

Describing Data: Frequency Tables, Frequency Distributions, and Graphic Presentation

Chapter 2

Learning Objectives

- LO2-1 Summarize qualitative variables with frequency and relative frequency tables
- LO2-2 Display a frequency table using a bar or pie chart
- LO2-3 Summarize quantitative variables with frequency and relative frequency distributions
- LO2-4 Display a frequency distribution using a histogram or frequency polygon

Constructing Frequency Tables

FREQUENCY TABLE A grouping of qualitative data into mutually exclusive and collectively exhaustive classes showing the number of observations in each class.

- ▶ Mutually exclusive means the data fit in just one class
- ▶ Collectively exhaustive means there is a class for each value

TABLE 2-1 Frequency Table for Vehicles Sold Last Month at Applewood Auto Group by Location

Location	Number of Cars
Kane	52
Olean	40
Sheffield	45
Tionesta	43
Total	<u>180</u>

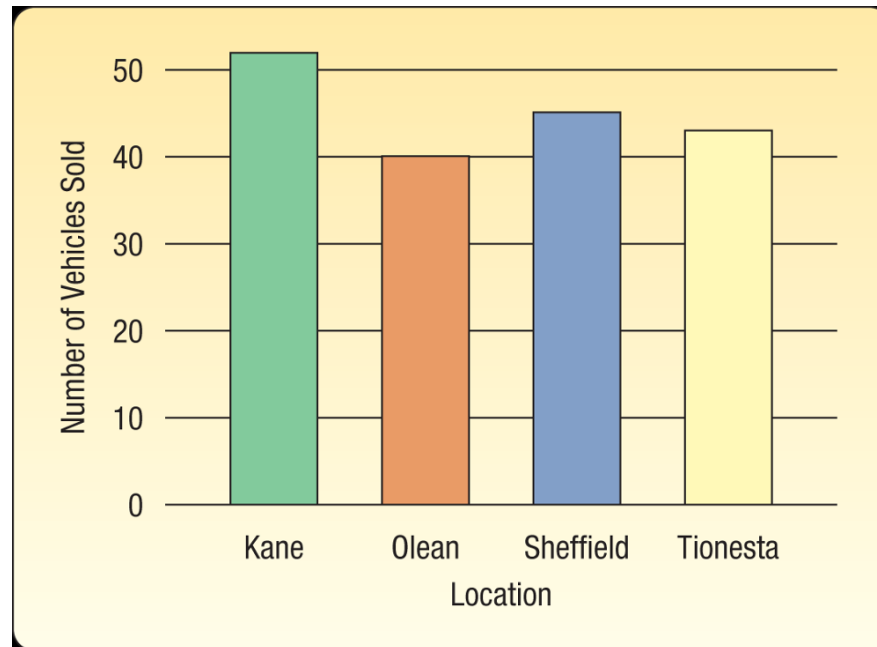
Constructing Frequency Tables

- ▶ To construct a frequency table
 - ▶ First sort the data into classes
 - ▶ Count the number in each class and report as the class frequency
- ▶ Convert each frequency to a relative frequency
 - ▶ Each of the class frequencies is divided by the total number of observations
 - ▶ Shows the fraction of the total number observations in each class

Graphic Presentation of Qualitative Data

BAR CHART A graph that shows the qualitative classes on the horizontal axis and the class frequencies on the vertical axis. The class frequencies are proportional to the heights of the bars.

