SECTION 1.2

Graphical Methods of Describing Data

Objectives

- Create and interpret the basic types of graphs used to display data.
- Distinguish between the basic shapes of a distribution.

Data List

- A **data list** is an explicit listing of all the individual measurements, either as a display with space between the individual measurements, or in set notation with individual measurements separated by commas.

Example: The data obtained by measuring the age of 21 randomly selected students enrolled in freshman courses at a university could be presented as the data list

18 18 19 19 19 18 22 20 18 18 17 19 18 24 18 20 18 21 20 17 19

or in set notation as

{18,18,19,19,19,18,22,20,18,18,17,19,18,24,18,20,18,21,20,17,19}

Data Frequency Table

- A data frequency table, a table in which each distinct value x is listed in the first row and its frequency *f*, which is the number of times the value x appears in the data set, is listed below it in the second row.

The data set of the previous example is represented by the data frequency table:

x	**17**	**18**	**19**	**20**	**21**	**22**	**24**
f	2	8	5	3	1	1	1

Graphs

- Should be able to stand alone without the original data.
- Must have a title and labels for both axes.
- When appropriate, a legend, a source, and a date should be included.

Example: Creating a Stem-and-Leaf Plot

- Create a stem-and-leaf plot of the following ACT scores from a group of college freshmen.

ACT Scores				
18	23	24	31	19
27	26	22	32	18
35	27	29	24	20
18	17	21	25	26

ACT Scores

Stem	Leaves
1	8 9 8 8 7
2	3 4 7 6 2 7 9 4 0 1 5 6
3	1 2 5

Key: 1|8 = 18

ACT Scores

Stem	Leaves
1	7 8 8 8 9
2	0 1 2 3 4 4 5 6 6 7 7 9
3	1 2 5

Key: 1|8 = 18

A **stem-and-leaf plot** is a graph of quantitative data that visually displays the data.

Characteristics:

- A stem-and-leaf plot retains the original data.
- The leaves are usually the last digit in each data value and the stems are the remaining digits.
- A legend, sometimes called a **key**, should be included so that the reader can interpret the information.

Constructing a Stem-and-Leaf Plot

1. *Create two columns, one on the left for stems and one on the right for leaves.*

List each stem that occurs in the data set in numerical order. Each stem is normally listed only once; however, the stems are sometimes listed two or more times if splitting the leaves would make the data set's features clearer.

3. *List each leaf next to its stem*. Each leaf will be listed as many times as it occurs in the original data set. There should be as many leaves as there are data values. Be sure to line up the leaves in straight columns so that the table is visually accurate.

4. *Create a key to guide interpretation of the stem-and-leaf plot.*

5. *If desired, put the leaves in numerical order to create an* ***ordered stem-and-leaf plot***.

Example: Creating and Interpreting a Stem-and-Leaf Plot

Create a stem-and-leaf plot for the following starting salaries for entry-level accountants at public accounting firms. Use the stem-and-leaf plot that you create to answer the following questions.

Starting Salaries for Entry-Level Accountants				
$51,500	$48,300	$40,900	$40,700	$48,200
$45,500	$42,500	$44,200	$46,400	$48,600
$45,800	$46,300	$50,000	$50,700	$44,300
$43,000	$42,700	$49,000	$46,700	$43,200
$42,900	$46,500	$47,700	$48,000	$46,300
$44,500	$47,900	$45,300	$46,100	$45,000

a. What were the smallest and largest salaries recorded?
b. Which salary appears the most often?
c. How many salaries were in the range $41,000–$41,900?
d. In which salary range did the most salaries lie: $40,000–$44,900, $45,000–$49,900, or $50,000 and above?

Example: Creating and Interpreting a Stem-and-Leaf Plot (cont.)

Starting Salaries for Entry-Level Accountants

Stem	Leaves
40	7 9
41	
42	5 7 9
43	0 2
44	2 3 5
45	0 3 5 8
46	1 3 3 4 5 7
47	7 9
48	0 2 3 6
49	0
50	0 7
51	5

Key: 40 | 7 = $40,700

Histograms

A **frequency histogram**, shortened to histogram, is a bar graph of a frequency distribution of quantitative data.

A **relative frequency histogram** is a histogram in which the heights of the bars represent the relative frequencies of each class rather than simply the frequencies.

