

CHOSUN UNIVERSITY SEOK-GANG,PARK  
**CHAPTER 2 SECTION 1: GRAPHICAL AND TABULAR DESCRIPTIVE  
TECHNIQUES**

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**MULTIPLE CHOICE**

1. The classification of student major (accounting, economics, management, marketing, other) is an example of a(n)
  - a. nominal random variable.
  - b. interval random variable.
  - c. continuous random variable.
  - d. parameter.
  
2. The classification of student class designation (freshman, sophomore, junior, senior) is an example of a(n)
  - a. nominal random variable.
  - b. interval random variable.
  - c. ordinal random variable.
  - d. a parameter.
  
3. A researcher wishes to estimate the textbook costs of first-year students at Ferris State University. To do so, he recorded the textbook cost of 200 first-year students and found that their average textbook cost was \$275 per semester. The variable of interest to the researcher is
  - a. textbook cost.
  - b. class rank.
  - c. number of students.
  - d. name of university.
  
4. All calculations are permitted on what type of data?
  - a. Interval data
  - b. Nominal data
  - c. Ordinal data
  - d. All of these choices are true.
  
5. Values must represent ordered rankings for what type of data?
  - a. Interval data
  - b. Nominal data
  - c. Ordinal data
  - d. None of these choices.

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6. For what type of data are frequencies the only calculations that can be done?
  - a. Interval data
  - b. Nominal data
  - c. Ordinal data
  - d. None of these choices.
  
7. For which type of data are the values arbitrary numbers?
  - a. Interval data
  - b. Nominal data
  - c. Ordinal data
  - d. None of these choices.

**TRUE/FALSE**

8. Your gender is a nominal variable.
  
9. Your final grade in a course (A, B, C, D, E) is a nominal variable.
  
10. Your age is an interval variable.
  
11. Your age group (1-10; 11-20; 21-30; 31-40; etc.) is an interval variable.
  
12. Whether or not you are over the age of 21 is a nominal variable.
  
13. The values of quantitative data are categories.
  
14. Interval data, such as heights, weights, and incomes, are also referred to as quantitative or numerical data.
  
15. Nominal data are also called qualitative or categorical data.
  
16. A variable is some characteristic of a population or sample.
  
17. With nominal data, there is one and only one way the possible values can be ordered.
  
18. You cannot calculate and interpret differences between numbers assigned to nominal data.

19. All calculations are permitted on interval data.

20. Interval data may be treated as ordinal or nominal.

**COMPLETION**

21. The Dean of Students conducted a survey of students on campus. A student's SAT score in mathematics is an example of a(n) \_\_\_\_\_ variable.

ANS:  
interval  
quantitative  
numerical

22. The Dean of Students conducted a survey on campus. The gender of each student is an example of a(n) \_\_\_\_\_ variable.

ANS:  
nominal  
categorical  
qualitative

23. The Dean of Students conducted a survey on campus. Class rank (Freshman, Sophomore, Junior, and Senior) is an example of a(n) \_\_\_\_\_ variable.

ANS: ordinal

24. The final grade received in an English course (A, B, C, D, or F) is an example of a(n) \_\_\_\_\_ variable.

ANS:  
nominal  
categorical  
qualitative

25. In purchasing a used automobile, there are a number of variables to consider. The age of the car is an example of a(n) \_\_\_\_\_ variable.

ANS:  
interval  
quantitative  
numerical

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26. In purchasing an automobile, there are a number of variables to consider. The body style of the car (sedan, coupe, wagon, etc.) is an example of a(n) \_\_\_\_\_ variable.

ANS:  
nominal  
categorical  
qualitative

**SHORT ANSWER**

27. At the end of a tour vacation, the travel agent asks the vacationers to respond to the questions listed below. For each question, determine whether the possible responses are interval, nominal, or ordinal.
- How many tour vacations have you taken prior to this one?
  - Do you feel that your tour vacation lasted sufficiently long (yes/no)?
  - Which of the following features of the hotel accommodations did you find most attractive: location, facilities, room size, service, or price?
  - What is the maximum number of hours per day that you would like to spend traveling?
  - Is your overall rating of this tour: excellent, good, fair, or poor?

ANS:

- Interval
- Nominal
- Nominal
- Interval
- Ordinal

28. Before leaving a particular restaurant, customers are asked to respond to the questions listed below. For each question, determine whether the possible responses are interval, nominal, or ordinal.
- What is the approximate distance (in miles) between this restaurant and your residence?
  - Have you ever eaten at this restaurant before?
  - On how many occasions have you eaten at the restaurant before?
  - Which of the following attributes of this restaurant do you find most attractive: service, prices, quality of the food, or the menu?
  - What is your overall rating of the restaurant: excellent, good, fair, or poor?

ANS:

- Interval
- Nominal
- Interval
- Nominal
- Ordinal

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29. For each of the following examples, identify the data type as nominal, ordinal, or interval.
- The final grade received by a student in a computer science class.
  - The number of students in a statistics course.
  - The starting salary of an MBA graduate.
  - The size of an order of fries (small, medium, large, super-size) purchased by a McDonald's customer.
  - The college you are enrolled in (Arts and Sciences, Business, Education, etc.).

ANS:

- Ordinal
- Interval
- Interval
- Ordinal
- Nominal

30. For each of the following, indicate whether the variable of interest is nominal or interval.
- Whether you are a U.S. citizen.
  - Your marital status.
  - The number of cars parked in a certain parking lot at any given time.
  - The amount of time you spent last week on your homework.
  - Lily's travel time from her dorm to the student union on campus.
  - Heidi's favorite brand of tennis balls.

ANS:

- Nominal
- Nominal
- Interval
- Interval
- Interval
- Nominal

31. Provide one example of nominal data; one example of ordinal data; and one example of interval data.

ANS:

Nominal data example: Political party affiliation for voters using the code: 1 = Democrat, 2 = Republican, and 3 = Independent.

Ordinal data example: Response to a market research survey question measured on the Likert scale using the code: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree.

Interval data example: The temperature on a tennis court during the U.S. Open (degrees Fahrenheit).

32. Explain why political affiliation is not an ordinal variable.

ANS:

The values of political affiliation cannot be ranked in order in any way.

33. Explain the difference between ordinal data and interval data.

ANS:

The critical difference between them is that the intervals or differences between values of interval data are consistent and meaningful. That is, we can calculate the difference and interpret the results. Because the codes representing ordinal data are arbitrarily assigned except for the order, we cannot calculate and interpret differences.

34. Give an example of interval data that can also be treated as ordinal data and nominal data.

ANS:

Example: Your actual age is interval data; your age group (1-10; 11-20; 21-30; etc) is ordinal data; and whether or not you are over age 21 is nominal data.

**MULTIPLE CHOICE**

35. Which of the following statements about pie charts is false?

- a. A pie chart is a graphical representation of a relative frequency distribution.
- b. You can always determine frequencies for each category by looking at a pie chart.
- c. The total percentage of all the slices of a pie chart is 100%.
- d. The area of a slice of a pie chart is the proportion of all the individuals that fall into that particular category.

36. Which of the following situations is best suited for a pie chart?

- a. The number of dollars spent this year on each type of legal gambling.
- b. The percentage of a charitable donation that goes to administrative costs vs. directly to the charity.
- c. The number of students in your class who received an A, B, C, D, F on their exam.
- d. All of these choices are true.

37. Which situation identifies when to use pie charts and/or bar charts?

- a. You want to describe a single set of data.
- b. Your data is nominal.
- c. You want to show the number or the percentage of individuals in each category.
- d. All of these choices are true.

38. Suppose you measure the number of minutes it takes an employee to complete a task, where the maximum allowed time is 5 minutes, and each time is rounded to the nearest minute. Data from 130 employees is summarized below. How long did it take most employees to complete the task?

Time (minutes)	1	2	3	4	5
Frequency	15	30	40	25	20

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- a. 5 minutes
- b. 3 minutes
- c. 40 minutes
- d. 20 minutes

39. Car buyers were asked to indicate the car dealer they believed offered the best overall service. The four choices were Carriage Motors (C), Marco Chrysler (M), Triangle Auto (T), and University Chevrolet (U). The following data were obtained:

T	C	C	C	U	C	M	T	C	U
U	M	C	M	T	C	M	M	C	M
T	C	C	T	U	M	M	C	C	T
T	U	C	U	T	M	M	C	U	T

What percentage of car buyers identified Carriage Motors as having the best overall service?

- a.  $1/4 = 0.25$  or 25%
- b.  $14/40 = 0.35$  or 35%
- c. 14%
- d. None of these choices.

**TRUE/FALSE**

- 40. A bar chart is used to represent interval data.
- 41. One of the advantages of a pie chart is that it clearly shows that the total percentages of all the categories add to 100%.
- 42. Bar and pie charts are graphical techniques for nominal data. The former focus the attention on the *frequency* of the occurrences of each category, and the later emphasizes the *proportion* of occurrences of each category.
- 43. A relative frequency distribution lists the categories and their counts.
- 44. A frequency distribution lists the categories and the proportion with which each occurs.
- 45. From a pie chart you are able to find the frequency for each category.

COMPLETION

46. Two types of graphs that organize nominal data are \_\_\_\_\_ and \_\_\_\_\_.

ANS:

pie charts; bar charts

bar charts; pie charts

47. A bar chart is used to represent \_\_\_\_\_ data.

ANS:

nominal

categorical

qualitative

48. A pie chart is used to represent \_\_\_\_\_ data.

ANS:

nominal

categorical

qualitative

49. A(n) \_\_\_\_\_ chart is often used to display frequencies; a(n) \_\_\_\_\_ chart graphically shows relative frequencies.

ANS: bar; pie

50. A pie chart shows the \_\_\_\_\_ of individuals that fall into each category.

ANS:

percentage

relative frequency

proportion

51. We can summarize nominal data in a table that presents the categories and their counts. This table is called a(n) \_\_\_\_\_ distribution.

ANS: frequency

52. A(n) \_\_\_\_\_ distribution lists the categories of a nominal variable and the proportion with which each occurs.

ANS: relative frequency



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53. A(n) \_\_\_\_\_ chart is not able to show frequencies. It can only show relative frequencies.

ANS: pie

54. In a pie chart, each slice is proportional to the \_\_\_\_\_ of individuals in that category.

ANS:  
percentage  
proportion  
relative frequency

55. A category in a pie chart that contains 25% of the observations is represented by a slice of the pie that is equal to \_\_\_\_\_ degrees.

ANS: 90

**SHORT ANSWER**

56. Identify the type of data for which each of the following graphs is appropriate.

- a. Pie chart
- b. Bar chart

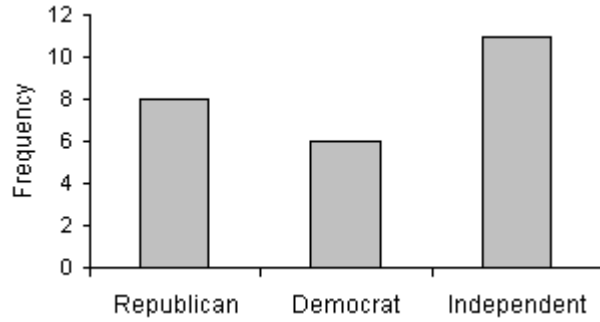
ANS:

- a. Nominal
- b. Nominal

57. Twenty-five voters participating in a recent election exit poll in Minnesota were asked to state their political party affiliation. Coding the data as 1 for Republican, 2 for Democrat, and 3 for Independent, the data collected were as follows: 3, 1, 2, 3, 1, 3, 3, 2, 1, 3, 3, 2, 1, 1, 3, 2, 3, 1, 3, 2, 3, 2, 1, 1, and 3. Construct a frequency bar chart from this data. What does the bar chart tell you about the political affiliations of those in this sample?

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ANS:



The bar graph shows most of the people surveyed were Independents (11 out of 25 = 44.0%); Republicanations followed with  $8/25 = 32.0\%$  and Democrats made up 6 of the 25, or 24.0%.

**Car Buyers**

Forty car buyers were asked to indicate which car dealer offered the best overall service. The four choices were Carriage Motors (C), Marco Chrysler (M), Triangle Auto (T), and University Chevrolet (U). The following data were obtained:

T C C C U C M T C U  
 U M C M T C M M C M  
 T C C T U M M C C T  
 T U C U T M M C U T

58. {Car Buyers Narrative} Construct a frequency bar chart of this data. Which car dealer came in last place in terms of overall service?

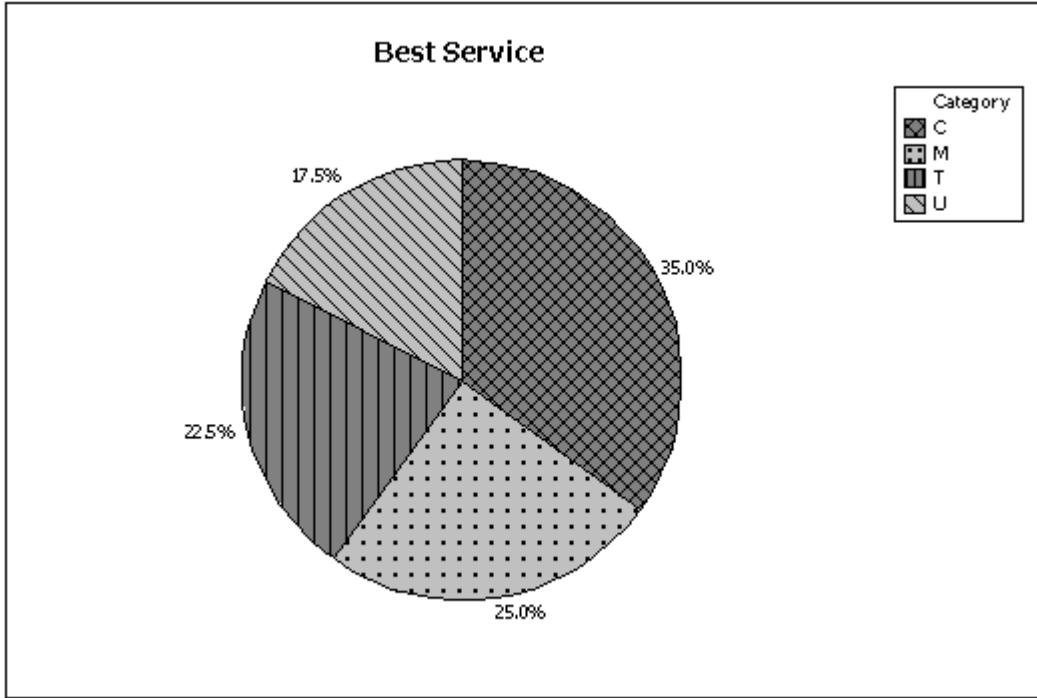
ANS:



University Chevrolet (U) received the fewest votes for best overall service (7 out of 40, or 17.5%) and came in last place.

59. {Car Buyers Narrative} Construct a pie chart of this data. Which car dealer offered the best overall service?