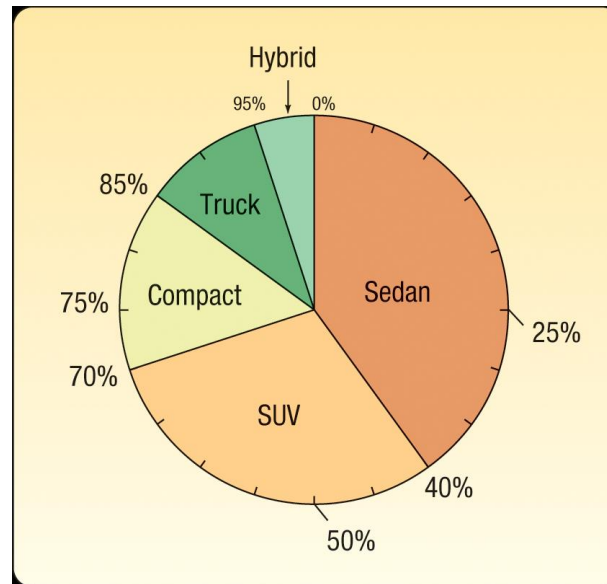
Use a bar chart when you wish to compare the number of observations for each class of a qualitative variable.



Graphic Presentation of Qualitative Data

PIE CHART A chart that shows the proportion or percentage that each class represents of the total number of frequencies.

Use a pie chart when you wish to compare relative differences in the percentage of observations for each class of a qualitative variable.



Constructing Frequency Distributions

FREQUENCY DISTRIBUTION A grouping of quantitative data into mutually exclusive and collectively exhaustive classes showing the number of observations in each class.

- ▶ This is a four-step process
 1. Decide on the number of classes
 2. Determine the class interval
 3. Set the individual class limits
 4. Tally the data into classes and determine the number of the observations in each class

Frequency Distributions

- ▶ Step 1 Decide on the number of classes
- ▶ Use the $2^k > n$ rule, where $n=180$
 - ▶ k is the number of classes
 - ▶ n is the number of values in the data set
 - ▶ $2^k > 180$, let $k = 8$
 - ▶ So use 8 classes

TABLE 2-4 Profit on Vehicles Sold Last Month by the Applewood Auto Group

								Maximum
\$1,387	\$2,148	\$2,201	\$ 963	\$ 820	\$2,230	\$3,043	\$2,584	\$2,370
1,754	2,207	996	1,298	1,266	2,341	1,059	2,666	2,637
1,817	2,252	2,813	1,410	1,741	3,292	1,674	2,991	1,426
1,040	1,428	323	1,553	1,772	1,108	1,807	934	2,944
1,273	1,889	352	1,648	1,932	1,295	2,056	2,063	2,147
1,529	1,166	482	2,071	2,350	1,344	2,236	2,083	1,973
3,082	1,320	1,144	2,116	2,422	1,906	2,928	2,856	2,502
1,951	2,265	1,485	1,500	2,446	1,952	1,269	2,989	783
2,692	1,323	1,509	1,549	369	2,070	1,717	910	1,538
1,206	1,760	1,638	2,348	978	2,454	1,797	1,536	2,339
1,342	1,919	1,961	2,498	1,238	1,606	1,955	1,957	2,700
443	2,357	2,127	294	1,818	1,680	2,199	2,240	2,222
754	2,866	2,430	1,115	1,824	1,827	2,482	2,695	2,597
1,621	732	1,704	1,124	1,907	1,915	2,701	1,325	2,742
870	1,464	1,876	1,532	1,938	2,084	3,210	2,250	1,837
1,174	1,626	2,010	1,688	1,940	2,639	377	2,279	2,842
1,412	1,762	2,165	1,822	2,197	842	1,220	2,626	2,434
1,809	1,915	2,231	1,897	2,646	1,963	1,401	1,501	1,640
2,415	2,119	2,389	2,445	1,461	2,059	2,175	1,752	1,821
1,546	1,766	335	2,886	1,731	2,338	1,118	2,058	2,487
								Minimum

Frequency Distributions

- ▶ Step 2 Determine the class interval, i
 - ▶ $i \geq (\text{highest value} - \text{lowest value})/k$
 - ▶ Round up to some convenient number

$$i \geq \frac{H - L}{k} = \frac{\$3,292 - \$294}{8} = \$374.75$$

- ▶ So decide to use an interval of \$400
- ▶ The interval is also referred to as the class width

