

Ch. 2 Summarizing Data: Listing and Grouping

2.1 Multiple Choice Questions

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

A sample of 18 tries to connect to an online service using a phone line.

Waiting time to connect to the Internet (sec.)	Frequency
25 – 29	3
30 – 34	4
35 – 39	5
40 – 44	3
45 – 49	2
50 – 55	1

- 1) The class boundaries of the second class are
 - A) 29.5–34.5
 - B) 30–34
 - C) 30–34.9
 - D) 29.9–34.9
- 2) The numbers 40 and 44 are examples of
 - A) class marks.
 - B) class boundaries.
 - C) class limits.
 - D) class intervals.
- 3) The numbers 27 and 47 are examples of
 - A) class marks.
 - B) class boundaries.
 - C) class limits.
 - D) class intervals.
- 4) If a cumulative "less than" distribution were constructed from the above frequency distribution, the cumulative frequency in the third row down would be
 - A) 1.
 - B) 9.
 - C) 6.
 - D) 7.
- 5) In a cumulative "less than" distribution, the classes are labeled using
 - A) class marks.
 - B) lower class limits.
 - C) upper class limits.
 - D) class boundaries.
- 6) In a cumulative "more than" distribution, the classes are labeled using
 - A) class marks.
 - B) lower class limits.
 - C) upper class limits.
 - D) class boundaries.
- 7) We can show the proportion of values falling into various class intervals by using a _____ distribution.
 - A) frequency
 - B) cumulative
 - C) quantitative
 - D) percentage
- 8) In order to present numerical categories of a variable with their corresponding frequencies, we use a _____ distribution.
 - A) cumulative
 - B) quantitative
 - C) qualitative
 - D) percentage
- 9) Which of the following would be a desirable property of a frequency distribution?
 - A) contains open end classes
 - B) contains more than 15 classes
 - C) contains exactly 4 classes
 - D) contains equal class intervals

10) Given the frequency distribution:

Scores	Frequency
20–29	8
30–59	18

For the histogram of this distribution, the height of the 30–59 interval should be ____.

A) 18

B) 9

C) 54

D) 6

2.2 Short Answer Questions

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Table 1

A sample of 80 company employees is grouped into a table based on their weekly salaries:

Salary	Freq.	class limits	class boundaries	class ranks	class intervals
100.00–149.99	15	100–149.99	99.995–149.995	124.995	50
150.00–199.99	10	150–199.99	149.995–199.995	174.995	50
200.00–249.99	30	200–249.99	199.995–249.995	224.995	50
250.00–299.99	25	250–299.99	249.995–299.995	274.995	50

- 1) From the data in Table 1, construct a percentage distribution.
- 2) From the data in Table 1, construct the cumulative "less than" distribution.
- 3) From the data in Table 1, construct a cumulative "greater than" distribution.
- 4) From the data in Table 1, construct a cumulative "or less" distribution.

Solve the problem.

- 5) Given the class marks 22, 30, 38, and 46, provide (i) class boundaries and (ii) class limits for this frequency distribution.
- 6) Given the class boundaries 30.95, 42.95, 54.95, 66.95, 78.95, provide (i) class limits and (ii) class marks for this frequency distribution.

The following are three daily pizza sales in units for a local pizza restaurant for the past two weeks:

228, 252, 310, 305, 165, 182, 312, 182, 171, 285, 307, 281, 234, 175

- 7) For this data, construct a stem-and-leaf display with the stem labels 1, 2, and 3 (and, hence, with two-digit leaves).
- 8) For this data, construct a stem-and-leaf display with one-digit leaves.

Solve the problem.