ANS:

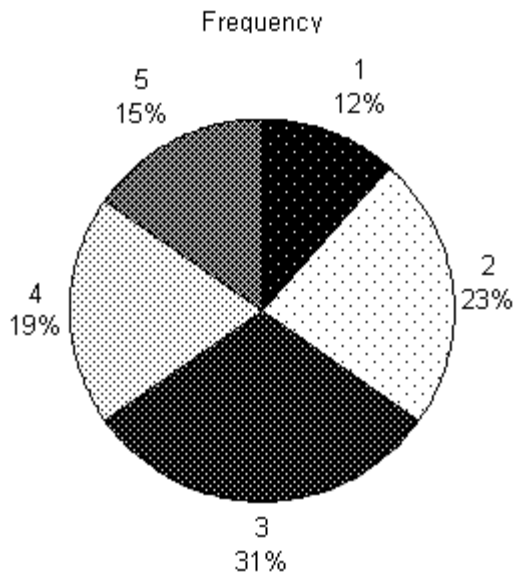
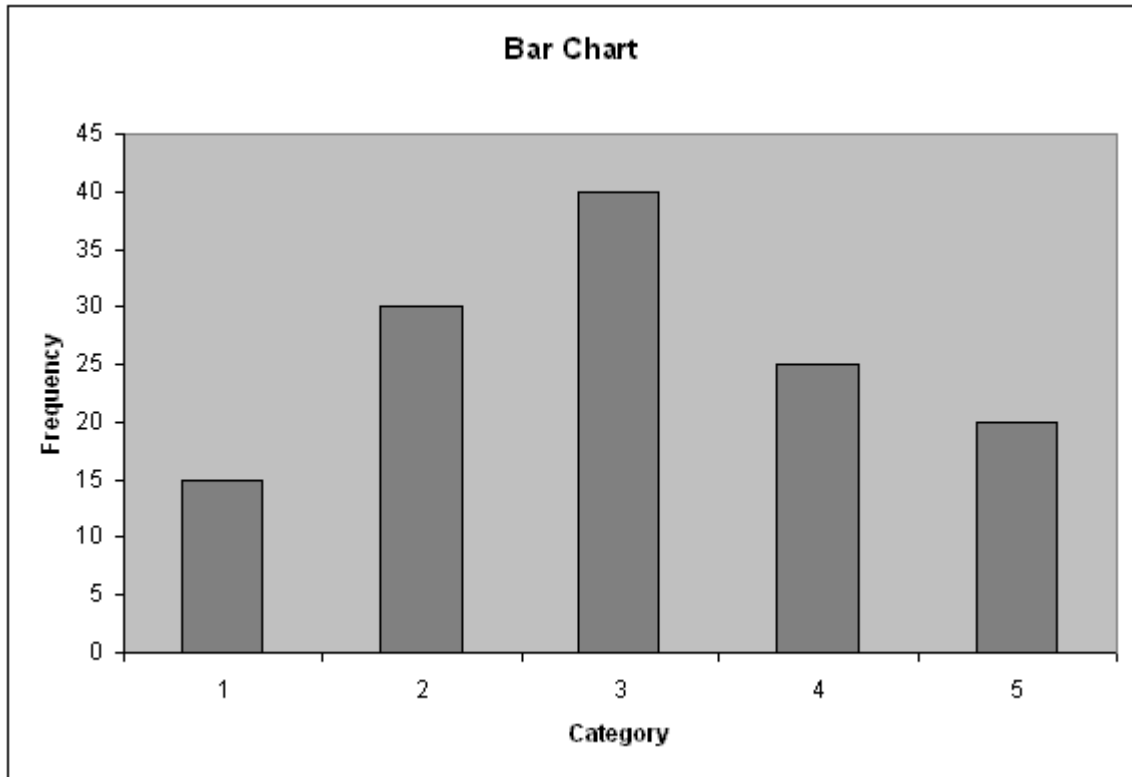


Carriage Motors (C) received the most votes (35.0%).

60. Suppose you measure the number of minutes it takes an employee to complete a task, where the maximum allowed time is 5 minutes, and each time is rounded to the nearest minute. Data from 130 employees is summarized below. Construct a frequency bar chart and a pie chart from this data. How long did it take most employees to complete the task?

Time (minutes)	1	2	3	4	5
Frequency	15	30	40	25	20

ANS:



The most common time to complete the task was 3 minutes, which was recorded for 40 of the 130 (31%) of the employees.

**Business School Graduates**

A sample of business school graduates were asked what their major was. The results are shown in the following frequency distribution.

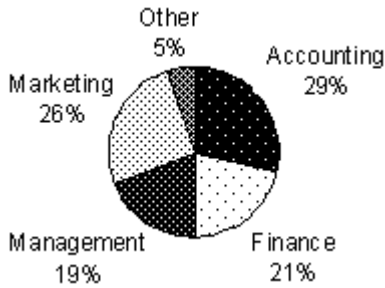
Major of Graduates	Number of graduates
Accounting	58
Finance	42
Management	38
Marketing	52
Other	10

61. {Business School Graduates Narrative} How many graduates were surveyed?

ANS:  
200; you get this by totaling the counts for each major.

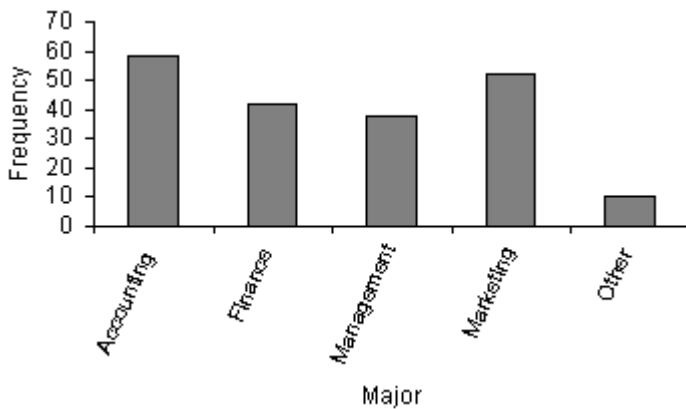
62. {Business School Graduates Narrative} Draw a pie chart to summarize this data. Which major was the most popular?

ANS:



The most popular major was accounting (29.0%), followed by marketing (26%).

63. {Business School Graduates Narrative} If you were only given the frequency bar chart below, would you be able to reconstruct the original observations in the data set?



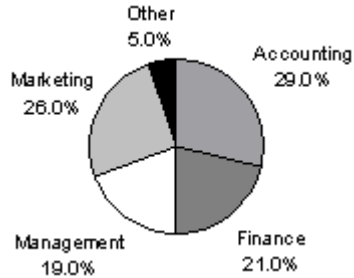
ANS:

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No; you cannot reconstruct the original data from this graph because the scale on the frequency (Y) axis is not precise enough. For example, you can't tell exactly what number of students majored in finance; it appears to be 40 on this bar chart, but the actual value is 42, as seen on the original table.

64. {Business School Graduates Narrative} Draw a pie chart of this data. Are you able to reconstruct the original data from this pie chart alone?

ANS:

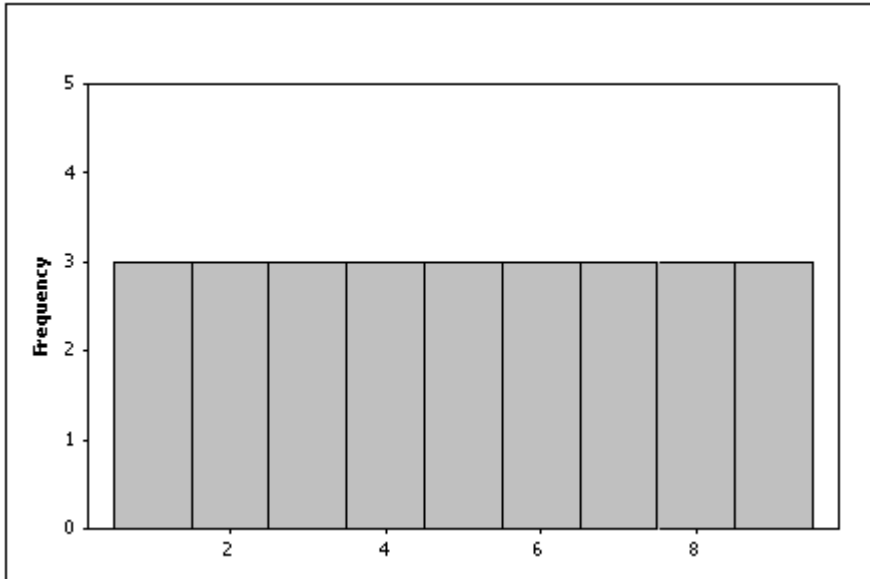


No; you cannot reconstruct the original data from this pie chart alone, because you don't know how many observations are in each category.

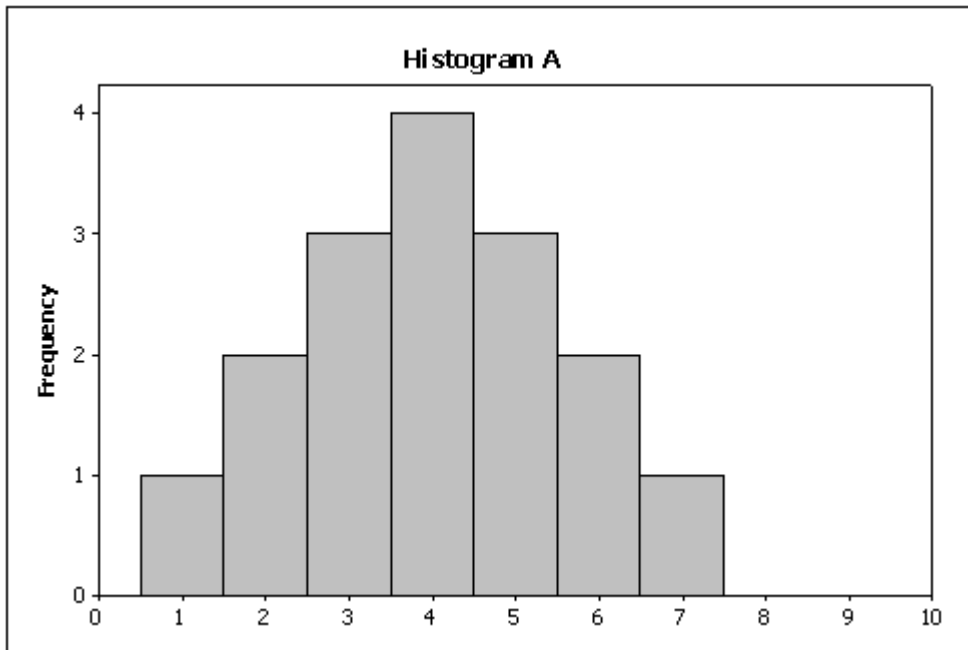
**MULTIPLE CHOICE**

65. Which of the following represents a graphical presentation of interval data?
- a. A bar chart.
  - b. A histogram.
  - c. A pie chart.
  - d. All of these choices are true.
66. Which of the following statements about histograms is false?
- a. A histogram is a summary of interval data.
  - b. A histogram is made of a series of intervals, called classes.
  - c. The classes in a histogram cover the complete range of observations.
  - d. All of these choices are true.
67. Which of the following statements about histograms is false?
- a. The intervals of a histogram do not overlap.
  - b. Every observation is assigned to one and only one class in a histogram.
  - c. The intervals of a histogram are equally wide.
  - d. None of these choices.

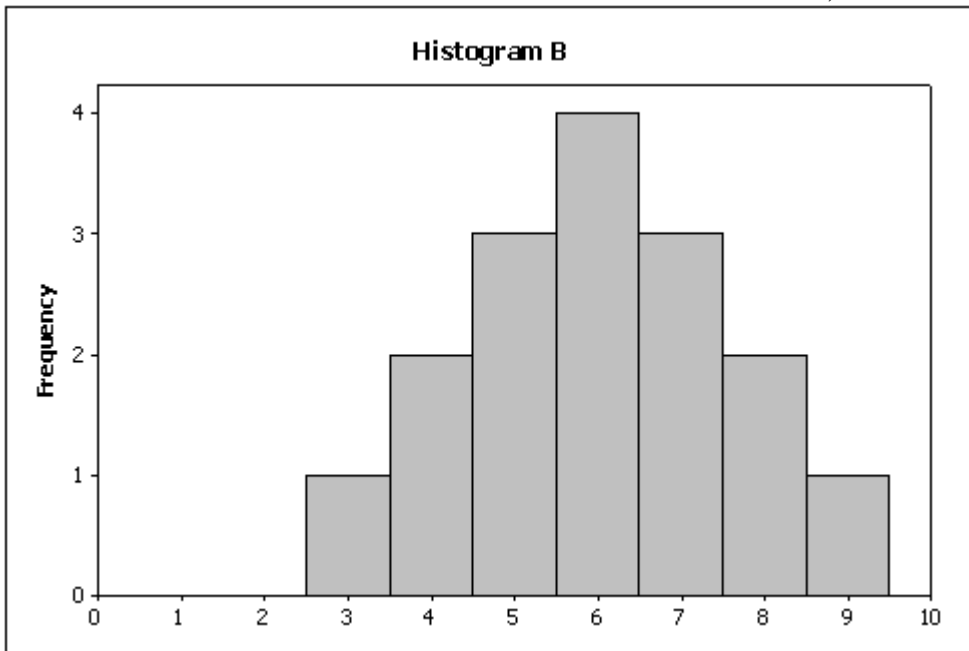
68. Which of the following describes the shape of the histogram below?



- a. Positively skewed
  - b. Negatively skewed
  - c. Symmetric
  - d. None of these choices
69. The relative frequency of a class in a histogram is computed by
- a. dividing the frequency of the class by the number of classes.
  - b. dividing the frequency of the class by the class width.
  - c. dividing the frequency of the class by the total of all frequencies.
  - d. None of these choices.
70. Compare the two histograms below. Which statement is true?

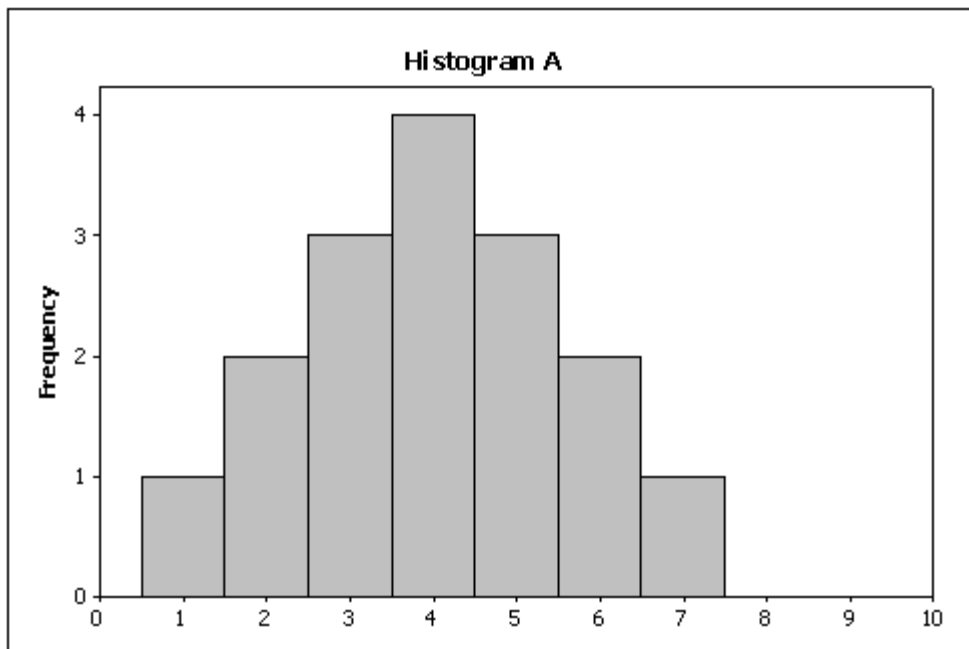


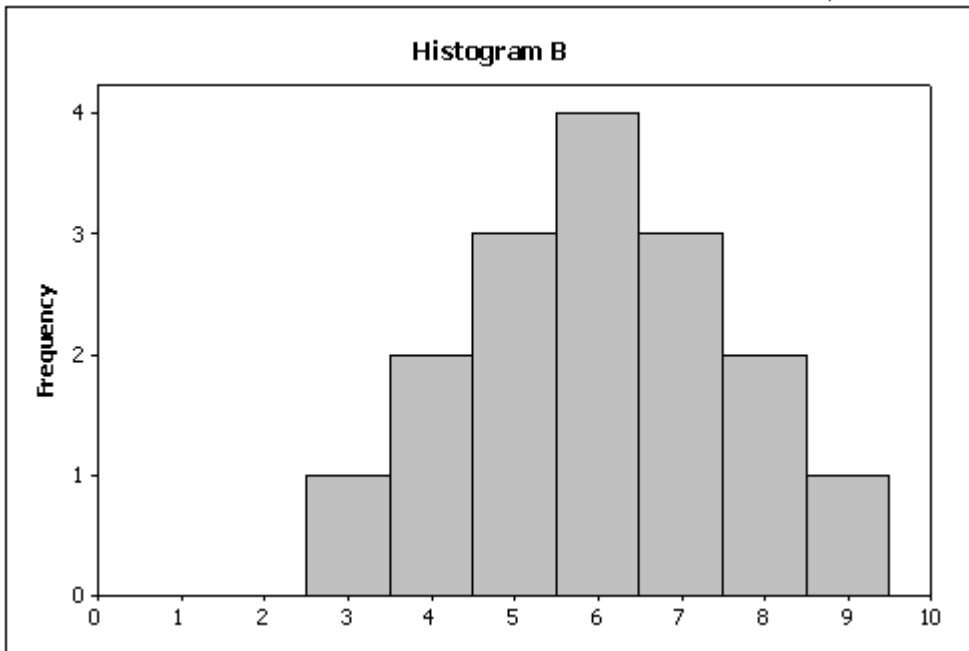




- a. The center of histogram A is lower than the center of histogram B.
- b. The center of histogram A is higher than the center of histogram B.
- c. The center of histogram A is the same as the center of histogram B.
- d. You cannot compare the centers of these two histograms without the original data.