Frequency Distributions

- ▶ **Step 3 Set the individual class limits**
 - ▶ Lower limits should be rounded to an easy to read number when possible

Classes
\$ 200 up to \$ 600
600 up to 1,000
1,000 up to 1,400
1,400 up to 1,800
1,800 up to 2,200
2,200 up to 2,600
2,600 up to 3,000
3,000 up to 3,400

Frequency Distributions

- ▶ Step 4 Tally the individual data into the classes and determine the number of observations in each class
 - ▶ The number of observations is the class frequency

Profit	Frequency
\$ 200 up to \$ 600	III
600 up to 1,000	I
1,000 up to 1,400	III
1,400 up to 1,800	III
1,800 up to 2,200	
2,200 up to 2,600	II
2,600 up to 3,000	
3,000 up to 3,400	

Profit	Frequency
\$ 200 up to \$ 600	8
600 up to 1,000	11
1,000 up to 1,400	23
1,400 up to 1,800	38
1,800 up to 2,200	45
2,200 up to 2,600	32
2,600 up to 3,000	19
3,000 up to 3,400	4
Total	<u>180</u>

Relative Frequency Distributions

- ▶ To find the relative frequencies, simply take the class frequency and divide by the total number of observations

TABLE 2-7 Relative Frequency Distribution of Profit for Vehicles Sold Last Month at Applewood Auto Group

Profit	Frequency	Relative Frequency	Found by
\$ 200 up to \$ 600	8	.044	8/180
600 up to 1,000	11	.061	11/180
1,000 up to 1,400	23	.128	23/180
1,400 up to 1,800	38	.211	38/180
1,800 up to 2,200	45	.250	45/180
2,200 up to 2,600	32	.178	32/180
2,600 up to 3,000	19	.106	19/180
3,000 up to 3,400	4	.022	4/180
Total	180	1.000	

Graphic Presentation of a Frequency Distribution

HISTOGRAM A graph in which the classes are marked on the horizontal axis and the class frequencies on the vertical axis. The class frequencies are represented by the heights of the bars, and the bars are drawn adjacent to each other.

- ▶ A histogram shows the shape of a distribution.
- ▶ Each class is depicted as a rectangle, with the height of the bar representing the number in each class.

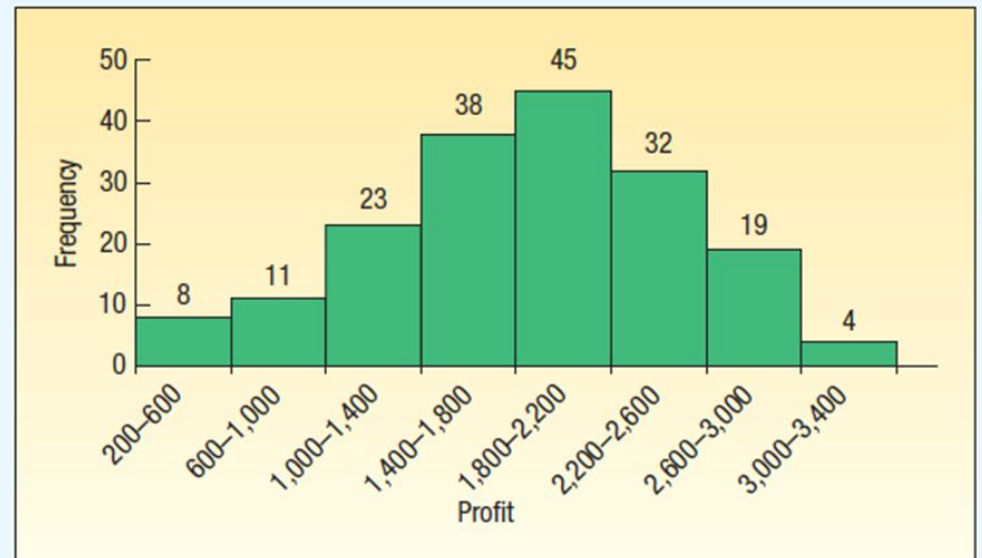
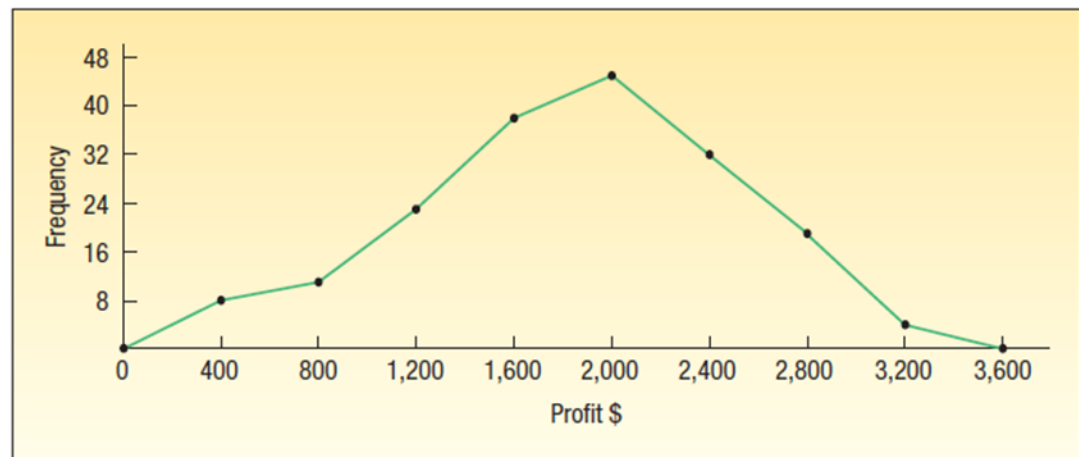