- 9) To group data on the number of potential buyers entering an automobile dealer's showroom for a given week, the sales manager uses the classes 25–49, 51–75, 75–99, 100–124, and 125–149. Explain what difficulties might arise.
- 10) In a graph of frequency distribution with classes 10–19, 20–29, 30–59, and 60–69, explain why a histogram of the data might be misleading if all the heights of the rectangles are equal to the class frequencies.
- 11) List the data which correspond to the following stem-and-leaf display.
3 | 6 2 5 7 2
- 12) List the data which correspond to the following stem-and-leaf display.
4 | 72 51 36 23 95
- 13) The Highway Patrol, using radar, checked the speeds (in mph) of 30 passing motorists at a checkpoint. The results are listed below. Construct a dot diagram for the data.
- 44 38 41 50 36 36 43 42 49 48
35 40 37 41 43 50 45 45 39 38
50 41 47 36 35 40 42 43 48 33
- 14) The heights (in inches) of 30 adult males are listed below. Construct a dot diagram for the data.
- 70 72 71 70 69 73 69 68 70 71
67 71 70 74 69 68 71 71 71 72
69 71 68 67 73 74 70 71 69 68
- 15) At a dairy products convention, an interviewer asked 40 persons to name their favorite dairy product. Their replies were ice cream, butter, cheese, butter, butter, milk, butter, sour cream, ice cream, cheese, butter, cheese, milk, cheese, butter, cheese, ice cream, butter, milk, butter, sour cream, ice cream, cheese, milk, butter, ice cream, cheese, butter, milk, sour cream, butter, cheese, milk, butter, cheese, milk, ice cream, sour cream, ice cream, and ice cream. Draw a bar chart with vertical bars for these categorical data.
- 16) In a software engineering class, the professor asked 48 students to name their favorite programming language. Their replies were Java, Perl, Perl, C++, Java, Lisp, Perl, Java, C++, Perl, Perl, Java, Smalltalk, Perl, Java, C++, Perl, Lisp, Perl, Perl, Java, Java, C++, Perl, Smalltalk, C++, Perl, Java, Lisp, Java, Perl, Perl, Perl, Smalltalk, C++, Java, Lisp, Perl, Java, Lisp, Java, Perl, Smalltalk, Java, Lisp, C++, Java, and Perl. Draw a bar chart with vertical bars for these categorical data.

- 17) A study was conducted to determine how people get jobs. Four hundred subjects were randomly selected and the results are listed below.

Job Sources of Survey Respondents	Frequency
Newspaper want ads	72
Online services	124
Executive search firms	69
Mailings	32
Networking	103

Construct a Pareto diagram in the form of a bar chart for the data. (Remember, in a Pareto diagram, the data is arranged in descending order.)

- 18) The heights (in inches) of 30 adult males are listed below. Construct a Pareto diagram in the form of a bar chart for the data. (Remember, in a Pareto diagram, the data is arranged in descending order.)

70 72 71 70 69 73 69 68 70 71
 67 71 70 74 69 68 71 71 71 72
 69 71 68 67 73 74 70 71 69 68

- 19) For the data below, construct a frequency histogram and a frequency polygon.

Height (in inches)	Frequency
50 – 52	5
53 – 55	8
56 – 58	12
59 – 61	13
62 – 64	11

- 20) For the data below, construct a frequency histogram and a frequency polygon.

Weight (in pounds)	Frequency
135 – 139	6
140 – 144	4
145 – 149	11
150 – 154	15
155 – 159	8

- 21) The grade point averages for 40 students are listed below. Construct a frequency histogram and a frequency polygon using eight classes.

2.0 3.2 1.8 2.9 0.9 4.0 3.3 2.9 3.6 0.8
 3.1 2.4 2.4 2.3 1.6 1.6 4.0 3.1 3.2 1.8
 2.2 2.2 1.7 0.5 3.6 3.4 1.9 2.0 3.0 1.1
 3.0 4.0 4.0 2.1 1.9 1.1 0.5 3.2 3.0 2.2

22) The heights (in inches) of 30 adult males are listed below. Construct a frequency histogram using five classes.

70 72 71 70 69 73 69 68 70 71
 67 71 70 74 69 68 71 71 71 72
 69 71 68 67 73 74 70 71 69 68

23) The heights (in inches) of 30 adult males are listed below. Construct a frequency polygon using five classes.

70 72 71 70 69 73 69 68 70 71
 67 71 70 74 69 68 71 71 71 72
 69 71 68 67 73 74 70 71 69 68

24) The Highway Patrol, using radar, checked the speeds (in mph) of 30 passing motorists at a checkpoint. The results are listed below. Construct a frequency histogram and a frequency polygon using six classes.

44 38 41 50 36 36 43 42 49 48
 35 40 37 41 43 50 45 45 39 38
 50 41 47 36 35 40 42 43 48 33

25) For the data below, construct an ogive.

Phone Calls (per day)	Frequency
8 – 11	18
12 – 15	23
16 – 19	38
20 – 23	47
24 – 27	32

26) For the data below, construct an ogive.

Height (in inches)	Frequency
50 – 52	5
53 – 55	8
56 – 58	12
59 – 61	13
62 – 64	11

27) For the data below, construct an ogive.

Weight (in pounds)	Frequency
135 – 139	6
140 – 144	4
145 – 149	11
150 – 154	15
155 – 159	8

28) For the data below, construct an ogive.

Miles (per day)	Frequency
1 - 2	9
3 - 4	22
5 - 6	28
7 - 8	15
9 - 10	4

29) A study was conducted to determine how people get jobs. Four hundred subjects were randomly selected and the results are listed below.