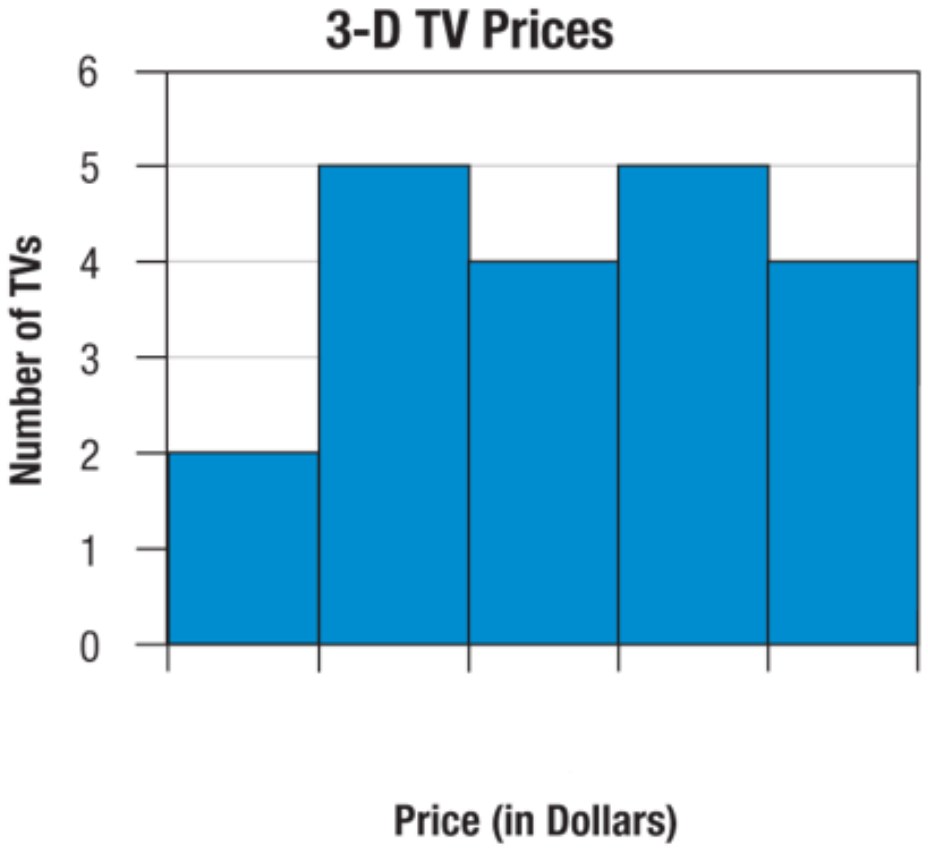
Characteristics of Histograms

- A bar graph of a frequency distribution.
- The horizontal axis is a real number line.
- The width of the bars represent the class width from the frequency table and should be uniform.
- The bars in a histogram should touch.
- The height of each bar represents the frequency of the class it represents.

Example: Constructing a Histogram

Construct a histogram of the 3-D TV prices from the previous section. The frequency distribution of the data is restated here.

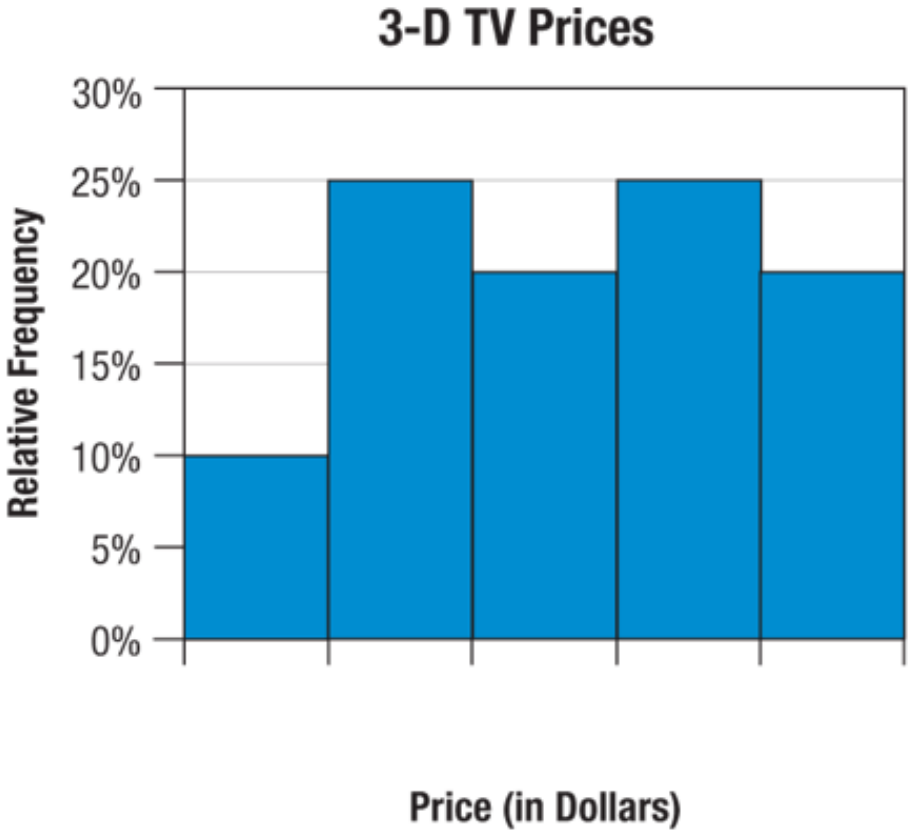
3-D TV Prices	
Class	**Frequency**
$1500 - $1599	2
$1600 - $1699	5
$1700 - $1799	4
$1800 - $1899	5
$1900 - $1999	4