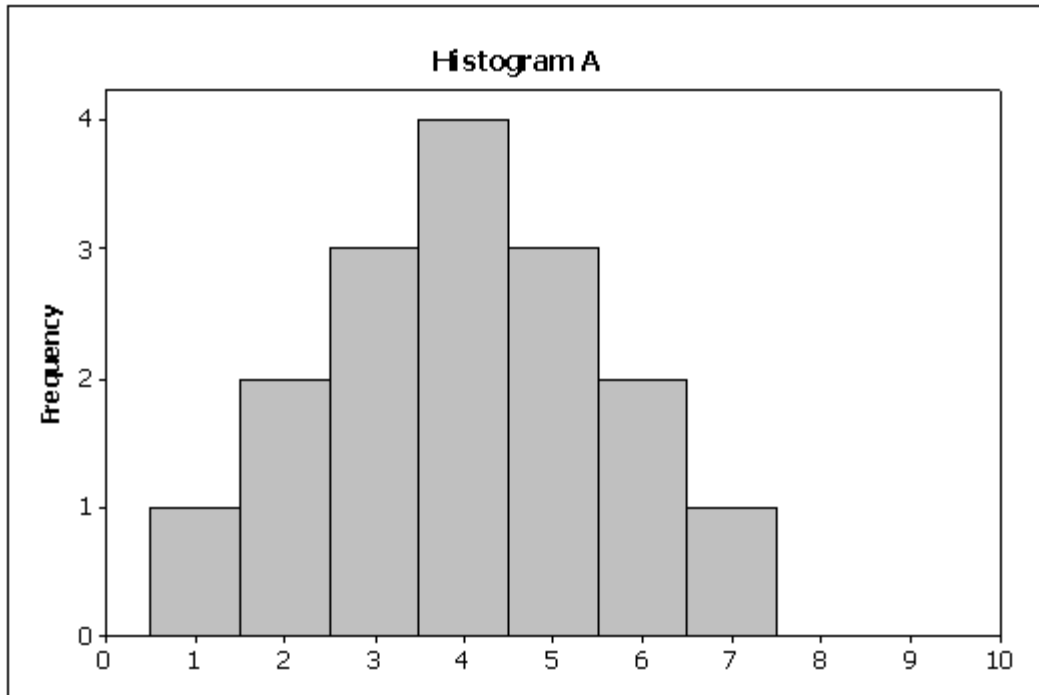
71. Compare the two histograms below. Which statement is true?

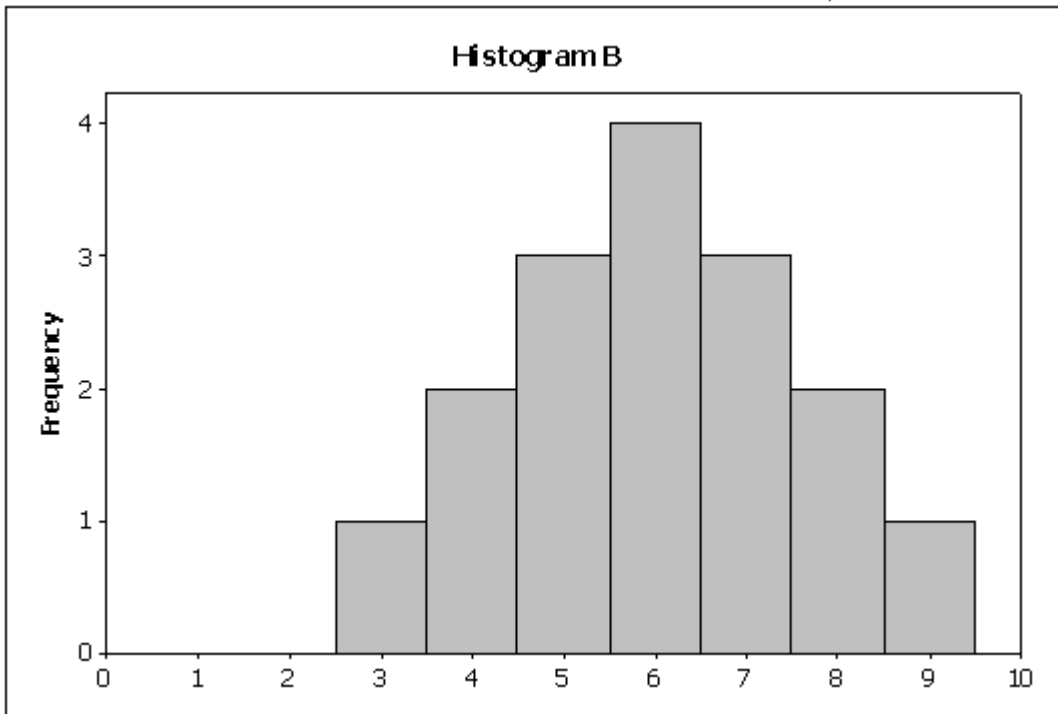




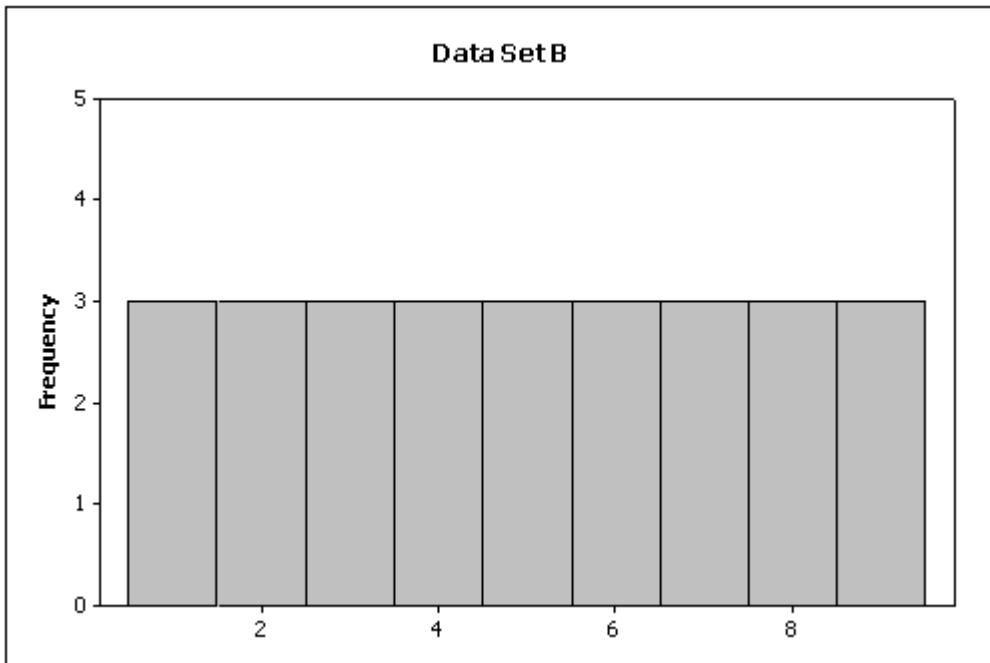
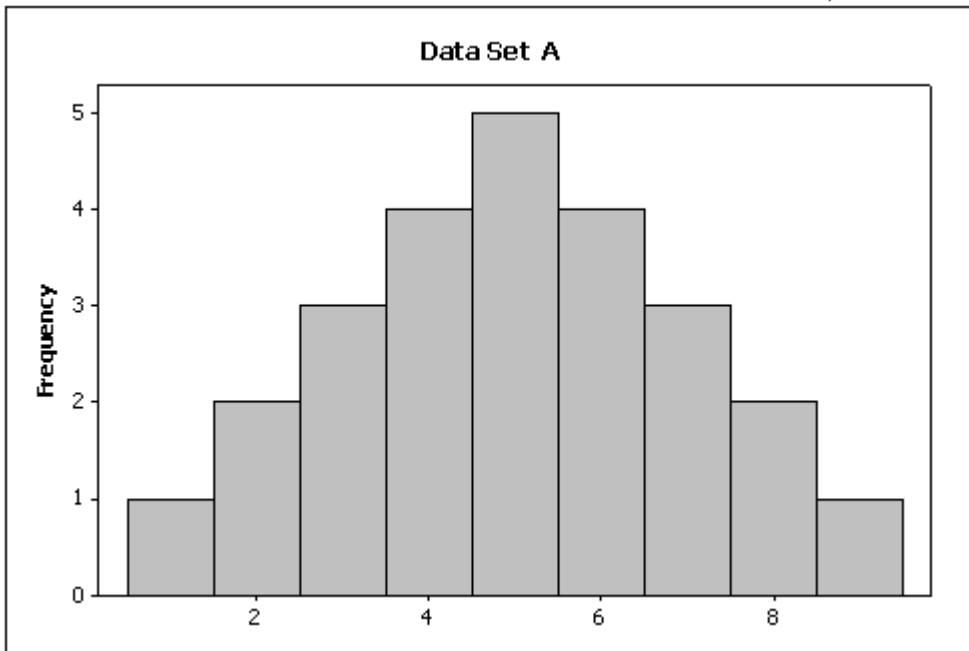
- a. The spread of histogram A is smaller than the spread of histogram B.
- b. The spread of histogram A is larger than the spread of histogram B.
- c. The spread of histogram A is the same as the spread of histogram B.
- d. You cannot compare the spreads of these two histograms without the original data.

72. Compare the two histograms below. Which statement is true?





- a. The shape of histogram A is the same as the shape of histogram B.
  - b. The shape of histogram A is positively skewed compared to histogram B.
  - c. The shape of histogram A is negatively skewed compared to histogram B.
  - d. You cannot compare the shapes of these two histograms without the original data.
73. A modal class in a histogram is the class that includes
- a. the largest number of observations.
  - b. the smallest number of observations.
  - c. the largest observation in the data set.
  - d. the smallest observation in the data set.
74. The sum of the relative frequencies for all classes in a histogram always equals
- a. the number of classes.
  - b. the class width.
  - c. the total of all the frequencies.
  - d. one.
75. Which of the following statements about shapes of histograms is true?
- a. A histogram is said to be symmetric if, when we draw a vertical line down the center of the histogram, the two sides are identical in shape and size.
  - b. A negatively skewed histogram is one with a long tail extending to the left.
  - c. A positively skewed histogram is one with a long tail extending to the right.
  - d. All of these choices are true.
76. Compare the spread of the two histograms below. Which of the following is true?



- a. Data Set A has a larger spread than Data Set B.
- b. Data Set A has a smaller spread than Data Set B.
- c. Data Set A has the same spread as Data Set B.
- d. You cannot compare the spreads of these histograms without the original data.

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77. Which of the following is true about a stem-and-leaf display?
- You can recreate the original data set from it.
  - Its shape resembles a histogram turned on its side.
  - It provides an organized way to depict interval data.
  - All of these choices are true.
78. What does the length of each line of a stem-and-leaf display represent?
- The percentage of observations in the interval represented by that stem.
  - The number of observations in the interval represented by that stem.
  - The total frequency of observations within or below that stem.
  - The number of digits to the left of the decimal point.
79. What values are displayed on a cumulative relative frequency distribution?
- The number of observations that fall into each class interval.
  - The proportion of observations that fall into each class interval.
  - The number of observations that fall below each class interval.
  - The proportion of observations that fall below each class interval.
80. Which of the following describes an ogive?
- A graphical representation of frequencies.
  - A graphical representation of relative frequencies.
  - A graphical representation of cumulative frequencies.
  - A graphical representation of cumulative relative frequencies.

**TRUE/FALSE**

81. The intervals (classes) in a histogram do not overlap.
82. The intervals (classes) in a histogram are equally wide.
83. In a histogram, each observation is assigned to one or more classes.
84. The number of class intervals in a histogram depends on the number of observations in the data set.
85. A relative frequency distribution describes the proportion of data values that fall within each category.
86. A stem-and-leaf display reveals more information about the original data than does a histogram.
87. The number of observations within each class may be found in a frequency distribution.
88. The advantage of a stem-and-leaf display over a histogram is that we can see the actual observations.

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89. According to the stem-and-leaf plot below, the median quiz score for this data set is 8.

Stem-and-leaf of Quiz Score; N = 75

Leaf Unit = 1

9	0	000112333
14	0	56899
21	1	0000123
26	1	66699
33	2	3334445
(8)	2	66677888
34	3	0023344
27	3	56669999
19	4	000122233
10	4	5556667799

90. A cumulative relative frequency distribution lists the number of observations that lie below each of the class limits.

91. According to the stem-and-leaf plot below, this data set has a negative median.

Stem-and-leaf of P/E ratio; N = 75

Leaf Unit = 0.01

1	-2	6
2	-2	0
5	-1	555
8	-1	420
22	-0	99999887777665
36	-0	44322111111000
(14)	0	01122233333344
25	0	66678889999
14	1	0022222334
4	1	56
2	2	03

92. A histogram represents interval data.

93. A stem-and-leaf display represents nominal data.

94. According to the stem-and-leaf plot below, this data set is symmetric.

Stem-and-leaf of P/E ratio; N = 10

Leaf Unit = 0.10

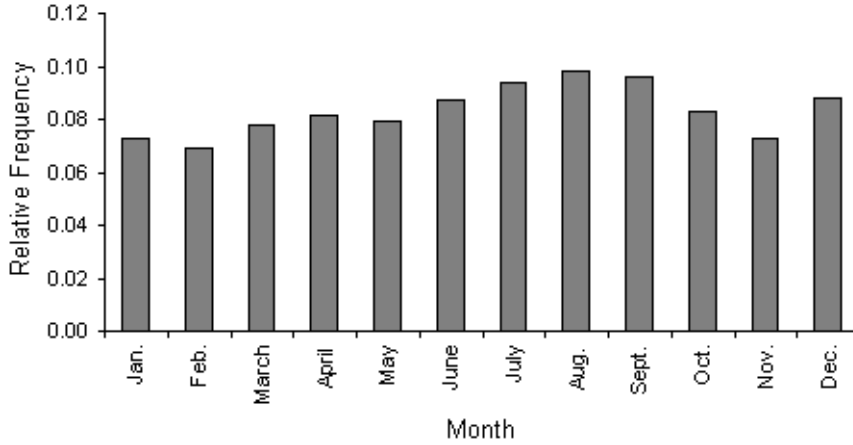
2	-1	53
4	-0	97
(2)	-0	65
4	0	3
3	0	6

2	1	3
1	1	8

95. When a distribution has more values to the left and tails off to the right, it is skewed negatively.
96. A histogram is said to be symmetric if, when we draw a vertical line down the center of the histogram the two sides are nearly identical.
97. A skewed histogram is one with a long tail extending either to the right or left.
98. When a distribution has more values to the right and tails to the left, we say it is skewed negatively.
99. The sum of relative frequencies in a distribution always equals 1.
100. The sum of cumulative relative frequencies always equals 1.
101. The original observations cannot be determined once they are grouped into a frequency distribution.

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- 102. A modal class is the class with the largest number of observations.
- 103. Experience shows that few students hand in their statistics exams early; most prefer to hand them in near the end of the test period. This means the time taken by students to write exams is positively skewed.
- 104. The graph below is an example of a histogram.



**COMPLETION**

- 105. We create a frequency distribution for interval data by counting the number of observations that fall into each of a series of intervals, called \_\_\_\_\_.  
ANS: classes
- 106. The more observations we have, the \_\_\_\_\_ the number of class intervals we need to use to draw a useful histogram.  
ANS:  
larger  
higher  
greater
- 107. A graph of the frequency distribution for interval data is called a(n) \_\_\_\_\_.  
ANS: histogram
- 108. We determine the approximate width of the classes of a histogram by subtracting the smallest observation from the largest and dividing the answer by the number of \_\_\_\_\_.  
ANS:  
classes  
intervals



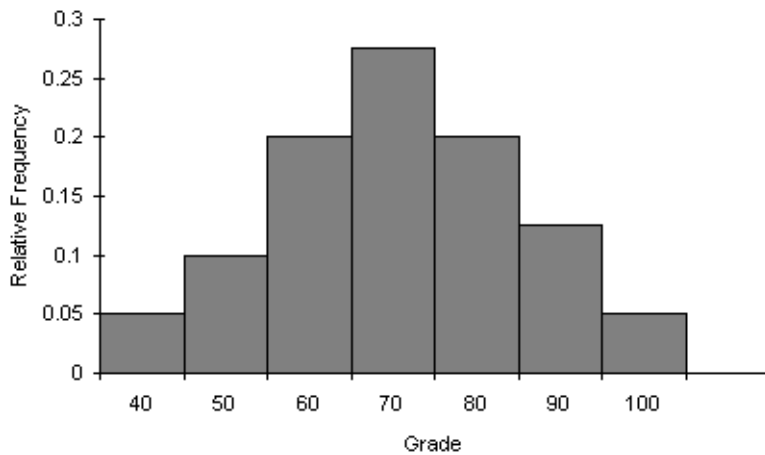
109. A histogram is said to be \_\_\_\_\_ if, when we draw a vertical line down the center of the histogram, the two sides are identical in shape and size.