Job Sources of Survey Respondents	Frequency
Newspaper want ads	72
Online services	124
Executive search firms	69
Mailings	32
Networking	103

Construct a pie chart of the data.

30) The grade point averages for 40 students are listed below. Construct an ogive using eight classes.

2.0 3.2 1.8 2.9 0.9 4.0 3.3 2.9 3.6 0.8
 3.1 2.4 2.4 2.3 1.6 1.6 4.0 3.1 3.2 1.8
 2.2 2.2 1.7 0.5 3.6 3.4 1.9 2.0 3.0 1.1
 3.0 4.0 4.0 2.1 1.9 1.1 0.5 3.2 3.0 2.2

31) The heights (in inches) of 30 adult males are listed below. Construct a ogive using five classes.

70 72 71 70 69 73 69 68 70 71
 67 71 70 74 69 68 71 71 71 72
 69 71 68 67 73 74 70 71 69 68

32) The Highway Patrol, using radar, checked the speeds (in mph) of 30 passing motorists at a checkpoint. The results are listed below. Construct an ogive using six classes.

44 38 41 50 36 36 43 42 49 48
 35 40 37 41 43 50 45 45 39 38
 50 41 47 36 35 40 42 43 48 33

- 33) In a study of the growth of termite hills in the desert, an experiment was performed to determine how well the height of such hills can be determined from aerial photographs. Following are the heights of 36 termite hills (in centimeters) estimated from aerial photographs, x , and measured on the ground, y :

x	y	x	y	x	y
219	204	289	275	239	221
274	263	240	261	243	254
235	251	201	215	240	257
241	229	243	228	262	245
279	259	229	217	271	258
264	246	291	274	218	202
222	231	205	217	283	269
284	271	273	261	216	201
277	253	229	238	245	259
218	241	268	251	281	269
225	211	263	248	262	249
273	258	221	207	243	255

Produce a two-way frequency distribution with the classes 200–219, 220–239, 240–259, 260–279, and 280–299 for both variables.

- 34) Following are the numbers of minutes it took 27 students to memorize two lists of German adjectives, one in the morning and one in the late afternoon.

Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
20	27	11	18	24	29
14	20	17	23	21	23
19	24	19	27	14	17
17	19	12	16	17	19
25	29	21	29	19	24
14	21	14	17	16	19
11	16	24	26	12	17
16	21	16	19	19	22
15	23	11	19	20	27

Produce a two-way frequency table for these data using the classes 10–14, 15–19, 20–24, and 25–29 for the morning, and the classes 15–19, 20–24, and 25–29 for the afternoon.

2.3 True-False Questions

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 1) One of the advantages of frequency distributions is that we can find the exact highest value in the data.
- 2) The sum of the frequencies in a frequency distribution is equal to the number of elements in the sample.
- 3) An ogive of a cumulative "less than" distribution always decreases as we move from left to right.
- 4) For a frequency distribution, we can never find the total of all the original scores.
- 5) It is possible for the class boundaries of an interval to be the same as its class limits.

- 6) A frequency polygon is a line graph of a cumulative frequency distribution.
- 7) A stem-and-leaf display contains no more information than a frequency distribution.
- 8) A frequency distribution always has equal class intervals.
- 9) Frequency distributions are of two types: quantitative and qualitative.
- 10) If two consecutive class intervals of a frequency distribution are 60–67 and 68–75, the class boundaries of the second interval are 68.95–75.95.

2.4 Fill-in-the-Blank Questions

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 1) In constructing a frequency distribution from raw data, there will usually be between _____ and _____ classes.
- 2) The single number that best represents a given interval of a frequency distribution is called the _____ .
- 3) In a stem-and-leaf display, each digit to the right of the vertical line is called a _____ .
- 4) Pie charts are graphical representations of _____ distributions.
- 5) If categories of a distribution differ in kind rather than degree, the resulting table is called a _____ .
- 6) A bar chart of a frequency distribution is called a _____ .
- 7) A class mark is defined as the average of _____ .
- 8) A class interval can be defined as a _____ .
- 9) For an ogive, the horizontal axis should contain the class _____ .
- 10) A numerical distribution is the same as a _____ distribution.

