

## Table 2.4

Number of TV sets in each of 50 randomly selected households.

1	1	1	2	6	3	3	4	2	4
3	2	1	5	2	1	3	6	2	2
3	1	1	4	3	2	2	2	2	3
0	3	1	2	1	2	3	1	1	3
3	2	1	2	1	1	3	1	5	1

## Organizing Quantitative Data

# Table 2.5

Frequency and relative-frequency distributions, using **single-value grouping**,  
for the number-of-TVs data in Table 2.4

Number of TVs	Frequency	Relative frequency
→ 0 ←	1 ←	0.02 ← = $\frac{1}{50}$
→ 1 ←	16 ←	0.32 ← = $\frac{16}{50}$
→ 2 ←	14	0.28
3	12	0.24
4	3	0.06
5	2	0.04
→ 6 ←	+ 2 ←	+ 0.04 ← = $\frac{2}{50}$
	→ 50	1.00

↑  
≈ 0.99

# Definition 2.7

## Terms Used in Limit Grouping

**Lower class limit:** The smallest value that could go in a class.

**Upper class limit:** The largest value that could go in a class.

**Class width:** The difference between the lower limit of a class and the lower limit of the next-higher class.

**Class mark:** The average of the two class limits of a class.

## Table 2.6

Days to maturity for 40 short-term investments

70	64	99	55	64	89	87	65
62	<u>38</u>	67	70	60	69	78	<u>39</u>
75	56	71	51	<u>99</u>	68	95	86
57	53	47	50	55	81	80	98
51	<u>36</u>	63	66	85	79	83	70

MIN

MAX = 99

MIN = 36

$$\begin{array}{r} 99 \\ - 36 \\ \hline 63 \end{array}$$

64 classes

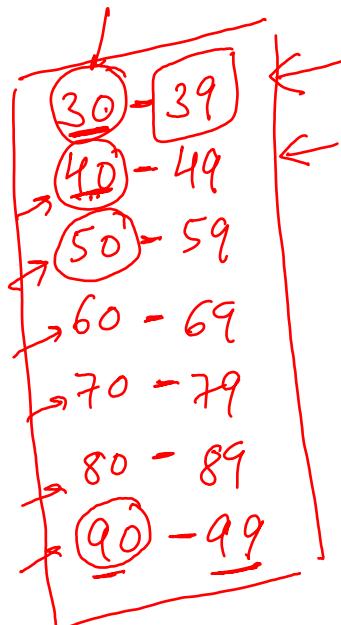
36

99  
9

## Table 2.7

Frequency and relative-frequency distributions, using limit grouping, for the days-to-maturity data in Table 2.6

class width = 10



Days to maturity	Tally	Frequency	Relative frequency
30-39		3	0.075
40-49		1	0.025
50-59		8	0.200
60-69		10	0.250
70-79		7	0.175
80-89		7	0.175
90-99		4	0.100
		40	1.000

$$\text{Lower limit} = 50$$

$$\text{Upper limit} = 59$$

$$\text{class width} = 10$$

$$\text{class mark of } 3^{\text{rd}} \text{ class} = \frac{50+59}{2} = 54.5$$

# Definition 2.8

## Terms Used in Cutpoint Grouping

Lower class cutpoint: The smallest value that could go in a class.

 Upper class cutpoint: The largest value that could go in the next-higher class (equivalent to the lower cutpoint of the next-higher class).

 Class width: The difference between the cutpoints of a class.