ANS:  
symmetric  
symmetrical

110. A(n) \_\_\_\_\_ histogram is one with a long tail extending to either the right or the left.

ANS: skewed

111. The histogram below has a shape that is \_\_\_\_\_.



ANS:  
symmetric  
symmetrical  
bell shaped  
bell-shaped

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112. It is typical that when taking an exam, few students hand in their exams early; most prefer to reread their papers and hand them in near the end of the scheduled exam period. Under this scenario, a histogram of exam taking times is \_\_\_\_\_ skewed.

ANS: negatively

113. In a histogram a(n) \_\_\_\_\_ class is the one with the largest number of observations.

ANS: modal

114. A(n) \_\_\_\_\_ histogram has two peaks, not necessarily equal in height.

ANS: bimodal

115. The length of each line in a step-and-leaf display represents the \_\_\_\_\_ of that class interval defined by the stems.

ANS:  
frequency  
count

116. A(n) \_\_\_\_\_ is a graphical representation of the cumulative relative frequencies.

ANS: ogive

117. The largest value of a cumulative relative frequency is \_\_\_\_\_.

ANS:  
one  
1

118. A(n) \_\_\_\_\_ display shows the actual observations as well as the number of observations in each class.

ANS:  
stem-and-leaf  
stem and leaf

119. A(n) \_\_\_\_\_ is a table that sorts data into class intervals (categories) and gives the number of observations in each interval (category).

ANS: frequency distribution

**SHORT ANSWER**

120. For what type of data is a histogram appropriate?

ANS:

Interval, numerical, or quantitative data.

\

121. Twenty-five voters participating in a recent election exit poll in Minnesota were asked to state their political party affiliation. Coding the data 1 for Republican, 2 for Democrat, and 3 for Independent, the data collected were as follows: 3, 1, 2, 3, 1, 3, 3, 2, 1, 3, 3, 2, 1, 1, 3, 2, 3, 1, 3, 2, 3, 2, 1, 1, and 3. Develop a frequency distribution and a relative frequency distribution for this data. What does the data suggest about the strength of the political parties in Minnesota?

ANS:

Party	Frequency	Proportion
Republican	8	0.32
Democrat	6	0.24
Independent	11	0.44

According to the frequency distribution above, the Independents in Minnesota outnumber the Republicans and Democrats.

\

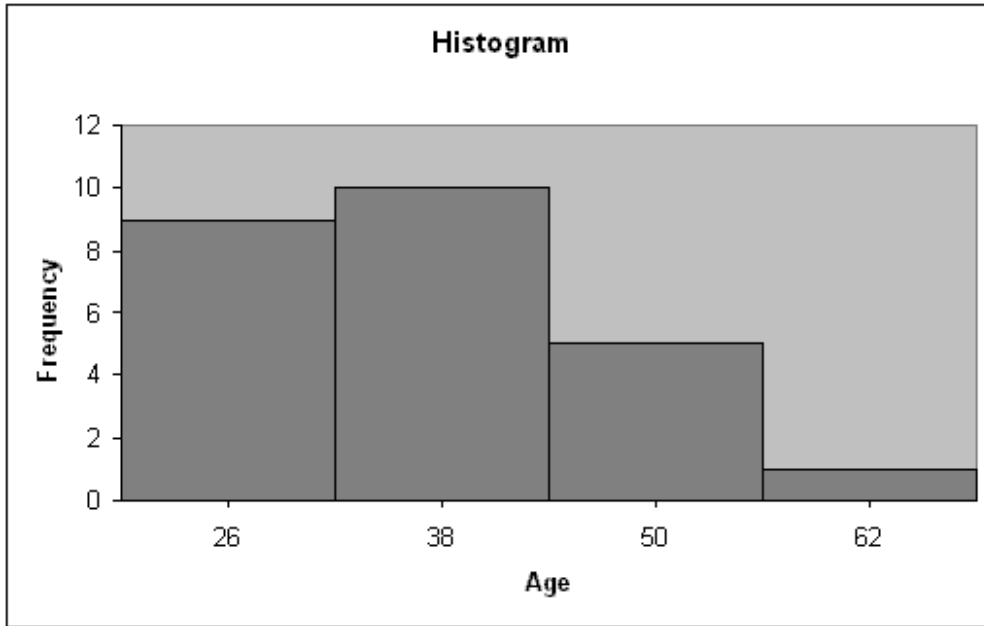
**Salesperson Ages**

The ages (in years) of a sample of 25 salespersons are as follows:

- 47      21      37      53      28
- 40      30      32      34      26
- 34      24      24      35      45
- 38      35      28      43      45
- 30      45      31      41      56

122. {Salesperson Ages Narrative} Draw a frequency histogram of this data which contains four classes. What is the shape of the histogram?

ANS:

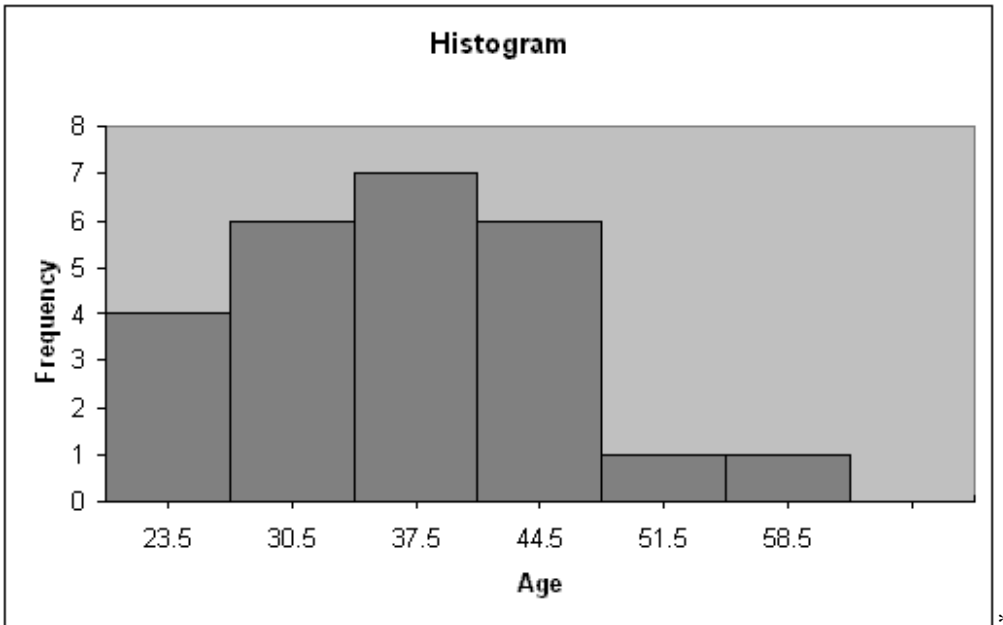


This histogram of ages of salespersons is positively skewed.

\

123. {Salesperson Ages Narrative} Draw a frequency histogram of this data which contains six classes. What is the shape of the histogram?

ANS:



This histogram of ages of salespersons is positively skewed.

\

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124. {Salespersons' Ages Narrative} Draw a stem-and-leaf display of this data. What is the minimum and maximum age of the salespersons in this data set?

ANS:

Stem	Leaf
2	144688
3	0012445578
4	0135557
5	36

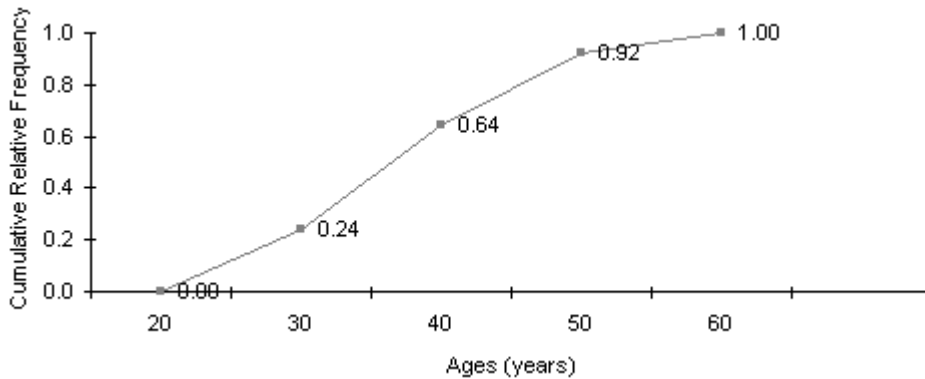
The minimum age is 21 and the maximum age is 56.

\

125. {Salesperson's Ages Narrative} Construct an ogive for this data. Estimate the proportion of salespersons that are: 1) under 30 years of age; 2) 40 years of age or over; and 3) between 40 and 50 years of age.

ANS:

According to the ogive below, the proportions are 0.24;  $1 - 0.64 = 0.36$ ; and  $0.92 - 0.64 = 0.28$ , respectively.



\

**Exam scores**

The scores on a calculus exam for a random sample of 40 students are as follows:

63	74	42	65	51	54	36	56	68	57
62	64	76	67	79	61	81	77	59	38
84	68	71	94	71	86	69	75	91	55
48	82	83	54	79	62	68	58	41	47

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126. {Exam Grades Narrative} Construct a stem-and-leaf display for this data set. Describe the shape of the data.

ANS:

Stem	Leaf
3	68
4	1278
5	14456789
6	12234578889
7	11456799
8	12346
9	14

The data is relatively symmetric and bell shaped.

127. {Exam Grades Narrative} Construct frequency and relative frequency distributions for this data set using seven class intervals. Describe the shape of the data set.

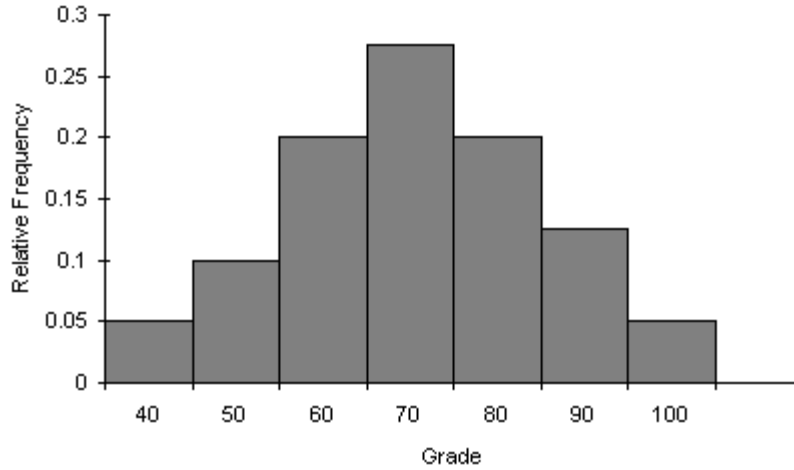
ANS:

Class Limits	Frequency	Relative Frequency
30 to 39	2	0.050
40 to 49	4	0.100
50 to 59	8	0.200
60 to 69	11	0.275
70 to 79	8	0.200
80 to 89	5	0.125
90 to 99	2	0.050
Total	40	1.00

The data is relatively symmetric and bell shaped.

128. {Exam Grade Narrative} Construct a relative frequency histogram for this data set and discuss its shape.

ANS:



The distribution of the data is relatively symmetric and bell shaped.

129. {Exam Grades Narrative} Describe the distribution of exam scores.

ANS:

The distribution of the data is symmetrical and bell-shaped, with 67.5% of the observations between 50 and 80. The center looks to be around 65.

130. {Exam Grades Narrative} Construct a cumulative frequency and a cumulative relative frequency distribution for this data. What proportion of the exam scores are less than 60? What proportion of the exam scores are 70 or more?

ANS:

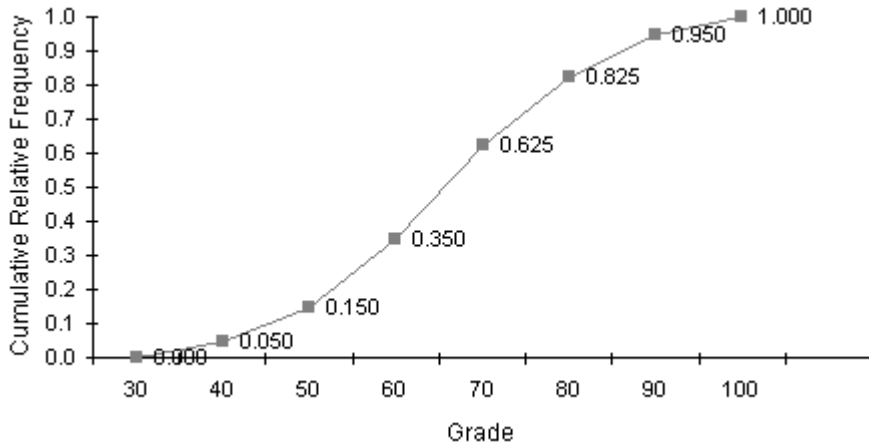
Classes	Cumulative Frequency	Cumulative Relative Frequency
< 40	2	0.050
< 50	6	0.150
< 60	14	0.350
< 70	25	0.625
< 80	33	0.825
< 90	38	0.950
< 100	40	1.000

$$0.35; 1 - 0.625 = 0.375$$

131. {Exam Grades Narrative} Construct an ogive for this data set. Use the ogive to estimate the proportion of exam scores that are between 80 and 90.

ANS:

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The proportion of grades that are between 80 and 90 =  $0.950 - 0.825 = 0.125$ .

132. Forty car buyers were asked to indicate the car dealer they believed offered the best overall service. The four choices were A, B, C, and D as shown below:

A C C C D C B A C D  
 D B C B A C B B C B  
 A C C A D B B C C A  
 A D C D A B B C D A

Construct a table showing the frequencies and relative frequencies for this data set. What proportion of car buyers rated dealer D as the best?

ANS:

Dealer	Frequency	Relative frequency
A	9	0.225
B	10	0.250
C	14	0.350
D	7	0.175

0.175 of the car buyers rated dealer D as the best.

133. A grocery store's monthly sales (in thousands of dollars) for the last year were as follows:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Sales	78	74	83	87	85	93	100	105	103	89	78	94

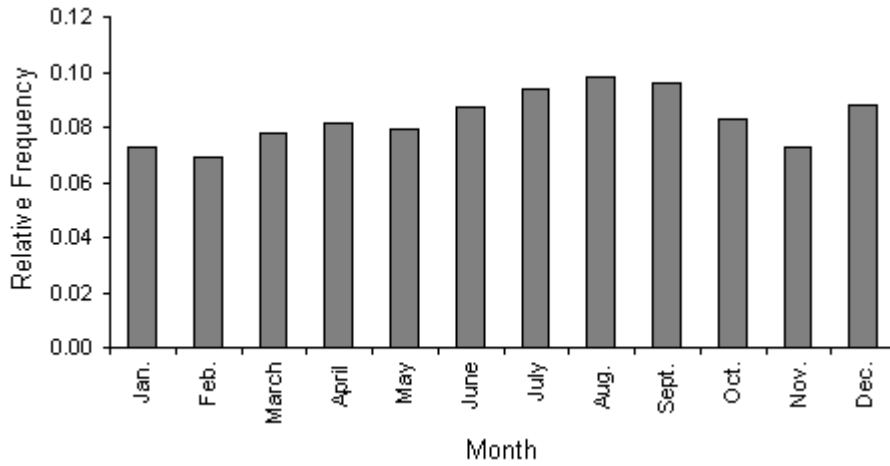
Construct a relative frequency bar chart for this data set. How many observations are there in this data set?

ANS:

See the graph below. There are 12 observations in this data set; one sales amount is listed for each month.



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134. Consider the following cumulative frequency distribution.

Classes Limits	Cumulative Frequency	Frequency
< 5	8	
< 10	15	
< 15	21	
< 20	30	
< 25	42	

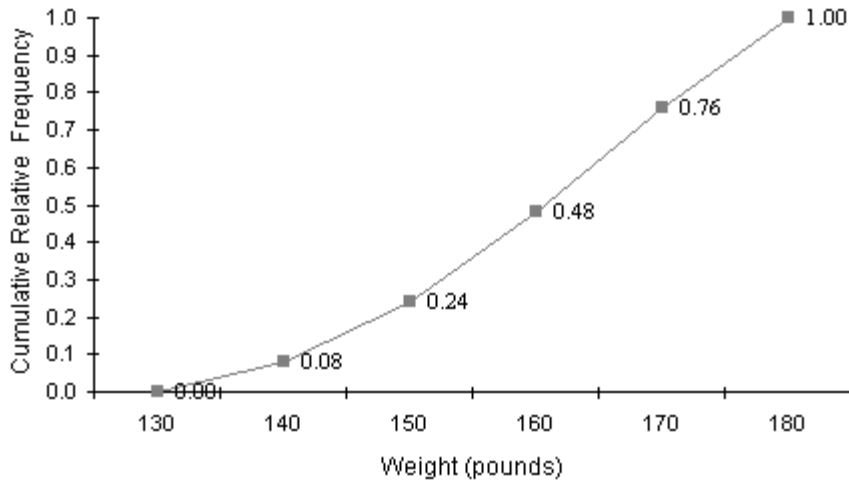
Fill in the frequencies for each class in the above table.