Ch. 2 Summarizing Data: Listing and Grouping

Answer Key

2.1 Multiple Choice Questions

- 1) A
- 2) C
- 3) A
- 4) D
- 5) B
- 6) C
- 7) D
- 8) B
- 9) D
- 10) D

2.2 Short Answer Questions

1)

class limits	rel. frequencies
100-149.99	$\frac{15}{80} = 18.75\%$
150-199.99	$\frac{10}{80} = 12.5\%$
200-249.99	$\frac{30}{80} = 37.5\%$
250-299.99	$\frac{25}{80} = 31.25\%$

2)

less than	cum. f
100	0
150	15
200	25
250	55
300	80

3)

greater than	cum. f
99.99	80
149.99	65
199.99	55
249.99	25
299.99	0

4)

less than	cum. f
99.99	0
149.99	15
199.99	25
249.99	55
299.99	80

5)

class marks	class boundaries	class limits
22	18-26	18.5-25.5
30	26-34	26.5-33.5
38	34-42	34.5-41.5
46	42-50	42.5-49.5

6)

class boundaries	class limits	class marks
30.95–42.95	31.00–42.90	36.95
42.95–54.95	43.00–54.90	48.95
54.95–66.95	55.00–66.90	60.95
66.95–78.95	67.00–78.90	72.95

7)

1	65	71	75	82	82
2	28	34	52	81	85
3	05	07	10	12	

8)

16	5	
17	1	5
18	2	2
22	8	
23	4	
25	2	
28	1	5
30	5	7
31	0	2

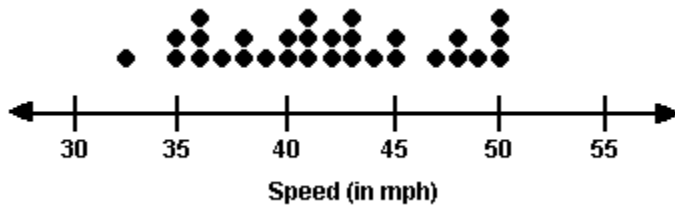
9) There is no place for 50, and 75 can go in either the second or third class.

10) It gives a misleading impression if we try to compare areas rather than the heights of rectangles. Since the third class has three times the width of the other classes, we can make areas represent the class frequencies by dividing the height of the third rectangle by 3.

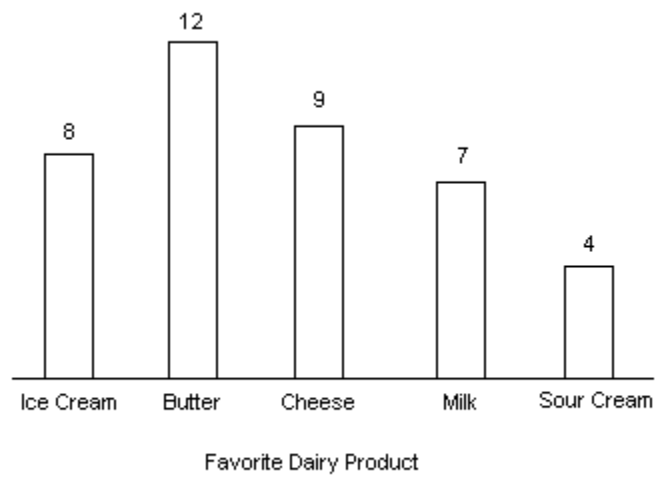
11) 36, 32, 35, 37, 32

12) 472, 451, 436, 423, 495

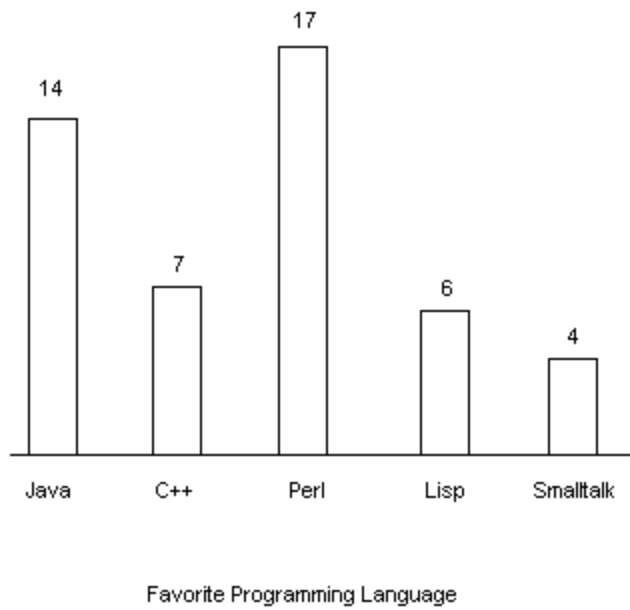
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14)