CHART 2-4 Histogram of the Profit on 180 Vehicles Sold at the Applewood Auto Group

Graphical Presentation of a Frequency Distribution

- ▶ A frequency polygon, similar to a histogram, also shows the shape of a distribution.
- ▶ These are good to use when comparing two or more distributions.

Profit	Midpoint	Frequency
\$ 200 up to \$ 600	\$ 400	8
600 up to 1,000	800	11
1,000 up to 1,400	1,200	23
1,400 up to 1,800	1,600	38
1,800 up to 2,200	2,000	45
2,200 up to 2,600	2,400	32
2,600 up to 3,000	2,800	19
3,000 up to 3,400	3,200	4
Total		180



Cumulative Frequency Distributions

Profit	Cumulative Frequency	Found by
Less than \$ 600	8	8
Less than 1,000	19	$8 + 11$
Less than 1,400	42	$8 + 11 + 23$
Less than 1,800	80	$8 + 11 + 23 + 38$
Less than 2,200	125	$8 + 11 + 23 + 38 + 45$
Less than 2,600	157	$8 + 11 + 23 + 38 + 45 + 32$
Less than 3,000	176	$8 + 11 + 23 + 38 + 45 + 32 + 19$
Less than 3,400	180	$8 + 11 + 23 + 38 + 45 + 32 + 19 + 4$