ANS:

8; 7; 6; 9; 12

135. The weights of a sample of 25 workers are given (in pounds): 164, 148, 137, 157, 173, 156, 177, 172, 169, 165, 145, 168, 163, 162, 174, 152, 156, 168, 154, 151, 174, 146, 134, 140, and 171. Construct an ogive for the data. What proportion of the worker's weights are between 160 and 180 pounds; below 150 pounds; and at or above 140 pounds, respectively?

ANS:



The proportions are  $1 - 0.48 = 0.52$ ;  $0.24$ ;  $1 - 0.08 = 0.92$ , respectively.

### Insurance Company

A representative from a local insurance agency selected a random sample of insured drivers and recorded the number of claims made in the last three years, with the following results:

Number of claims	0	1	2	3	4	5
Frequency	10	18	16	12	3	1

136. {Insurance Company Narrative} How many drivers are represented in the sample?

ANS:

$$10 + 18 + 16 + 12 + 3 + 1 = 60$$

137. {Insurance Company Narrative} How many total claims are represented in the sample?

ANS:

$$(0 \times 10) + (1 \times 18) + (2 \times 16) + (3 \times 12) + (4 \times 3) + (5 \times 1) = 103$$

138. {Insurance Company Narrative} What proportion of drivers had no claims in the last three years?

ANS:

$$10/60 = .17$$

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139. {Insurance Company Narrative} What number of claims was made by the highest proportion of drivers?

ANS:

$18/60 = 30\%$  of the drivers had one claim in the last three years.

**Computer Company**

At a meeting of regional offices managers of a national computer company, a survey was taken to determine the number of employees the regional managers supervise in the operation of their departments. The results of the survey are shown below.

Number of employees supervised	1	2	3	4	5
Frequency	7	11	14	8	10

140. {Computer Company Narrative} How many regional offices are represented in the survey results?
141. {Computer Company Narrative} Across all of the regional offices, how many total employees were supervised by those surveyed?

ANS:

142. {Computer Company Narrative} What proportion of managers supervise 3 employees?
143. {Computer Company Narrative} What is the cumulative relative frequency corresponding to 5 employees?

ANS:

This is the total proportion of employees supervising 4 or fewer employees:  $40/50 = 0.80$  or 80%.

**On-line Classes**

A survey of 25 students was conducted to determine how they rate the quality of on-line classes. Students were asked to rate the overall quality from 0 (no quality at all) to 100 (extremely good quality). The stem-and-leaf display of the data is shown below.

Stem	Leaves
3	15
4	01457889
5	0134677
6	24568
7	29
8	
9	5

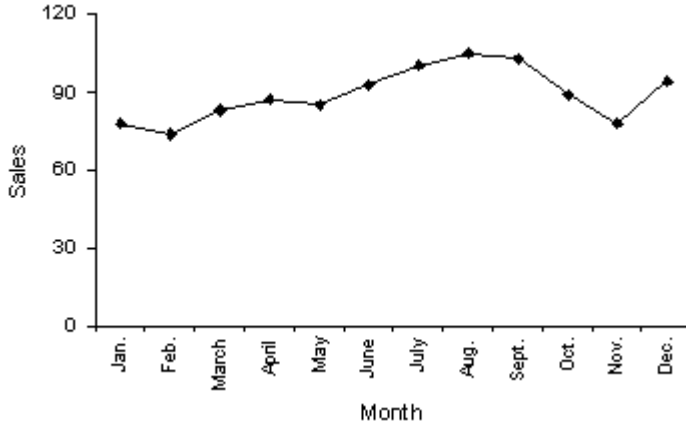
144. {On-line Classes Narrative} What percentage of the students rated the overall quality of on-line classes as being 70 or above?
  
145. {On-line Classes Narrative} What percentage of the students rated the overall quality of on-line classes as being 60 or below?
  
146. {On-line Classes Narrative} What percentage of the students rated the overall quality of on-line classes as being between 50 and 75, inclusive?
  
147. {On-line Classes Narrative} What percentage of the students rated the overall quality of on-line classes as being below 40?

**MULTIPLE CHOICE**

148. Observations that are measured at successive points in time is what type of data?
  - a. Time-series data
  - b. Cross-sectional data
  - c. Successive data
  - d. None of these choices.
  
149. Observations that are measured at the same time represent what type of data?
  - a. Time-series data
  - b. Cross-sectional data
  - c. Synchronous data
  - d. None of these choices.
  
150. Which of the following represents time-series data?
  - a. The length of time each of the top 100 stocks have been available on the NASDAQ.
  - b. The most popular time of year that people purchase the top 100 stocks on the NASDAQ.
  - c. The value of the #1 stock on the NASDAQ each month over a one-year period.

- d. All of these choices are true.
- 
- 151. Time-series data are often graphically depicted how?
    - a. Bar chart
    - b. Histogram
    - c. Line chart
    - d. All of these choices are true.
- 
- 152. Which of the following statements describes a line chart?
    - a. A line chart is a graph of time-series data.
    - b. A line chart is a plot of a variable over time.
    - c. The horizontal axis of a line chart contains time periods.
    - d. All of these choices are true.

153. What type of graph depicts the data below?

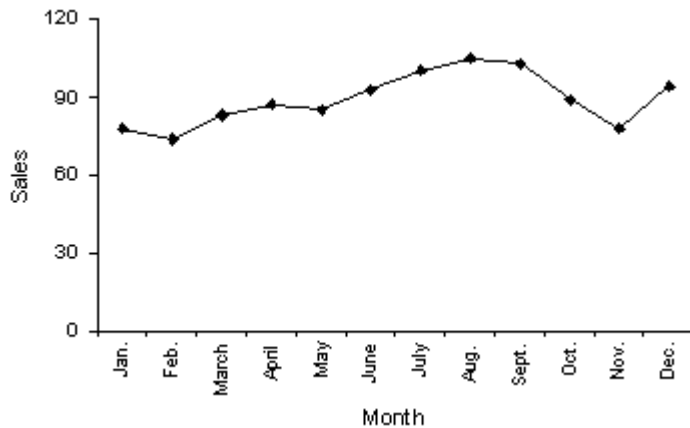


- a. A line chart
- b. A histogram
- c. A dot plot
- d. A bar chart

154. What kind(s) of data can be depicted by a line chart?

- a. Frequencies of an interval over time.
- b. Frequencies of a nominal variable over time.
- c. Relative frequencies of a nominal variable over time.
- d. All of these choices are true.

155. Which of the following statements describe(s) the line chart below?

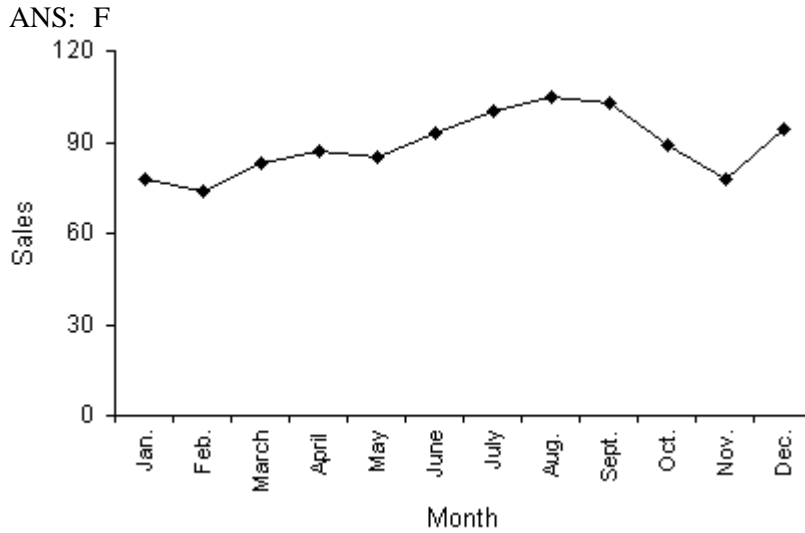


- a. November experienced the lowest sales throughout the year.
- b. August experienced the highest sales throughout the year.
- c. Sales did not fluctuate more than 30 units on either side of 90.
- d. All of these choices are true.

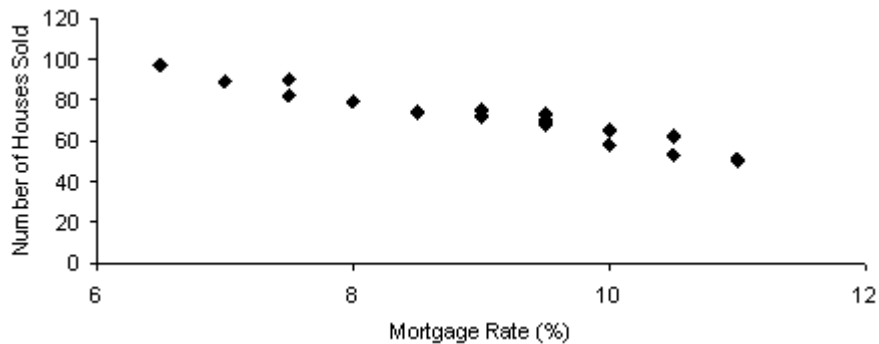
TRUE/FALSE

156. A grocery store's monthly sales (in thousands of dollars) for the last year were as follows. A histogram should be used to present these data.

Month	1	2	3	4	5	6	7	8	9	10	11	12
Sales	78	74	83	87	85	93	100	105	103	89	78	94

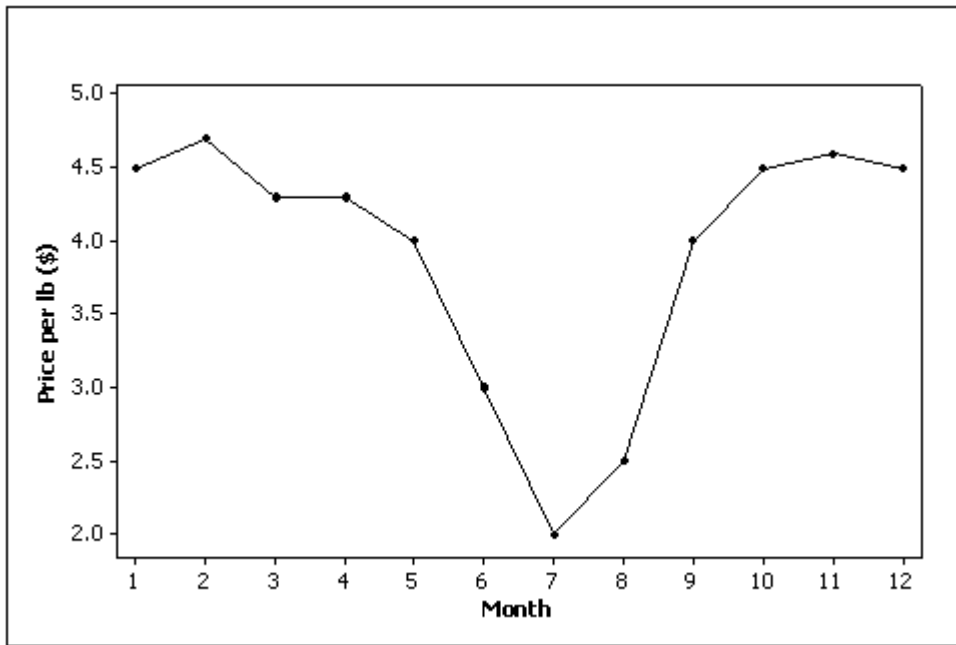


157. Time series data are often graphically depicted on a line chart, which is a plot of the variable of interest over time.
158. A line chart is created by plotting the values of the variable on the vertical axis and the time periods on the horizontal axis.
159. The graph below represents a line graph.



160. The line chart below shows pepper prices each month from January (month 1) to December last year (\$ per pound). By looking at this chart you can see the lowest pepper prices occurred in July.

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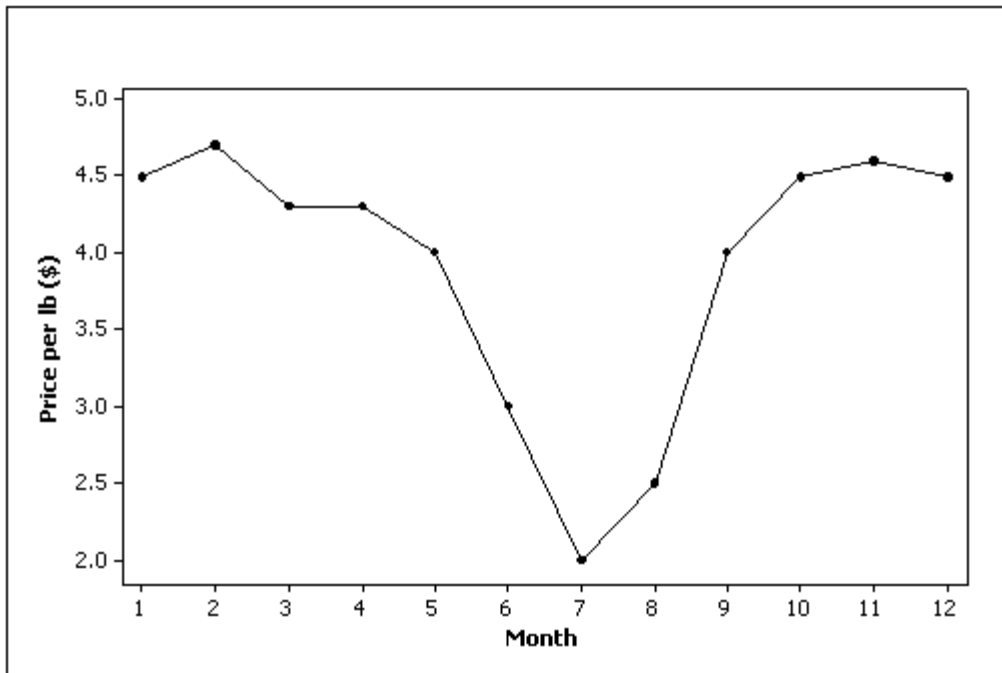


ANS: T

PTS: 1

REF: SECTION 2.4

161. The line chart below shows pepper prices fluctuated from \$2.00 per pound to over \$4.50 per pound during the year.

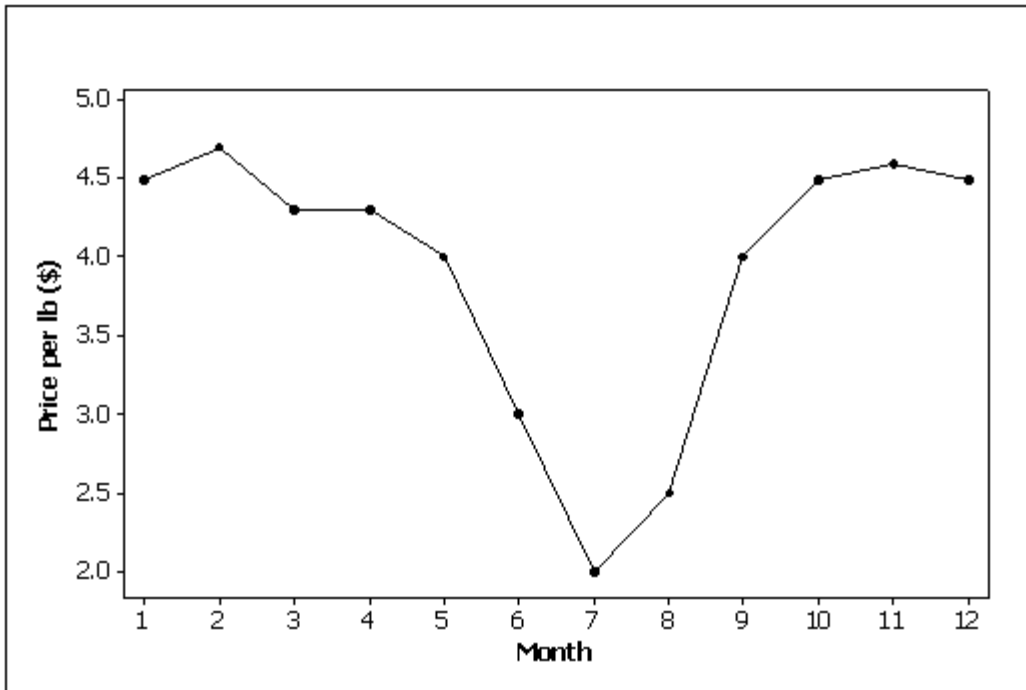


162. A line chart that is flat shows no fluctuation in the variable being presented.



**COMPLETION**

163. The line chart below shows pepper prices per pound for each month from January (month 1) to December last year. By looking at this chart you can see the lowest pepper prices occurred in \_\_\_\_\_.