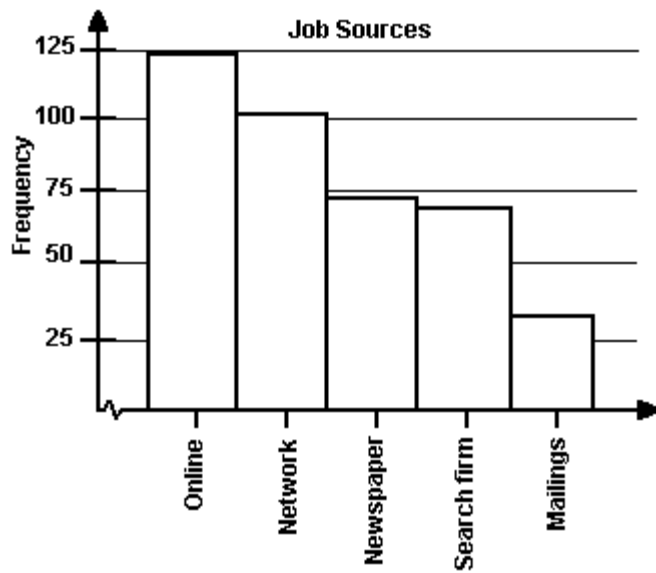


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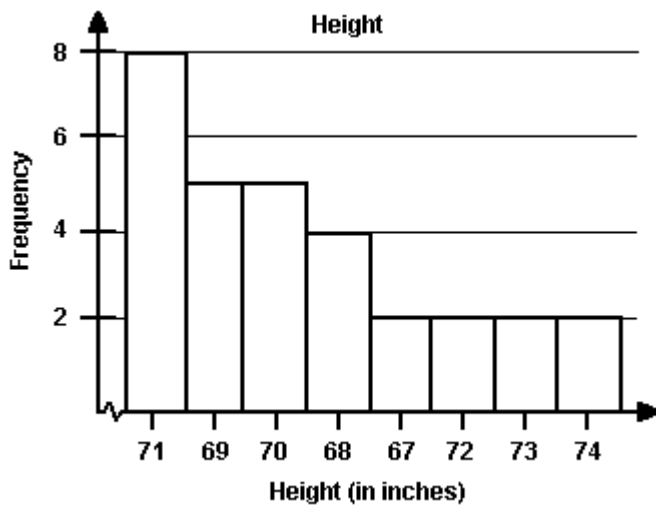