Cumulative Frequency Polygon

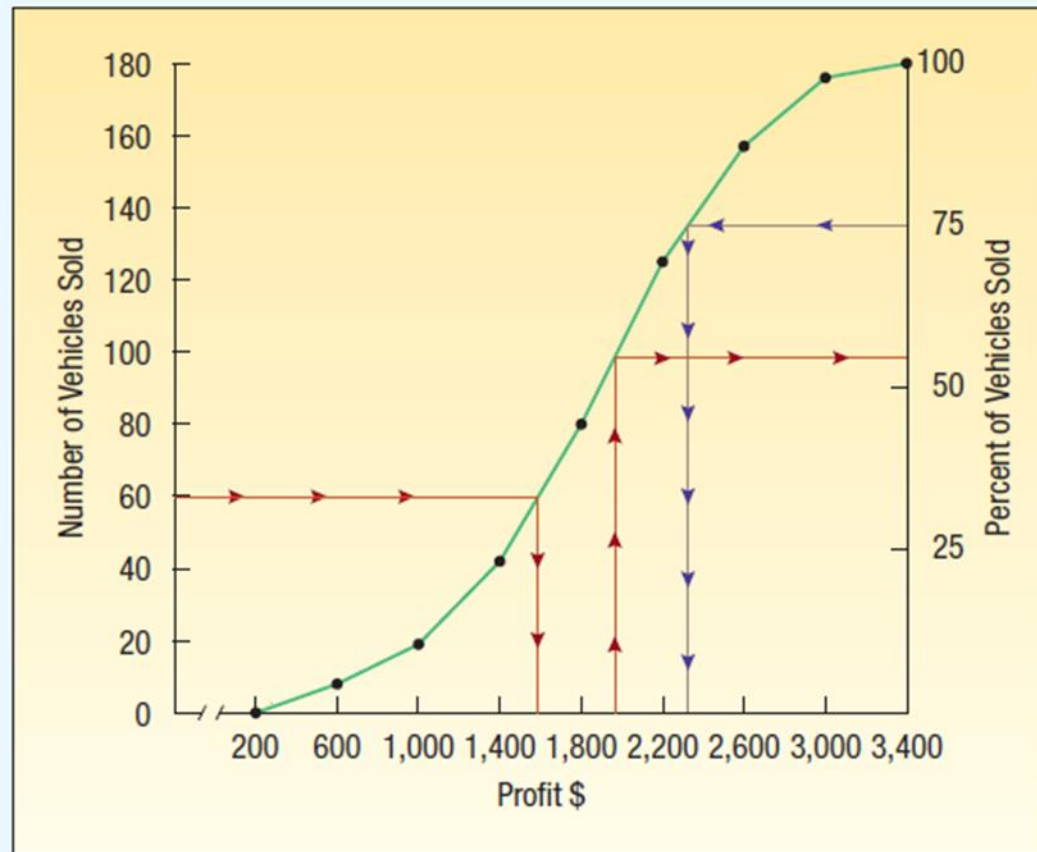


CHART 2-7 Cumulative Frequency Polygon for Profit on Vehicles Sold Last Month at Applewood Auto Group

Exercise 1

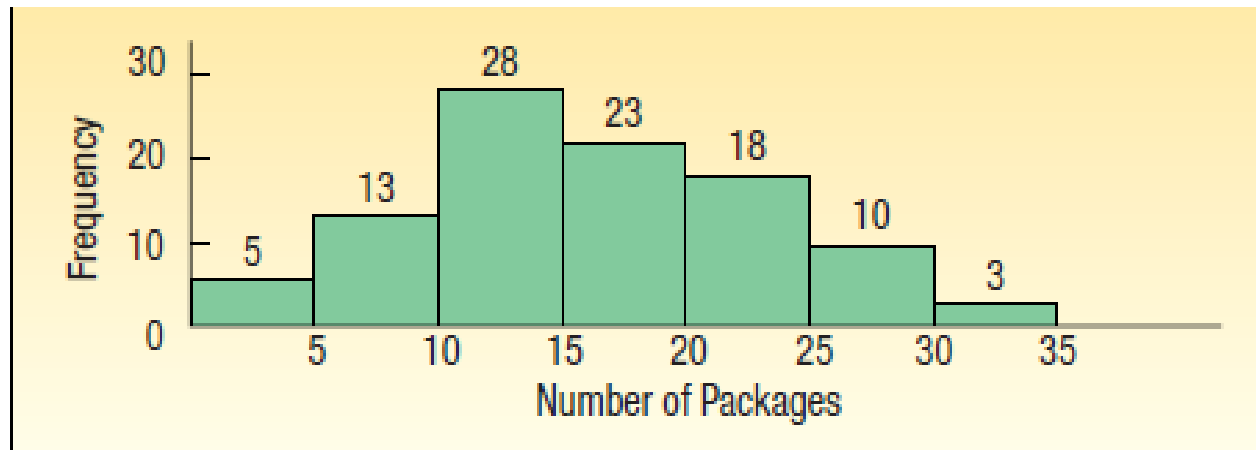
1. A pie chart shows the relative market share of cola products. The “slice” for Pepsi-Cola has a central angle of 90 degrees. What is its market share?
2. In a marketing study, 100 households were asked to select the best Program from the MTV, NewTV, LBC and FuturTV. To summarize the consumer responses with a frequency table, how many classes would the frequency table have?
3. Two thousand frequent travelers are asked which city they prefer: Beirut, New York, Paris, or Berlin. The results were 100 liked Beirut best, 450 liked New York, 1,300 liked Paris, and the remainder preferred Berlin. Develop a frequency table and a relative frequency table to summarize this information.