164. Observations that are measured at the same time are called \_\_\_\_\_ data.
165. Observations that are taken during successive points in time are called \_\_\_\_\_ data.
166. Time series data are often graphically depicted on a(n) \_\_\_\_\_, which is a plot of the variable of interest over time.
167. A(n) \_\_\_\_\_ is created by plotting the value of the variable on the vertical axis and the time periods on the horizontal axis.
168. A line chart is created by plotting the value of the variable on the \_\_\_\_\_ axis and the time periods on the \_\_\_\_\_ axis.

**SHORT ANSWER**

169. Briefly discuss the difference between cross-sectional data and time-series data.

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Data can be classified according to whether the observations are measured at the same time or whether they represent measurements at successive points in time. The former are called cross-sectional data and the latter, time-series data.

170. Explain the difference between a histogram and a line chart.

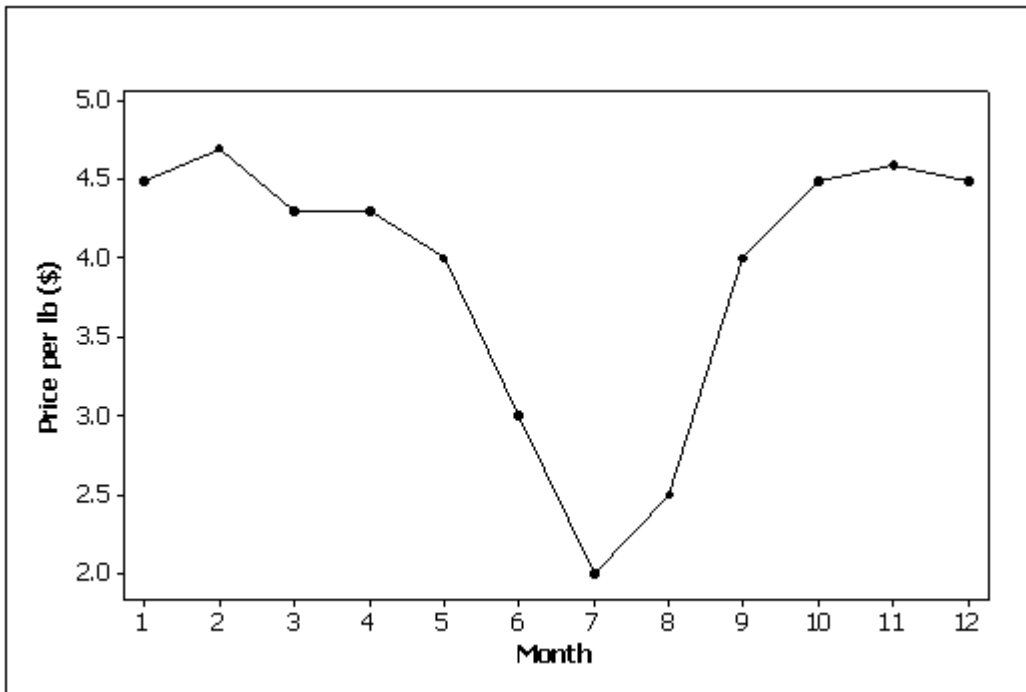
A histogram is a display of cross-sectional data and a line chart is a display of time-series data.

PTS: 1

REF: SECTION 2.4

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171. Pepper prices throughout the year (month 1 = January) are shown in the line chart below (per pound). Describe pepper prices for this given year using this line chart.



ANS:

Pepper prices started at around \$4.50 in January, then lowered consistently through the months of January through July, where they hit their lowest price, \$2.00 per pound. Then prices sharply increased until October, and stayed about the same through December. Prices started the year and ended the year at about the same level (\$4.50 per pound).

**MULTIPLE CHOICE**

172. When studying the responses to two nominal questions, we should develop a
- cross-classification table.
  - frequency distribution table.
  - cumulative percentage distribution table.
  - scatter diagram.
173. Which of the following techniques can be used to explore relationships between two nominal variables?
- Comparing the relative frequencies within a cross-classification table.
  - Comparing pie charts, one for each column (or row).
  - Comparing bar charts, one for each column (or row).
  - All of these choices are true.

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174. A statistics professor classifies his students according to their grade point average (GPA) and their gender. The resulting cross-classification table is shown below.

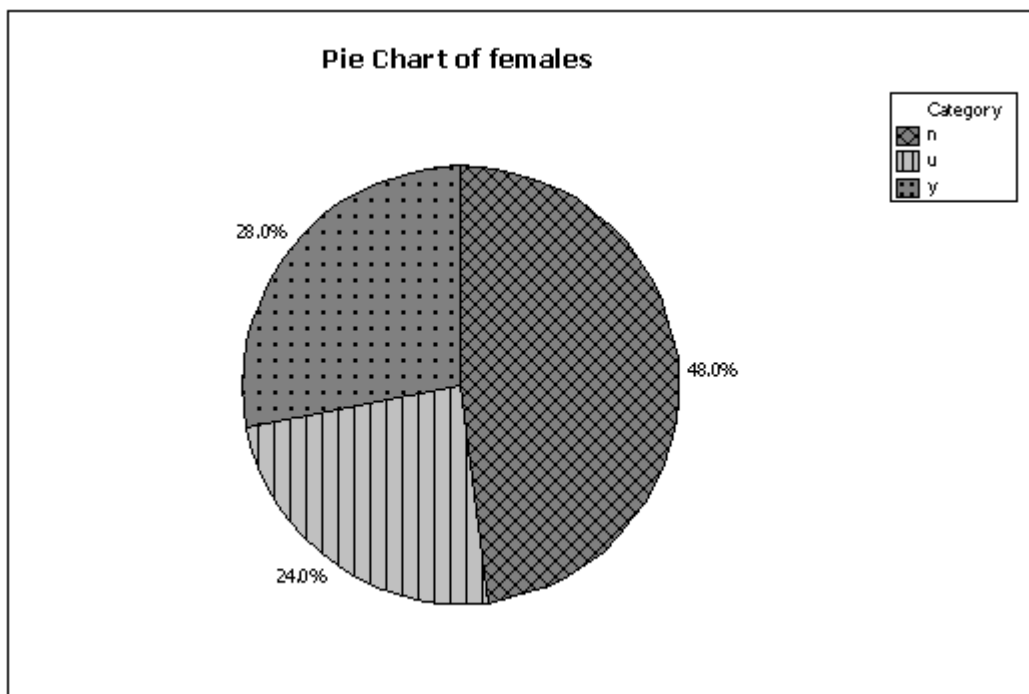
Gender	GPA		
	Under 2.0	2.0 – 3.0	Over 3.0
Male	5	25	10
Female	10	20	30

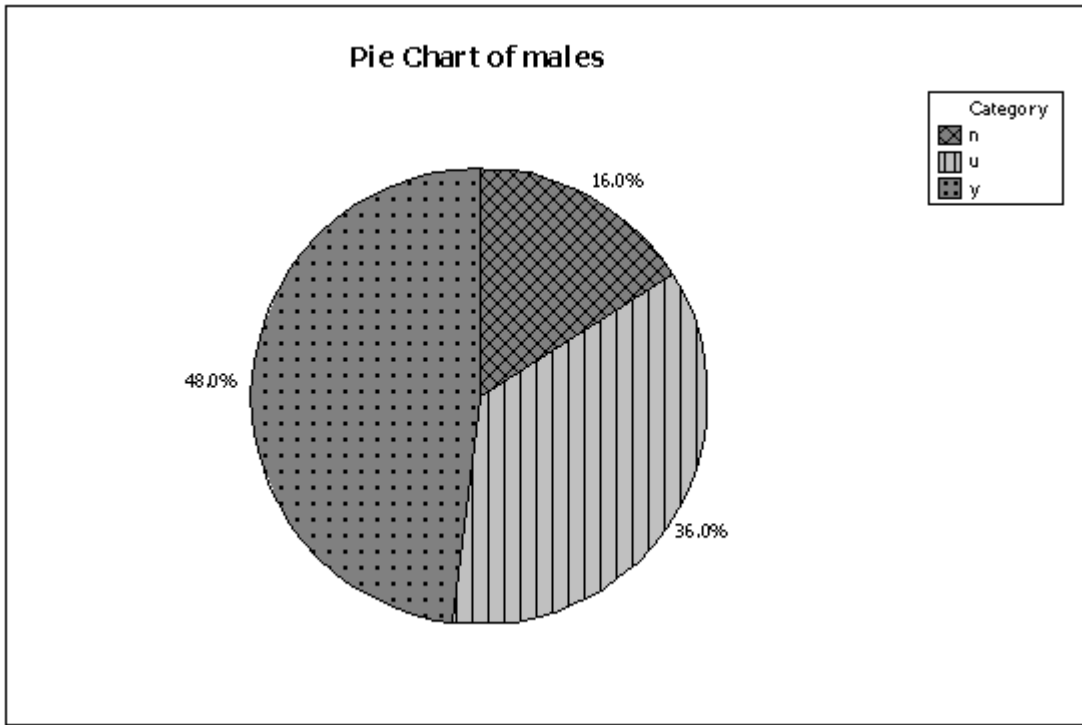
Which of the following describes the relationship between GPA and gender shown by this table?

- A higher percentage of females have GPAs over 3.0, compared to males.
  - A lower percentage of females have GPAs over 3.0, compared to males.
  - Females and males each have the same percentage of GPAs over 3.0.
  - You cannot compare male and female GPAs because the total number in each group is not the same.
175. In the following cross-classification table, how are gender and pet ownership related?

	Own a pet	Don't own a pet
Females	60	30
Males	80	40

- The percentage of pet owners is higher for males than for females.
  - The percentage of pet owners is higher for females than for males.
  - The percentage of pet owners is the same for females and males.
  - You cannot compare percentages for males and females since the total frequencies are not equal.
176. Two hundred males and two hundred females were asked whether or not college football should have a playoff system (yes/no/undecided). Pie charts of the responses for males vs. females are shown below. Which of the following describes the relationship between gender and opinion?

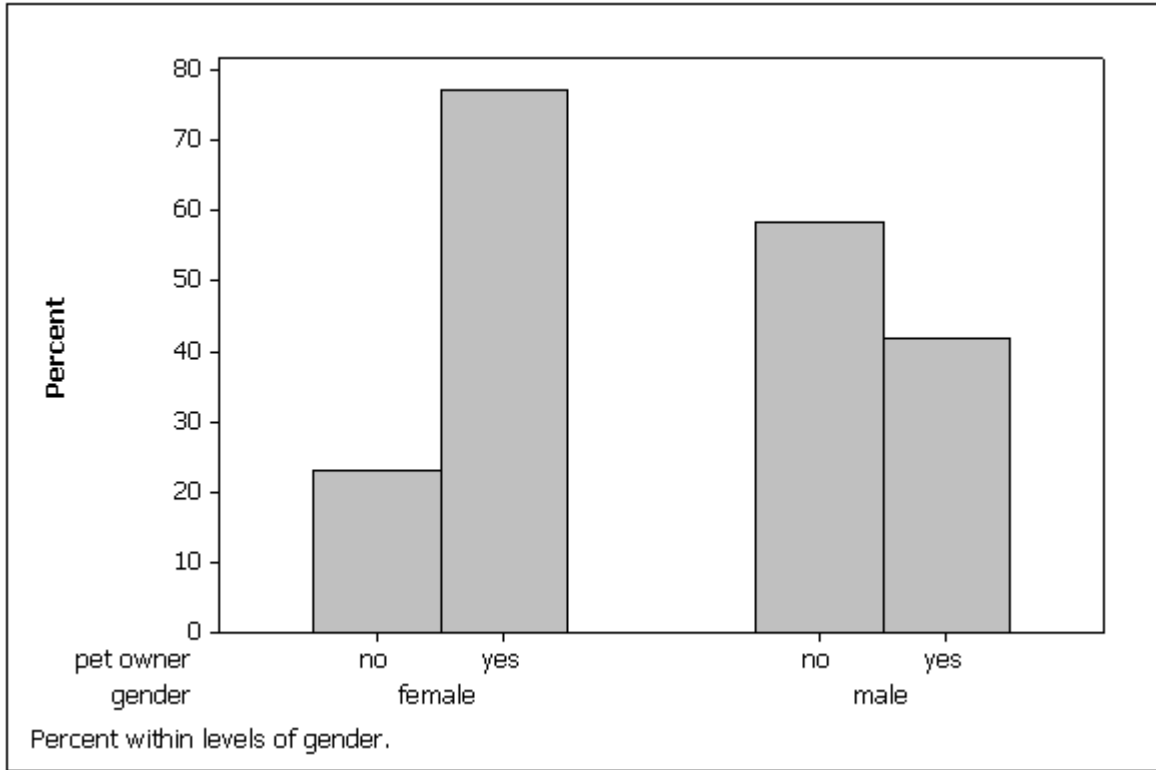




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- a. A higher percentage of males want a playoff system compared to females.
- b. More males than females are undecided on this issue.
- c. Gender and opinion on a playoff system are related.
- d. All of these choices are true.

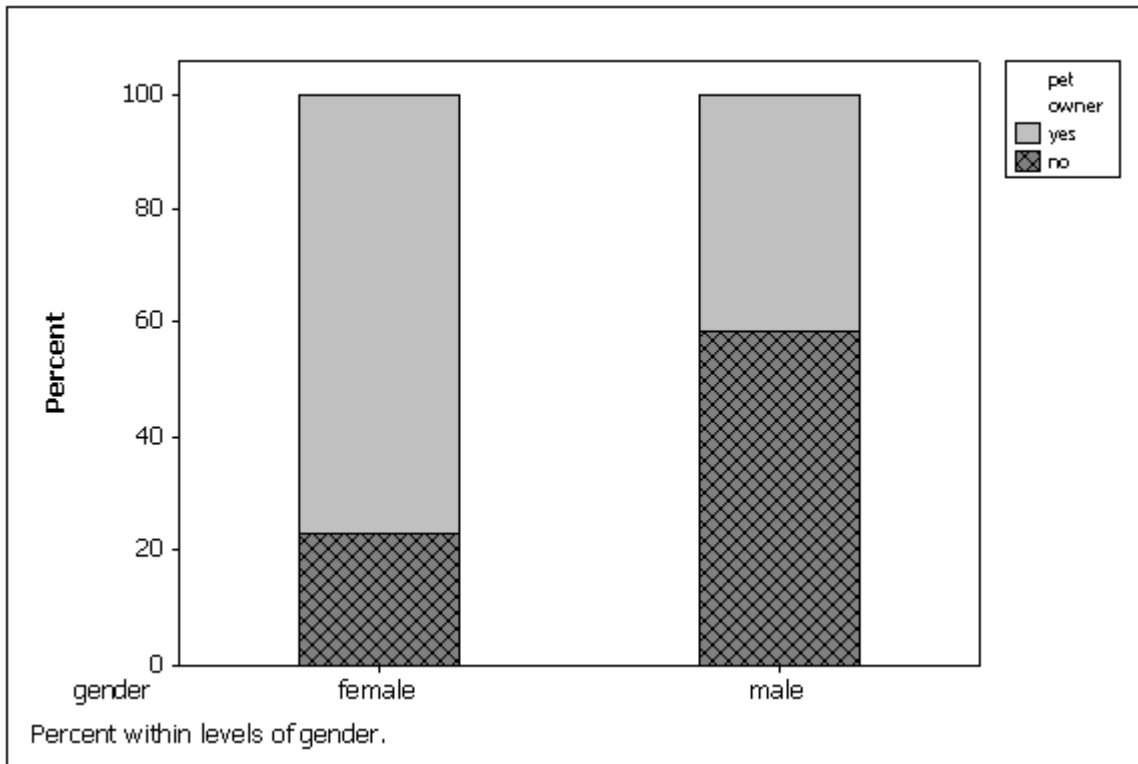
177. A survey of 100 adults was conducted to see if gender is related to pet ownership. The results are summarized in the bar chart below. Which of the following statements describes the relationship?



