% of the observations within ± two standard deviations of the mean. Since the percentages of measurements in the intervals $\bar{x} \pm s$ and $\bar{x} \pm 2s$ are close to those predicted by the Empirical Rule, the data must be approximately bell-shaped.

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

Consider the following scores on a 20 point aptitude test for two samples of eight students each:

Sample 1:   18, 19, 17, 15, 14, 20, 14, and 16

Sample 2:   14, 15, 13, 11, 10, 16, 10, and 12

313) Calculate the mean score in sample 1.

Answer: $\bar{x}_1$ = 16.625

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

314) Calculate the mean score in sample 2.

Answer: $\bar{x}_2$ = 12.625

Difficulty: Moderate

Topic: Measures of Central Tendency and Location

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

315) Calculate the variance for the scores in sample 1.

Answer: s_1^2 = 5.1248

Difficulty: Moderate

Topic: Measures of Variability

AACSB: Analytic Skills

Course LO: Identify and apply formulas for calculating descriptive statistics

316) Calculate the variance for the scores in sample 2.

Answer: $s_2^2 = 5.1248$

Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

317) You may have noticed that each score in sample 2 is obtained by subtracting 4 from the corresponding score in sample 1. Write your conclusion based on the measures of central tendency and variability.
Answer: The mean in the second sample is shifted to the left (decreased) by 4 from the mean in the first sample, but the variance remained unchanged.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:
In a time study, conducted at a manufacturing plant, the length of time to complete a specified operation is measured for each on $n = 40$ workers. The mean and standard deviation are found to be 15.2 and 1.40, respectively.

318) Describe the sample data using the Empirical Rule.
Answer: To describe the data, calculate these intervals:
$(\bar{x} \pm s) = 15.2 \pm 1.40$, or 13.8 to 16.6
$(\bar{x} \pm 2s) = 15.2 \pm 2.80$, or 12.4 to 18.0
$(\bar{x} \pm 3s) = 15.2 \pm 4.20$, or 11.0 to 19.4

If the distribution of measurements is bell-shaped, you can apply the Empirical Rule and expect approximately 68% of the measurements to fall into the interval from 13.8 to 16.6, approximately 95% to fall into the interval from 12.4 to 18.0, and all or almost all to fall into the interval from 11.0 to 19.4.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

319) Describe the sample data using Chebyshev's Theorem.
Answer: If you doubt that the distribution of measurements is bell-shaped, or if you wish for some other reason to be conservative, you can apply Chebyshev's Theorem and be absolutely certain of your statements. Chebyshev's Theorem tells you that at least 3/4 of the measurements fall into the interval from 12.4 to 18.0 and at least 8/9 into the interval from 11.0 to 19.4
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

THE NEXT QUESTIONS ARE BASED ON THE FOLLOWING INFORMATION:

The following data represents the number of minutes an athlete spends training per day.

73	74	76	77	79	79	83	84	88
84	84	85	86	86	87	87	88	91
92	92	93	97	98	98	81	82	

The mean and standard deviation were computed to be 85.54 and 6.97, respectively. The median is 85.5

320) What percentage of measurements would you expect to be between 71.60 and 99.48?
Answer: Since the distribution appears to be relatively bell-shaped, the Empirical Rule applies. The interval (71.60, 99.48) represents ± 2 standard deviations from the mean, so one would expect approximately 95% of the measurements to lie within this interval.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

321) What percentage of the measurements actually lie within the interval (71.60, 99.48)?
Answer: 26 of the 26 measurements or 100% of the measurements lie in the given interval.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

322) According to the empirical rule, you expect 95% of the measurements to lie within the interval [71.60, 99.48] whereas all the given measurements actually lie within this interval. Do your expectations agree with the provided data? If not, what conclusion can be drawn?
Answer: The two percentages do not agree exactly, indicating that the distribution of training times is not perfectly bell-shaped. However, it is very close.
Difficulty: Moderate
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

323) Calculate the location of the 25th, 50th, and 75th percentile and their values, using the following data:

0 0 5 7 8 9 12 14 22 33

Answer: Pth percentile = value located in the $(\frac{P}{100})(n + 1)$th ordered position or the