Exercise 2

4. A set of data consists of 38 observations. How many classes would you recommend for the frequency distribution?
5. A set of data consists of 45 observations between \$0 and \$29. What size would you recommend for the class interval?
6. A set of data consists of 230 observations between \$235 and \$567. What class interval would you recommend?
7. A set of data contains 53 observations. The lowest value is 42 and the largest is 129. The data are to be organized into a frequency distribution.
 - a. How many classes would you suggest?
 - b. What would you suggest as the lower limit of the first class

Exercise 3

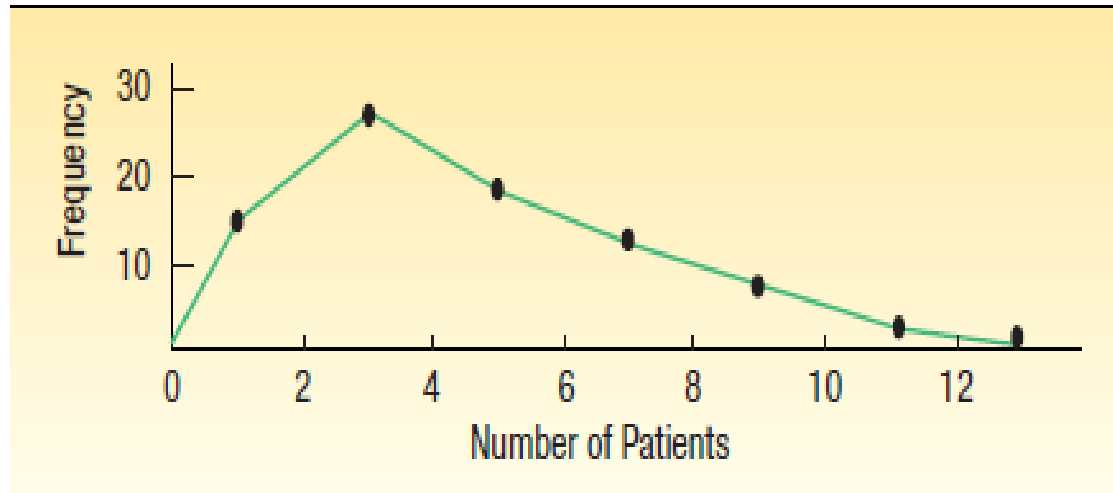
Molly's Candle Shop has several retail stores in the coastal areas of North and South Carolina. Many of Molly's customers ask her to ship their purchases. The following chart shows the number of packages shipped per day for the last 100 days.



- What is this chart called?
- What is the total number of frequencies?
- What is the class interval?
- What is the class frequency for the 10 up to 15 class?
- What is the relative frequency of the 10 up to 15 class?
- What is the midpoint of the 10 up to 15 class?
- On how many days were there 25 or more packages shipped?

Exercise 4

The following chart shows the number of patients admitted daily to Memorial Hospital through the emergency room.



- a. What is the midpoint of the 2 up to 4 class?
- b. How many days were 2 up to 4 patients admitted?
- c. Approximately how many days were studied?
- d. What is the class interval?
- e. What is this chart called?