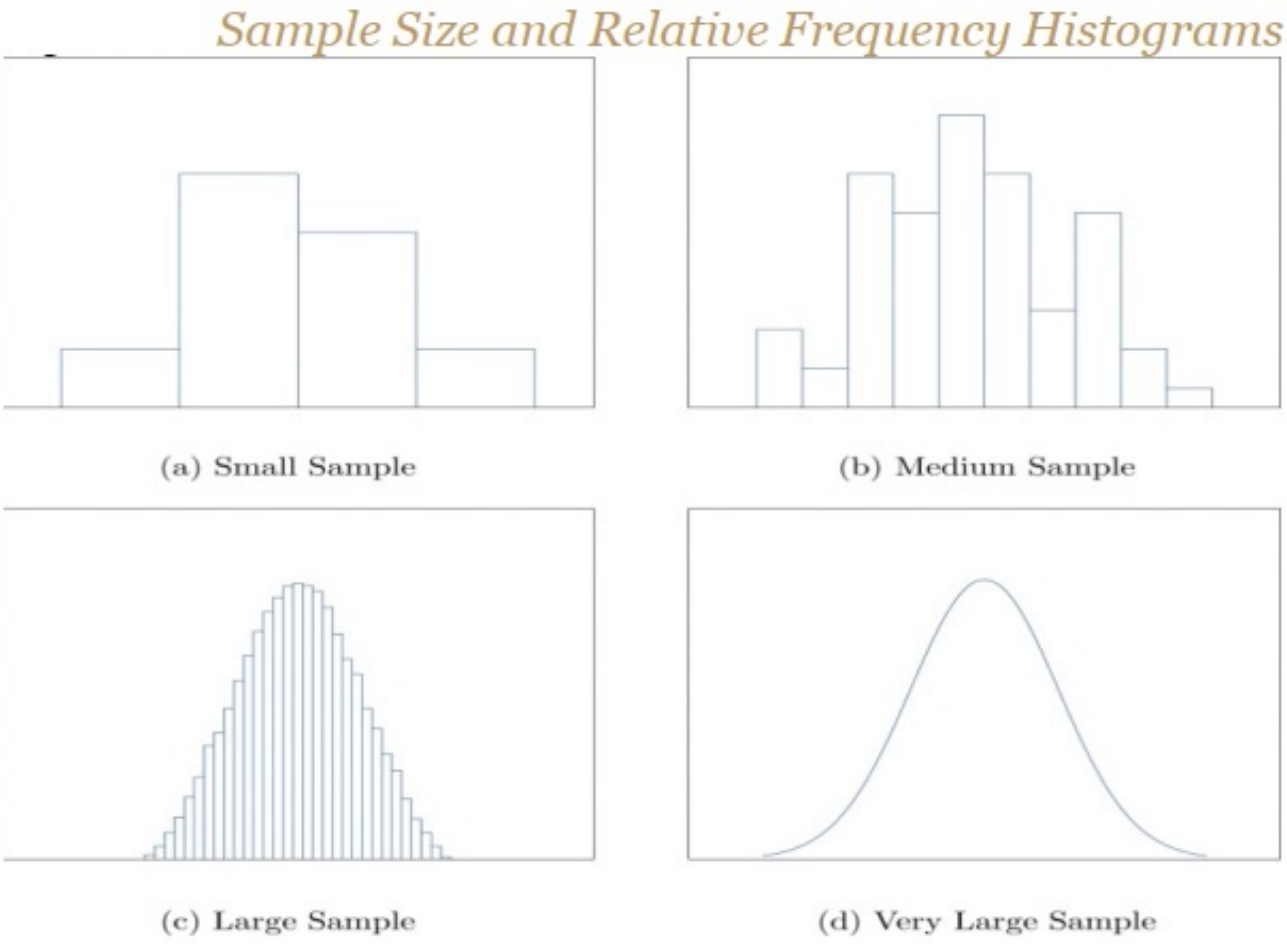
Example: Constructing a Relative Frequency Histogram