- a. Pet ownership and gender are not related.
- b. More females own pets than don't own pets.
- c. Fewer males own pets than don't own pets.
- d. None of these choices.

178. The bar charts below summarize data collected on 100 adults regarding gender and pet ownership. Which of the following statements is (are) true based on this chart?

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- a. Gender and pet ownership are related; a higher percentage of males own pets than females.
- b. Gender and pet ownership are related; a higher percentage of females own pets than males.
- c. Gender and pet ownership are related; males and females own the same percentage of pets.
- d. Gender and pet ownership are not related.

**TRUE/FALSE**

- 179. A cross-classification table summarizes data from two nominal variables.
- 180. To describe the relationship between two nominal variables you make a scatter diagram and look for a correlation.
- 181. If two nominal variables are unrelated, the patterns exhibited in their corresponding bar charts should be approximately the same. If a relationship exists, then some bar charts will differ from others.
- 182. A cross-classification table is the same thing as two frequency distribution tables, one for each variable.
- 183. If the relative frequencies in the rows of a cross-classification table are similar, then the two variables shown in the table are not related.
- 184. If two nominal variables are unrelated, the patterns exhibited in their corresponding pie charts should be approximately the same. If a relationship exists, then some pie charts will differ from others.

185. The percentage of observations in each combination of the cross-classification table must be equal in order to show two nominal variables are not related.

186. In the following cross-classification table, gender and pet ownership are related.

	Own a pet	Don't own a pet
Females	60	30
Males	80	40

187. In the following cross-classification table, gender and fantasy baseball participation are related.

	Participate in Fantasy Baseball	Don't participate in Fantasy Baseball
Males	70	30
Females	30	70

188. A statistics professor classifies his students according to their grade point average (GPA) and their gender. The resulting cross-classification table is shown below.

	<i>GPA</i>		
<i>Gender</i>	Under 2.0	2.0 – 3.0	Over 3.0
Male	5	25	10
Female	10	20	30

If you made a pie chart for male GPAs and a pie chart for female GPAs, those pie charts would look the same.

**COMPLETION**

189. To evaluate two nominal variables at the same time, a(n) \_\_\_\_\_ table should be created from the data.

ANS:  
 cross-classification  
 cross-tabulation  
 contingency

190. Data that contains information on two variables is called \_\_\_\_\_ data.

191. A cross-classification table is used to describe the relationship between two \_\_\_\_\_ variables.



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192. Data that contains information on a single variable is called \_\_\_\_\_ data.

ANS: univariate

193. You can graph the relationship between two nominal variables using two \_\_\_\_\_ or two \_\_\_\_\_.

ANS:

bar charts; pie charts

pie charts; bar charts

194. If two pie charts made from the rows of a cross-classification table look the same, then the two nominal variables \_\_\_\_\_ (are/are not) related.

ANS: are not

195. If two bar charts made from the rows of a cross-classification table look the same, then the two nominal variables \_\_\_\_\_ (are/are not) related.

ANS: are not

PTS: 1

REF: SECTION 2.5

**SHORT ANSWER**

**All-Nighters**

A sample of 200 students at a certain university was taken after the midterm; one hundred students reported staying up all night before the midterm and the other one hundred students did not. Researchers recorded whether each student did well or poorly on the midterm. The following table contains the results.

	Did Well on Midterm	Did Poorly on Midterm
Stayed up all night	30	70
Did not stay up all night	60	40

196. {All-Nighter Narrative} Of those who stayed up all night before the midterm, what percentage did well on the midterm?

ANS:  
 $30/100 = 30\%$

197. {All-Nighters Narrative} Of those who did well on the midterm, what percentage stayed up all night before the midterm?

ANS:  
 $30/90 = 33.3\%$

198. {All-Nighters Narrative} Briefly explain (using percentages) whether staying up all night before this midterm is related to a student doing poorly.

ANS:  
 Yes, they are related. Of those staying up all night,  $70/100 = 70\%$  did poorly. Of those who didn't stay up all night,  $40/100 = 40\%$  did poorly. Staying up all night before this midterm is associated with lower performance.

199. {All-Nighters Narrative} There is a relationship between whether or not a student stayed up all night before the midterm, and how well they did on the midterm. Describe this relationship using percentages.

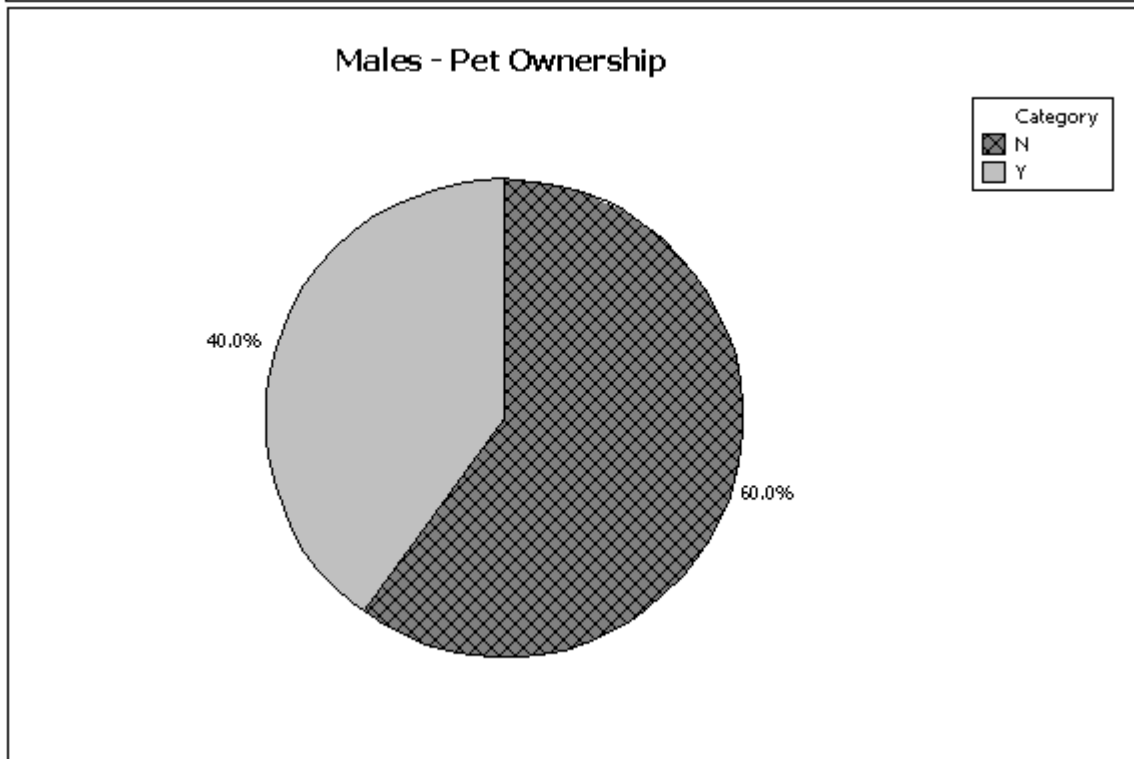
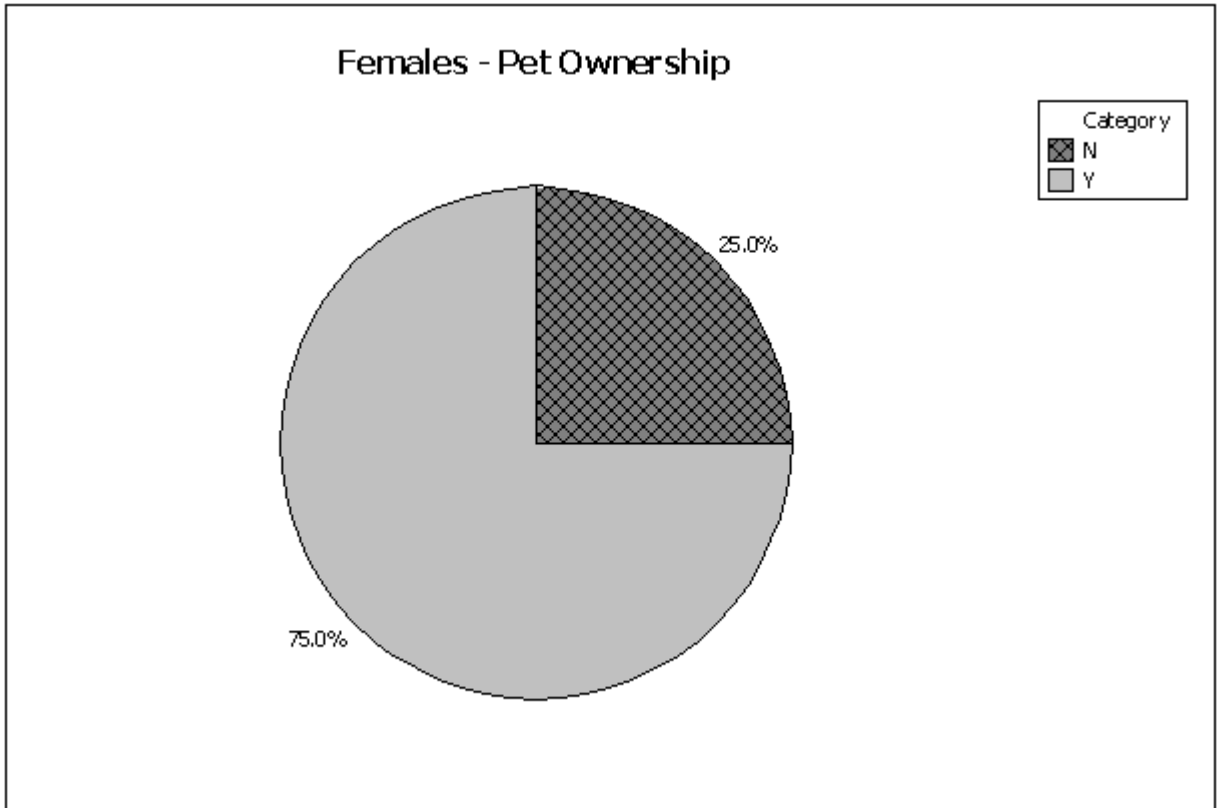
ANS:  
 Of those who stayed up all night,  $30/100 = 30\%$  did well and  $70\%$  did not. Of those who didn't stay up all night,  $60/100 = 60\%$  did well and  $40\%$  did not.

200. Using the following cross-classification table, draw two pie charts that compare pet ownership for males vs. females. Are gender and pet ownership related?

	Own a pet	Don't own a pet
Females	75	25
Males	40	60

ANS:

The pie charts below show gender and pet ownership are related. More females own pets than males (75% vs. 40%).

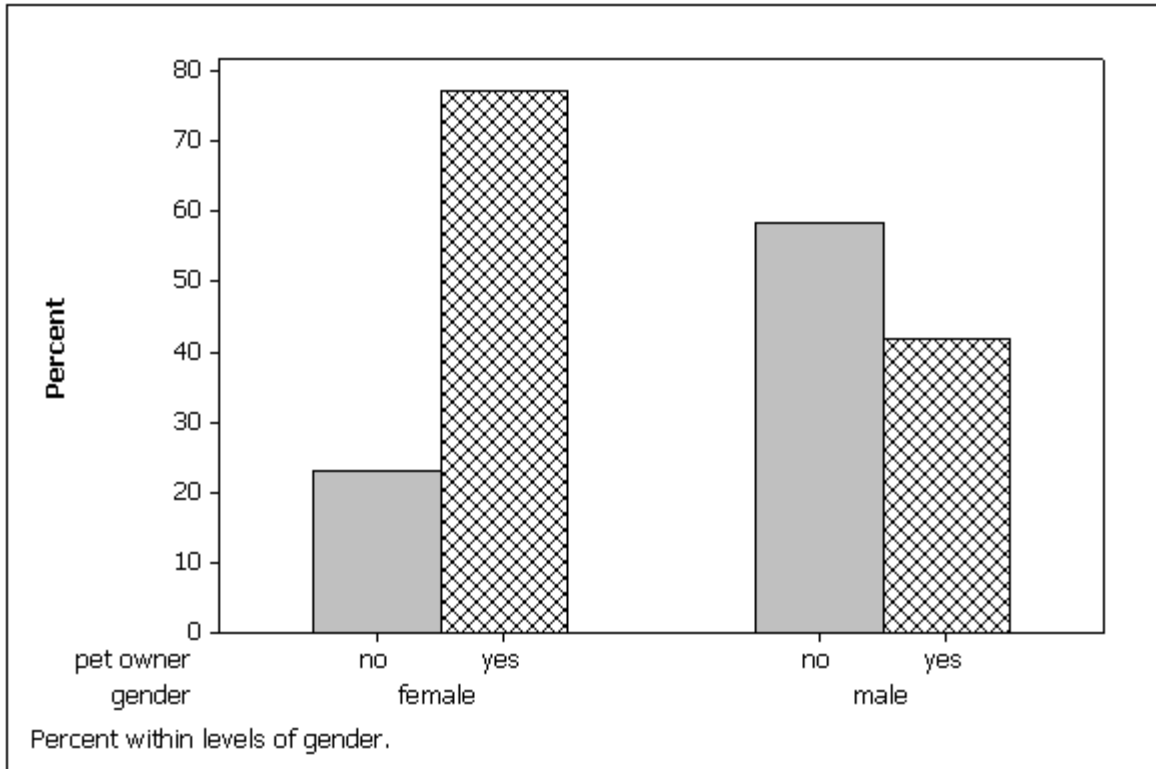


201. Using the following cross-classification table, draw two bar charts that compare pet ownership for males vs. females. Are gender and pet ownership related?

	Own a pet	Don't own a pet
Females	75	25
Males	40	60

ANS:

The first "side-by-side" bar chart below shows gender and pet ownership are related. More females own pets than males (75% vs. 40%.) Note the bar charts could be stacked also, and show the same results; see the second "stacked" bar chart below.



OR

**MULTIPLE CHOICE**

- 202. The relationship between two interval variables is graphically displayed by a
  - a. scatter diagram
  - b. histogram
  - c. bar chart
  - d. pie chart
  
- 203. In order to draw a scatter diagram, we need interval data for
  - a. one variable
  - b. two variables
  - c. three variables

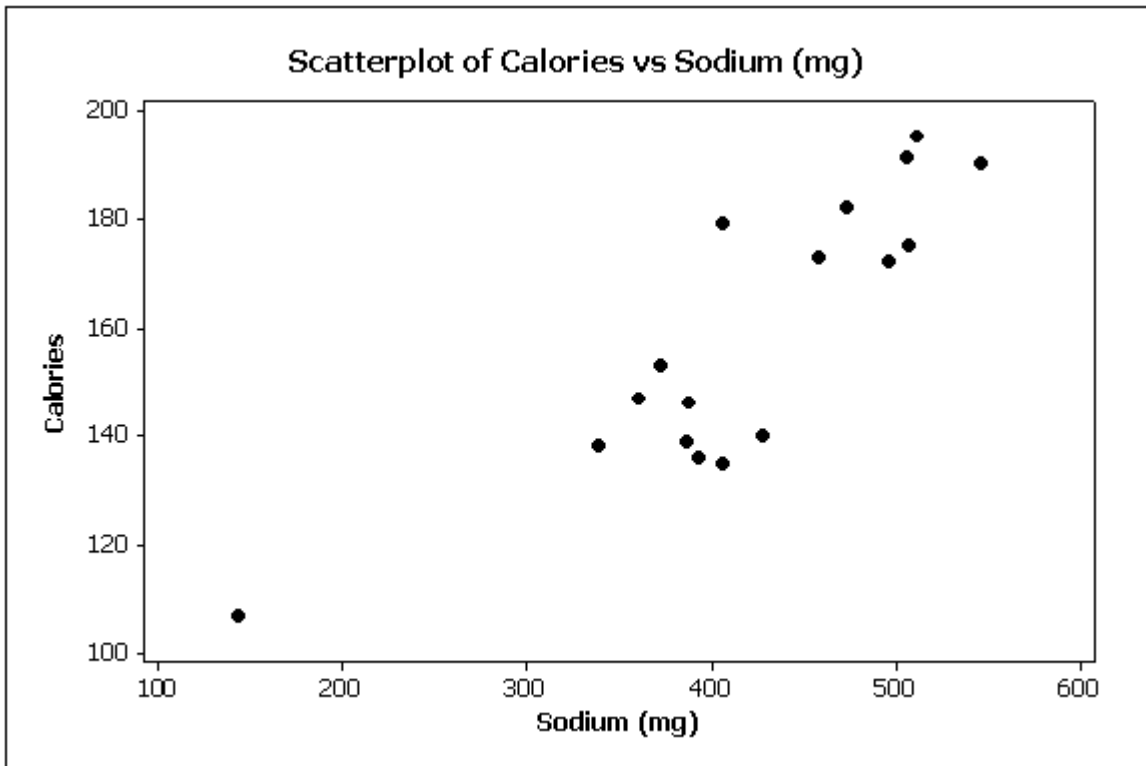
- d. four variables
204. Which of the following statements is false?
- a. You can examine the relationship between two nominal variables using a cross-classification table.
  - b. You can only apply statistical techniques to one variable at a time.
  - c. You can examine the relationship between two interval variables using a scatter diagram.
  - d. None of these choices.
205. How do you determine whether two interval variables have a positive linear relationship?
- a. Most of the points fall close to a straight line with positive slope.
  - b. As the  $X$  variable increases, the  $Y$  variable increases in a linear way.
  - c. The scatter diagram shows a linear pattern that is going uphill.
  - d. All of these choices are true.
206. If the data in a scatter diagram is scattered completely at random, what do you conclude?
- a. There is no linear relationship between  $X$  and  $Y$ .
  - b. There is a strong linear relationship between  $X$  and  $Y$ .
  - c. There is a strong linear relationship between  $X$  and  $Y$  that is described by a horizontal (flat) line.
  - d. None of these choices.