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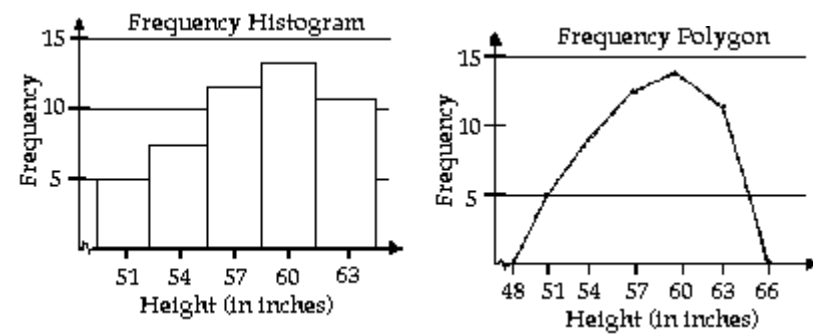
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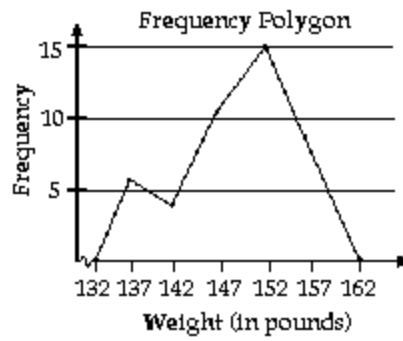
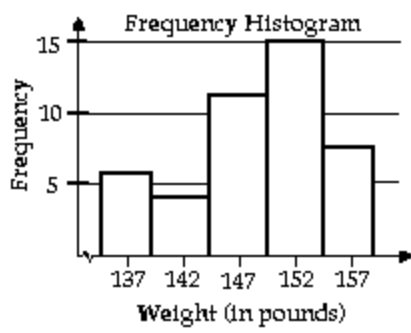
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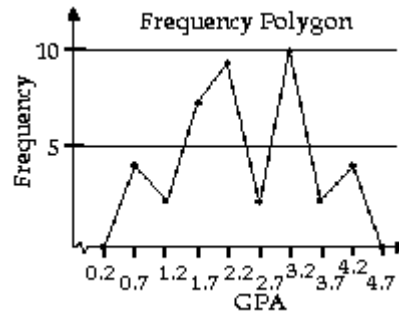
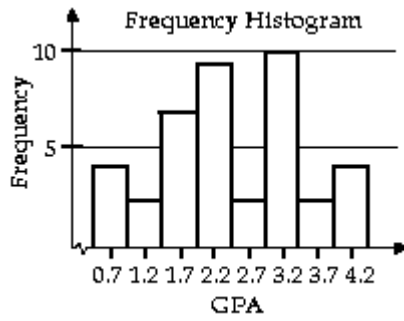
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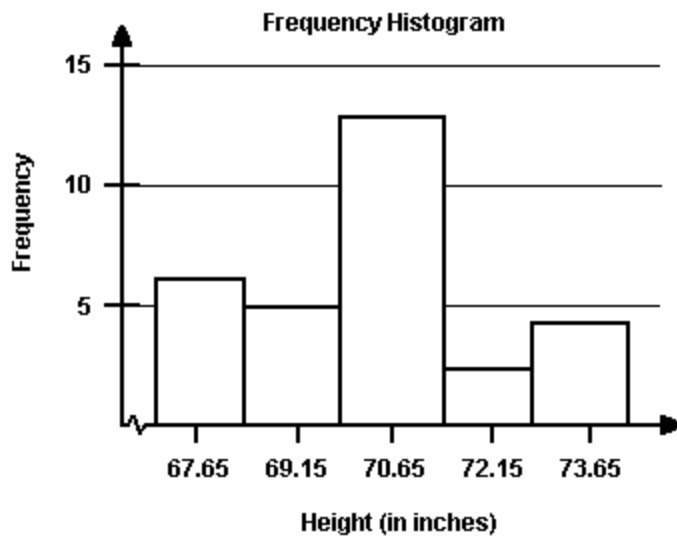
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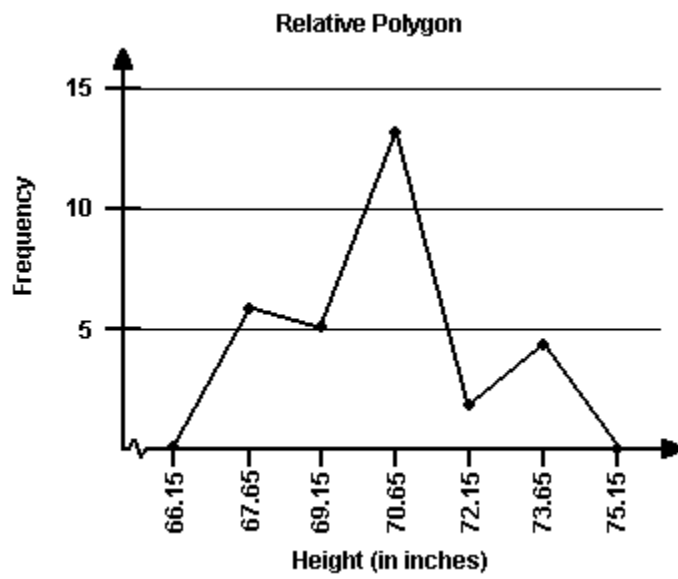