Construct a relative frequency histogram of the 3-D TV prices from the previous example. The frequency distribution of the data is reprinted here.

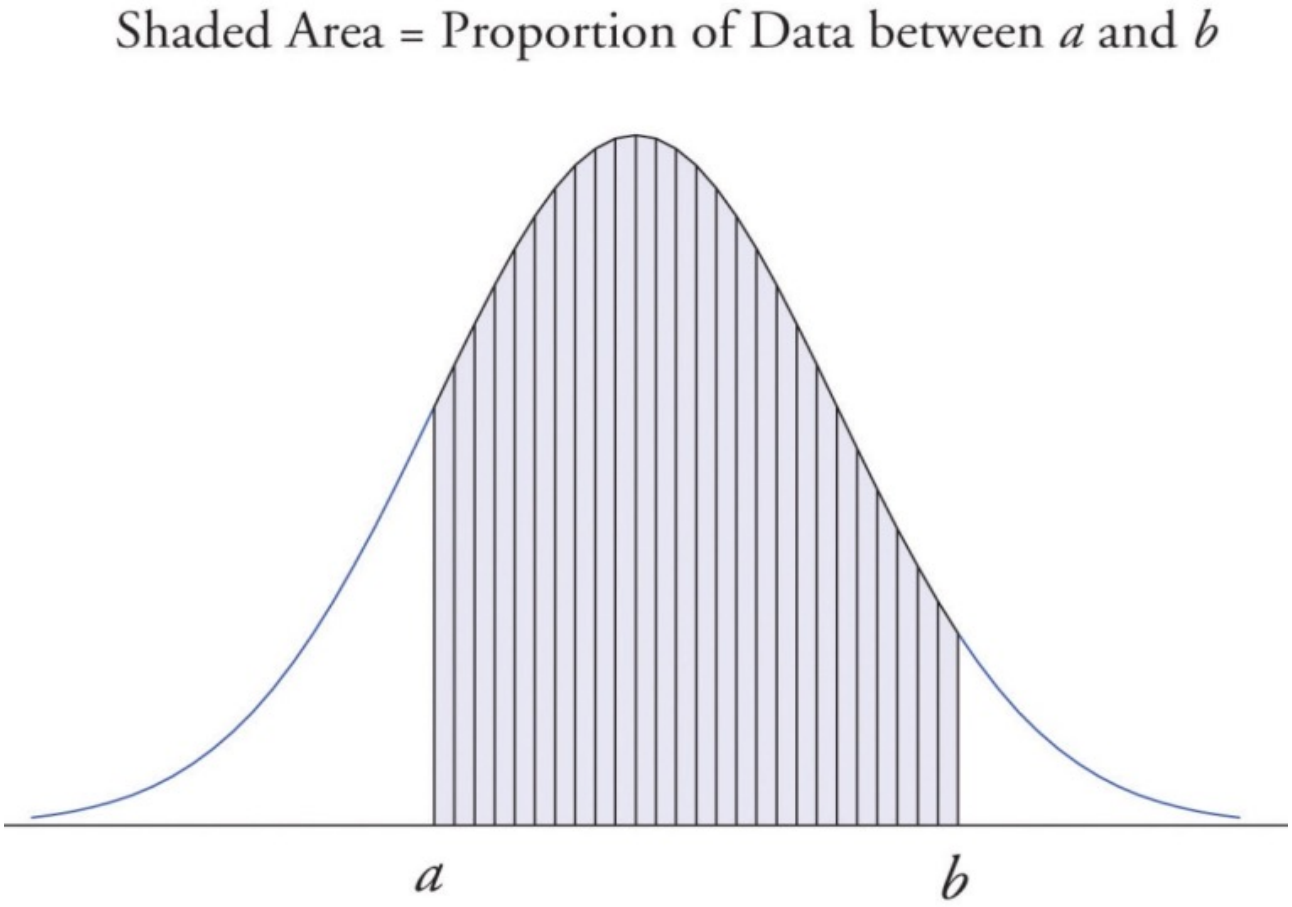
3-D TV Prices		
Class	**Frequency**	**Relative Frequency**
$1500 - $1599	2	
$1600 - $1699	5	
$1700 - $1799	4	
$1800 - $1899	5	
$1900 - $1999	4	