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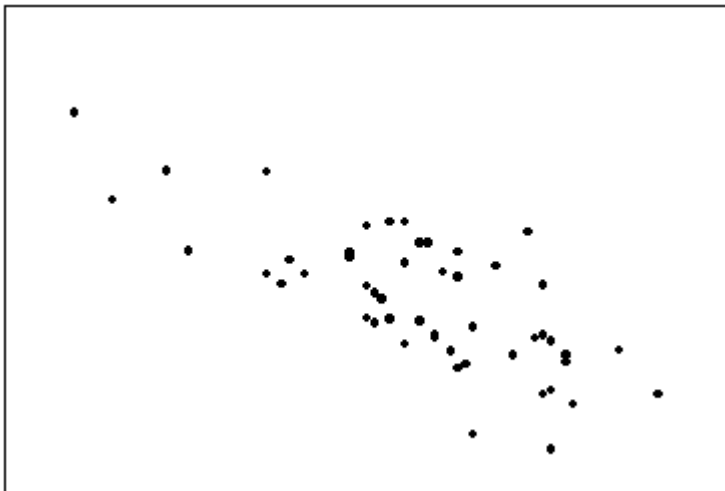
207. Which of the following is the method statisticians use to draw the best fitting straight line through the data on a scatter diagram?
- The fit best method.
  - The least squares method.
  - The point-intercept method.
  - None of these choices.
208. Which of the following describes a positive linear relationship between  $X$  and  $Y$ ?
- As the  $X$  values increase, the  $Y$  values increase in a linear manner.
  - As the  $X$  values decrease, the  $Y$  values decrease in a linear manner.
  - The  $X$  and  $Y$  values move uphill together in a linear manner.
  - All of these choices are true.
209. When two variables tend to move in opposite directions, yet still form a linear pattern, how do you describe their relationship?
- A positive linear relationship.
  - A negative linear relationship.
  - A proportional inverse relationship.
  - None of these choices.

**TRUE/FALSE**

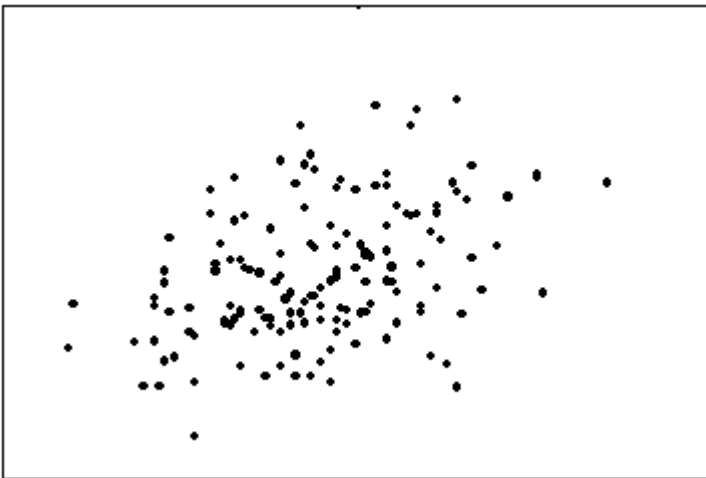
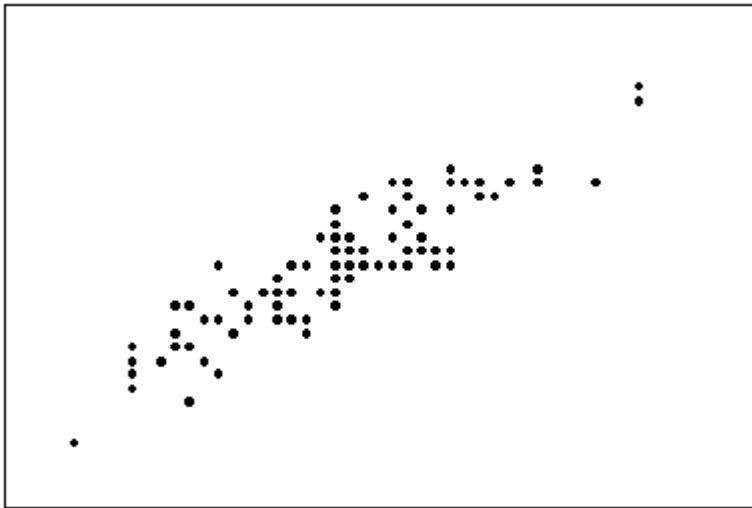
210. The graphical technique used to describe the relationship between two interval variables is the scatter diagram.
211. The two most important characteristics revealed by the scatter diagram are the strength and direction of the linear relationship.
212. If we draw a straight line through the points in a scatter diagram and most of the points fall close to the line, there must be a positive relationship between the two variables.
213. When two variables are linearly related, and tend to move in opposite directions, we describe the nature of their association as a negative linear relationship.
214. Data for calories and salt content (milligrams of sodium) in 17 brands of meat hot dogs are shown in the scatter diagram below. According to this diagram, it appears that hot dogs that are high in sodium are generally low in calories, and hot dogs with low sodium are generally high in calories.



215. The two most important characteristics to examine in a scatter diagram are the number of possible categories for  $X$  and  $Y$  and the number of observations in each category.
216. The scatter diagram below depicts data with a negative linear relationship.

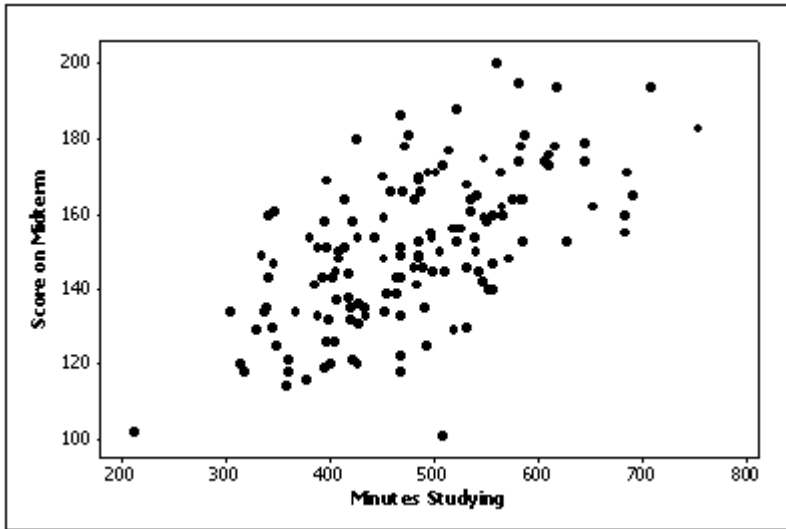


217. The first scatter diagram below shows a stronger linear relationship than the second scatter diagram. (Assume the scales on both scatter diagrams are the same.)



218. If two variables have a strong linear relationship, that means one variable is *causing* the other variable to go up or down.
219. Correlation implies causation.
220. A professor examines the relationship between minutes studying and exam score (out of 200 points) for a random sample of his students. The scatter diagram is shown below. It appears that study time has somewhat of a positive linear relationship with exam score.





**COMPLETION**

221. In applications involving two variables,  $X$  and  $Y$ , where one variable depends to some degree on the other, we call  $Y$  the \_\_\_\_\_ variable.

ANS: dependent

222. In applications involving two variables,  $X$  and  $Y$ , where one variable depends to some degree on the other, we call  $X$  the \_\_\_\_\_ variable.

ANS: independent

223. A(n) \_\_\_\_\_ is a graphical display consisting of a set of points, each point representing one variable measured along the horizontal axis, and another variable measured along the vertical axis.

ANS: scatter diagram

224. If when one variable increases the other one also increases, we say that there is a(n) \_\_\_\_\_ relationship between these two variables.

ANS:  
positive  
uphill

225. When one variable increases and the other decreases, we say that there is a(n) \_\_\_\_\_ relationship between these two variables.

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226. An individual's income depends somewhat on their number of years of education. Accordingly, we identify income as the \_\_\_\_\_ variable, and years of education as the \_\_\_\_\_ variable.
227. One of the variables used to help predict unemployment rates is the rate of inflation. Accordingly, we identify rate of inflation as the \_\_\_\_\_ variable, and unemployment rate as the \_\_\_\_\_ variable.
228. The two most important characteristics to look for in a scatter diagram are the \_\_\_\_\_ and \_\_\_\_\_ of the linear relationship.

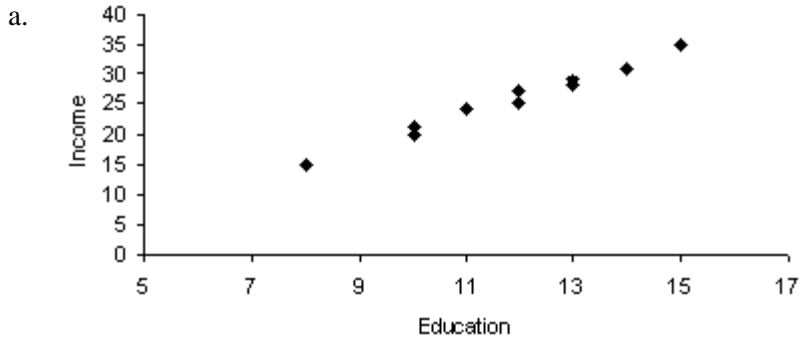
**SHORT ANSWER**

229. A professor of economics wants to study the relationship between income and education. A sample of 10 individuals is selected at random, and their income (in thousands of dollars) and education (in years) are shown below:

Education	12	14	10	11	13	8	10	15	13	12
Income	25	31	20	24	28	15	21	35	29	27

- a. Draw a scatter diagram for these data with the income on the vertical axis.  
b. Describe the relationship between income and education.

ANS:



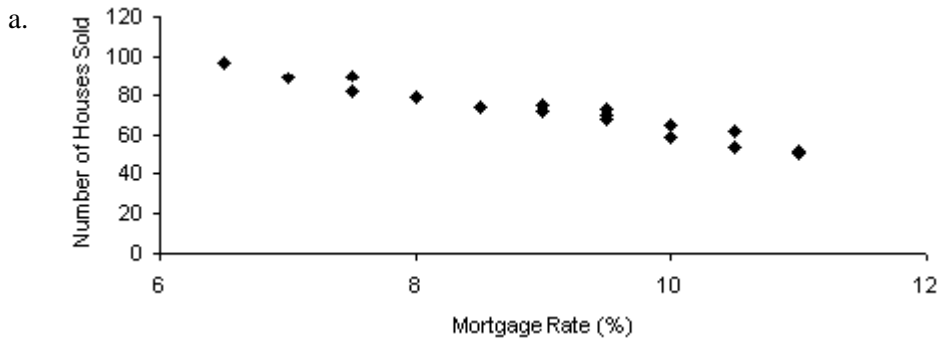
b. There is a very strong positive linear relationship between education and income; as years of education increase, income also increases in a linear manner.

230. The number of houses sold in Grand Rapids and the average monthly mortgage rates for 18 months randomly selected between January 1997 and April 1999 are shown in the following table.

Mortgage rate (%)	Number of houses sold	Mortgage rate (%)	Number of houses sold
7.5	90	9.5	68
9.0	72	6.5	97
7.0	89	8.0	79
10.5	62	9.0	75
10.0	58	10.5	53
9.5	70	9.5	73
8.5	74	11.0	50
10.0	65	7.5	82
11.0	51	8.5	70

a. Draw a scatter diagram with the number of houses sold on the vertical axis.  
 b. Describe the relationship between mortgage rate and number of houses sold.

ANS:



- b. There is a strong negative linear relationship between the mortgage rate and the number of houses sold. As the mortgage rate increases, the number of houses sold decreases, in a linear way.

231. Briefly explain the difference between correlation and causation in terms of a relationship between  $X$  and  $Y$ .

ANS:

If two variables are linearly related, it does not mean that one is causing the other to increase or decrease. It means a change in one variable is associated with a change in the other variable, in a linear way. Correlation implies association, not causation.

232. It is speculated that the number of police officers has a negative linear relationship with number of crimes. Explain why this might be so.

ANS:

As the number of police officers increases, number of crimes goes down. As the number of police officers decreases, the number of crimes goes up.

233. What are the two most important characteristics to look for in a scatter diagram?

ANS:

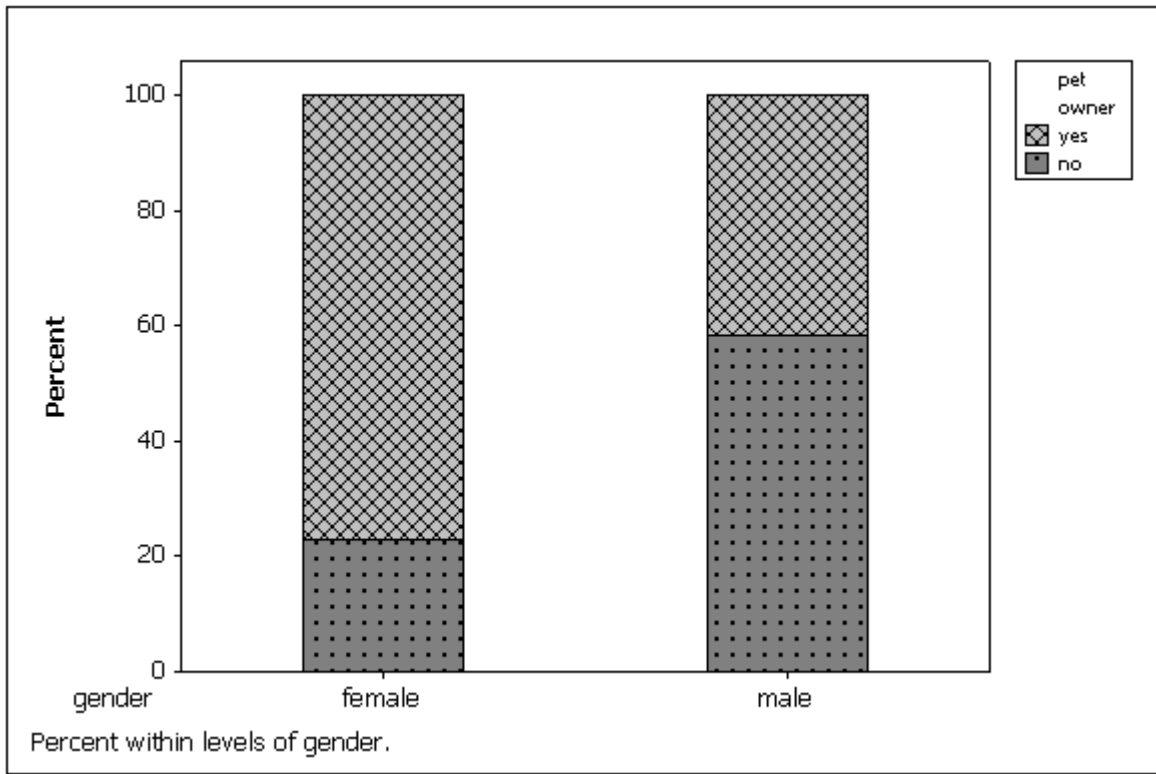
The strength and direction of the linear relationship between the two variables.

234. Can a scatter diagram be used to explore the relationship between two nominal variables? Explain why or why not.

ANS:

No; scatter diagrams plot points of  $X$  and  $Y$  when both variables are interval variables. You cannot talk about a nominal variable increasing or decreasing.

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PTS: 1

REF: SECTION 2.5