Pth percentile = $(n + 1)\frac{P}{100}$ th value

25th percentile = 11(.25) = <u>2.75</u>th <u>value</u>

Value at location = 0 + 0.25(5 - 0) = <u>1.25</u>

50th percentile = 11(.50) = <u>5.5</u>th <u>value</u>

Value at location = 8 + 0.5(9 - 8) = <u>8.5</u>

75th percentile = 11(.75) = <u>8.25</u>th <u>value</u>

Value at location = 8 + 0.25(22 - 14) = <u>16</u>
Difficulty: Challenging
Topic: Measures of Central Tendency and Location
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

324) Calculate the first, second, and third quartiles of the following sample:

2	2	3	3	4	4	4	5	5	5	7	7	8	9	10

Answer: Q_1 = value in the 0.25 $(n + 1)$th ordered position

Q_1 = .25(16) = 4th position

Q_1 = <u>3</u>

Q_2 = value in the 0.50 $(n + 1)$th ordered position

Q_2 = .50(16) = 8th position

Q_2 = <u>5</u>

Q_3 = value in the 0.75 $(n + 1)$th ordered position

Q_3 = .75(16) = 12th position

Q_3 = <u>7</u>
Difficulty: Challenging
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

325) Use the following data to construct a box-and-whiskers plot. Find the minimum value, median, first quartile, third quartile, and maximum value.

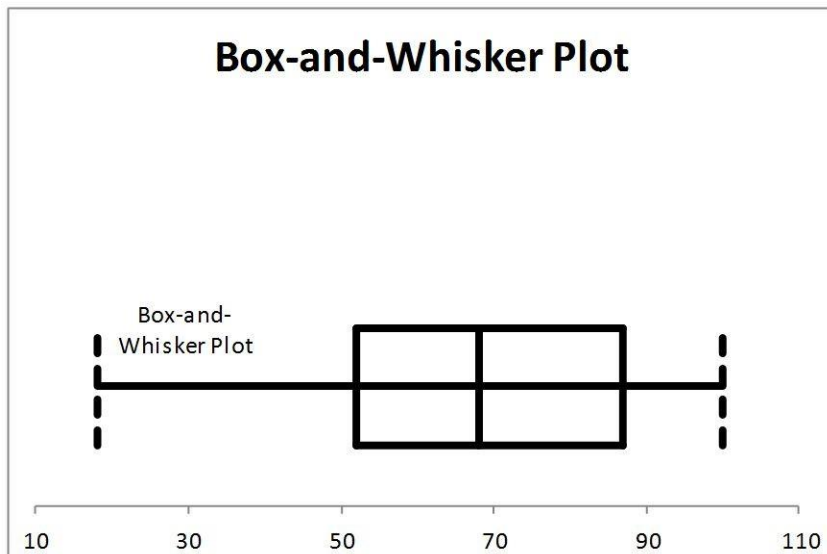18 27 34 52 54 59 61 68 78 82 85 87 91 93 100

Answer: Minimum value = <u>18</u>

Median = 0.50 $(n + 1)^{\text{th}}$ ordered position

= 0.50(16) = 8th position = <u>68</u>

First quartile = Median of numbers left of sample median

= 0.25 $(n + 1)^{\text{th}}$ ordered position

= 0.25(16) = 4th position = <u>52</u>

Third Quartile = Median of numbers right of sample median

= 0.75 $(n + 1)^{\text{th}}$ ordered position

= 0.75(16) = 12th position = <u>87</u>

Maximum value = <u>100</u>

Difficulty: Challenging
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics

326) A company produces flashlight batteries with a mean lifetime of 5,200 hours and a standard deviation of 100 hours.
a. Find the z-score for a battery which lasts only 5,100 hours
b. Find the z-score for a battery which lasts 5,300 hours

Answer: a.

$z = \dfrac{x - \mu}{\sigma}$ μ = Mean, and σ = Standard deviation

$x = \dfrac{5100 - 5200}{100} = \underline{-1.0}$

b.

$z = \dfrac{x - \mu}{\sigma}$ μ = Mean, and σ = Standard deviation

$z = \dfrac{5300 - 5200}{100} = \underline{1.0}$

Difficulty: Challenging
Topic: Measures of Variability
AACSB: Analytic Skills
Course LO: Identify and apply formulas for calculating descriptive statistics