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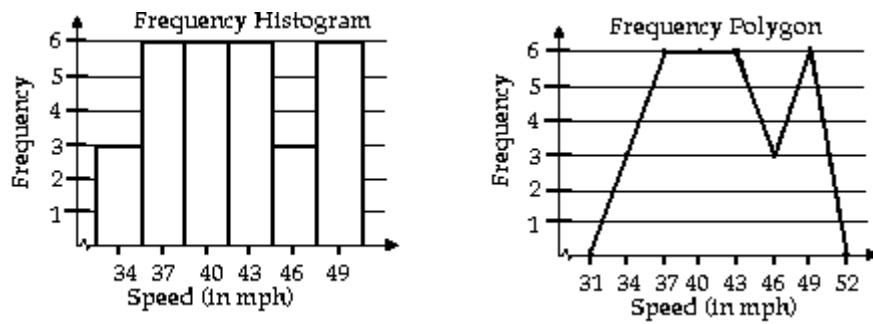
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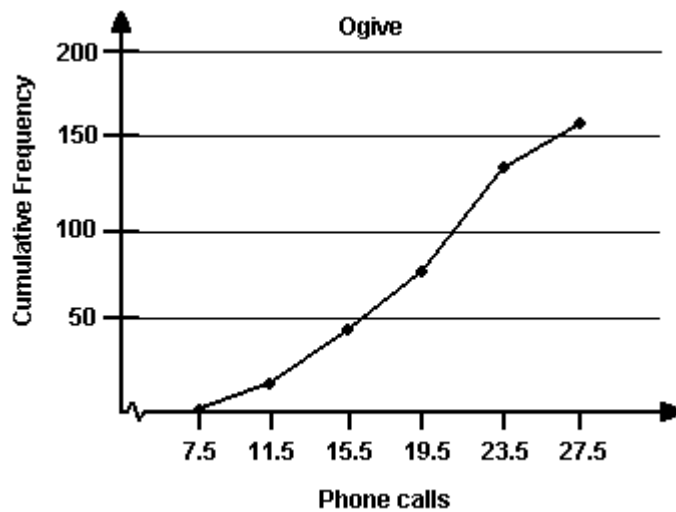
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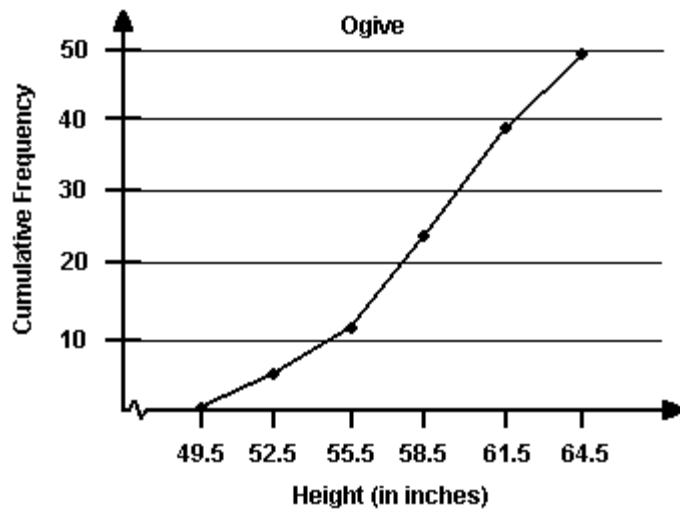
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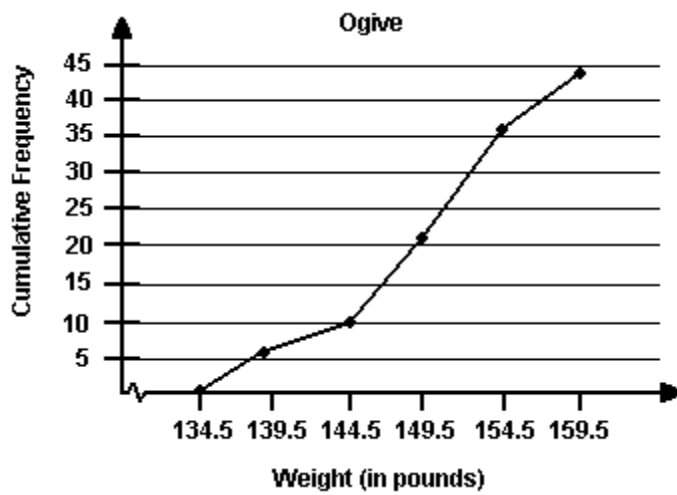
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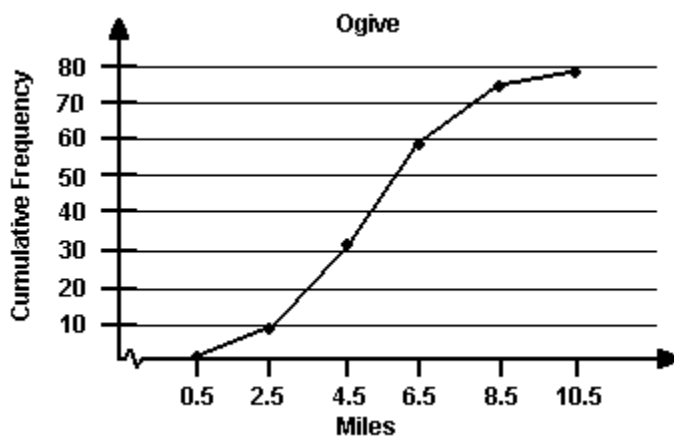
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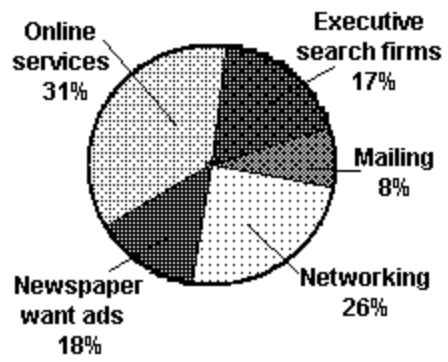
27)