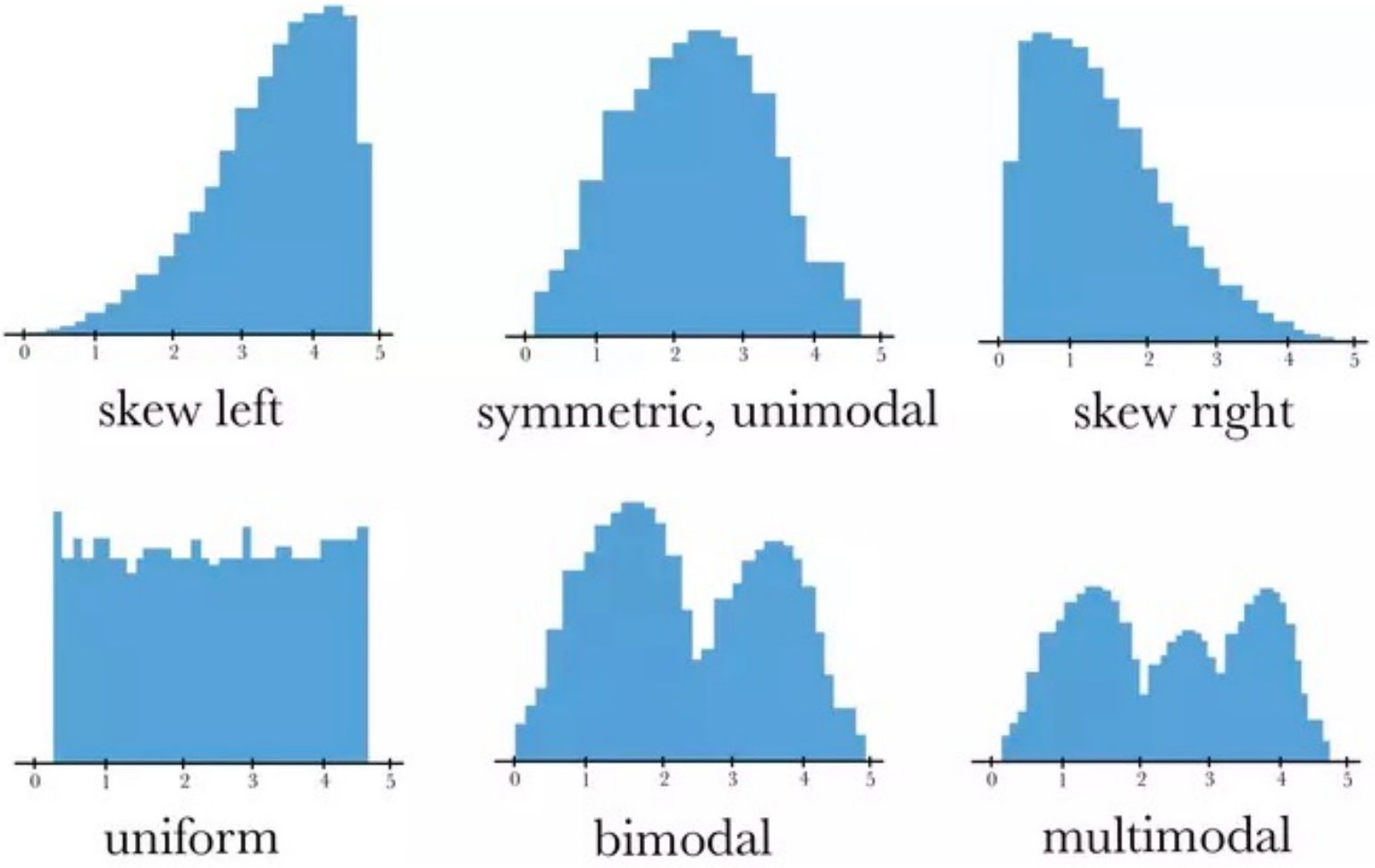
Shapes of Histograms



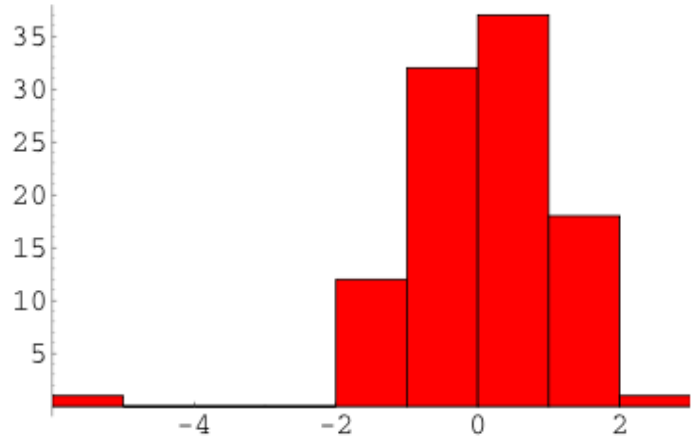
Shapes of Histograms

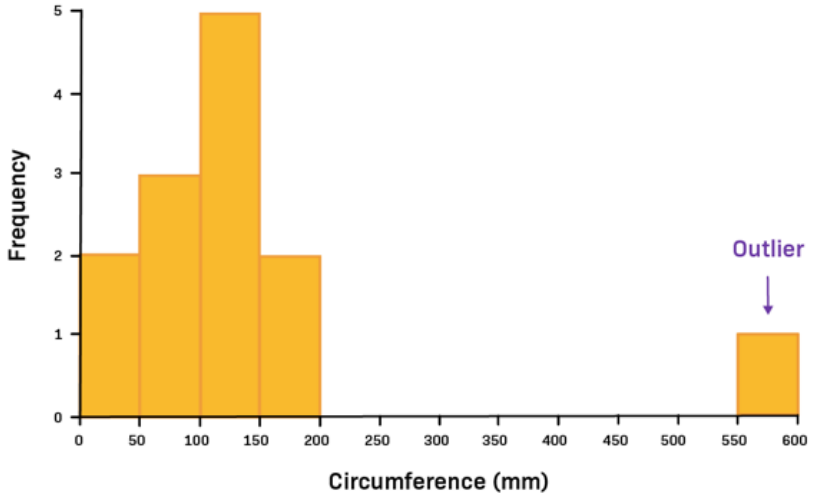


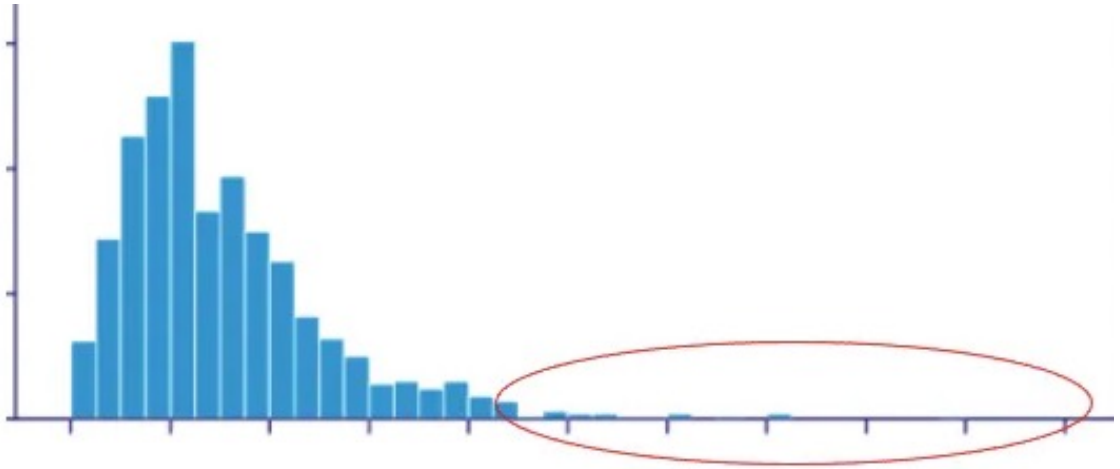
Shapes of Histograms



Shapes of Histograms







Dot Plot

- A dotplot is an attractive summary of numerical data when the data set is reasonably small or there are relatively few distinct data values.

Example:

A survey of "How long does it take you to eat breakfast?" has these results:

Minutes	1	2	3	4	5	6	7	8	9	10	11	12
People	6	2	3	5	2	5	0	0	2	3	7	4