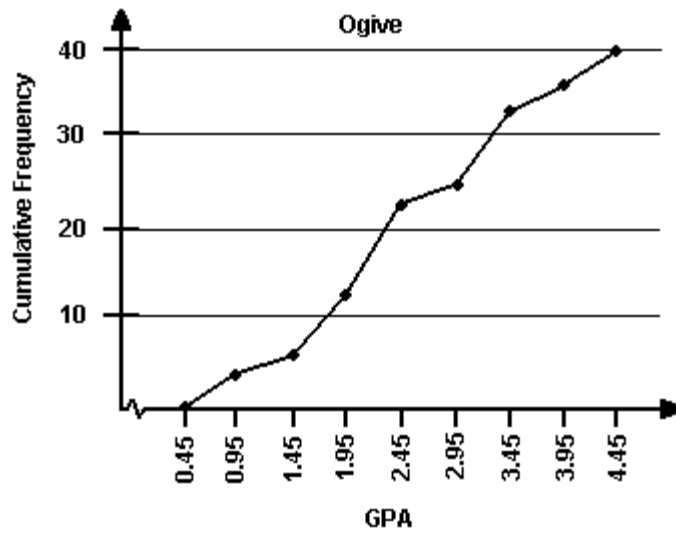
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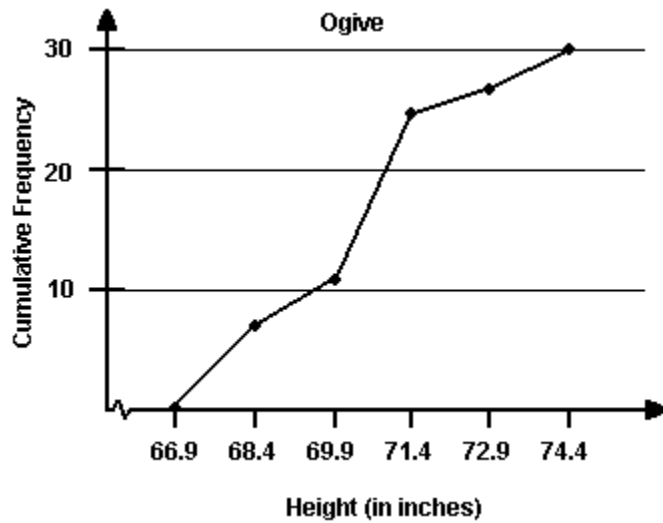
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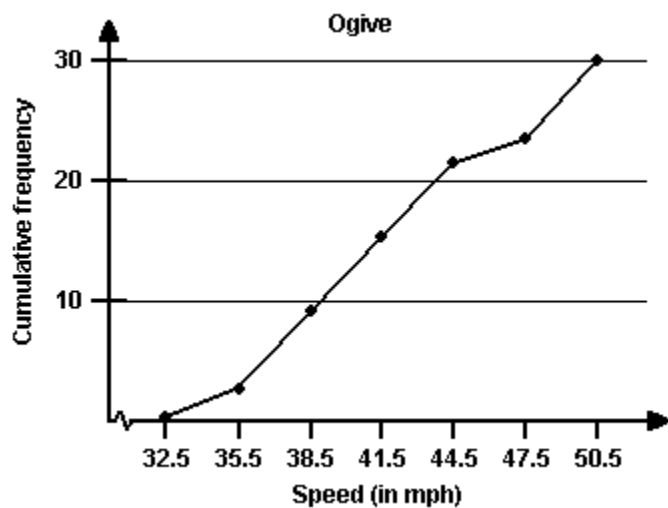
30)



31)



32)



		<i>x</i>				
		200-219	220-239	240-259	260-279	280-299
33)	200-219	5	3			
	220-239		3	2		
	240-259	1	1	4	9	
	260-279			1	2	5
	280-299					

		Morning			
		10-14	15-19	20-24	25-29
34)	Afternoon	15-19	7	4	
		20-24	2	6	1
		25-29		1	5

2.3 True-False Questions

- 1) FALSE
- 2) TRUE
- 3) FALSE
- 4) TRUE
- 5) FALSE
- 6) FALSE
- 7) FALSE
- 8) FALSE
- 9) TRUE
- 10) FALSE

2.4 Fill-in-the-Blank Questions

- 1) 5, 15
- 2) class mark
- 3) leaf
- 4) percentage
- 5) qualitative distribution
- 6) histogram
- 7) the lower and upper class limits
- 8) range of values of a class
- 9) boundaries
- 10) quantitative