 Class midpoint: The average of the two cutpoints of a class.

$$\text{upper cutpoint of class } i^{th} = \text{lower cutpoint of class } (i+1)^{th}$$

# Table 2.8

## Weights of 18- to 24-Year-Old Males

MIN	129.2	185.3	218.1	182.5	142.8	129.2
	155.2	170.0	151.3	187.5	145.6	136.7
	167.3	161.0	178.7	165.0	172.5	132.1
	191.1	150.7	187.0	173.7	178.2	
	161.7	170.1	165.8	214.6	136.7	
Max	278.8	175.6	188.7	132.1	158.5	
	146.4	209.1	175.4	182.0	173.6	
	149.9	158.6				

# Table 2.9

Frequency and relative-frequency distributions, using cutpoint grouping, for the days-to-maturity data in Table 2.8

Weight (lb)	Frequency	Relative frequency
120—under 140	3	→ 0.081 = $\frac{3}{37}$
140—under 160	9	→ 0.243
160—under 180	14	→ 0.378
180—under 200	7	→ 0.189
200—under 220	3	→ 0.081
220—under 240	0	→ 0.000
240—under 260	0	0.000
260—under 280	+ 1	+ 0.027
	37	0.999

class width = 20

C. F.	3
	$9 + 3 = 12$
37	$14 + 9 + 3 = 26$
	$7 + 14 + 9 + 3 = 33$
36	$3 + 7 + 14 + 9 + 3 = 36$
	36
37	

class 1<sup>st</sup> midpoint  
 $= \frac{120 + 140}{2}$   
 $= \underline{\underline{130}}$

# Choosing the Grouping Method

Grouping method	When to use
Single-value grouping	Use with <u>discrete data</u> in which there are only a small number of distinct values.
Limit grouping	Use when the <u>data are expressed as whole numbers</u> and there are too many <u>distinct values</u> to employ single-value grouping.
Cutpoint grouping	Use when the <u>data are continuous</u> and are expressed with decimals.

# Definition 2.9

## Histogram

A **histogram** displays the classes of the quantitative data on a horizontal axis and the frequencies (relative frequencies, percents) of those classes on a vertical axis. The frequency (relative frequency, percent) of each class is represented by a vertical bar whose height is equal to the frequency (relative frequency, percent) of that class. The bars should be positioned so that they touch each other.

- For single-value grouping, we use the distinct values of the observations to label the bars, with each such value centered under its bar.
- For limit grouping or cutpoint grouping, we use the lower class limits (or, equivalently, lower class cutpoints) to label the bars.  
Note: Some statisticians and technologies use class marks or class midpoints centered under the bars.

# Procedure 2.5

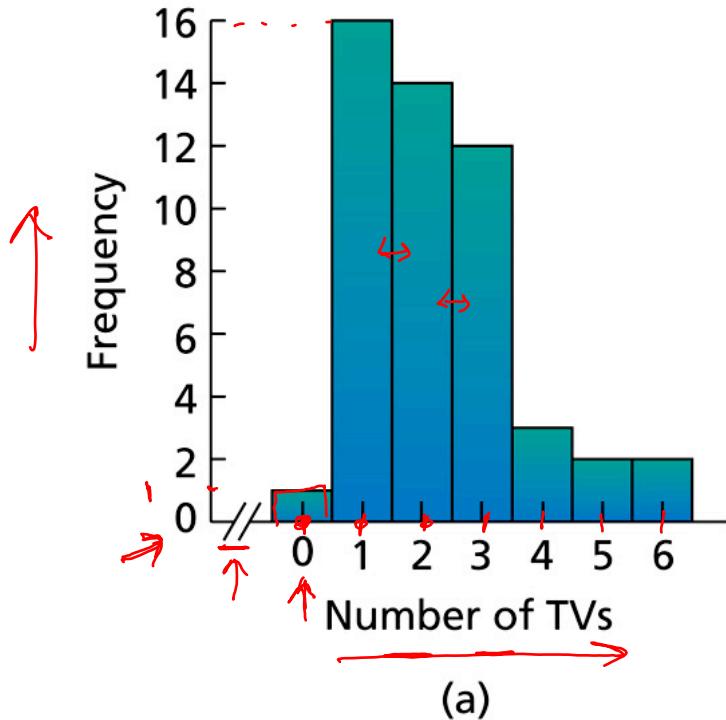
## To Construct a Histogram

- **Step 1** Obtain a frequency (relative-frequency, percent) distribution of the data.
- **Step 2** Draw a horizontal axis on which to place the bars and a vertical axis on which to display the frequencies (relative frequencies, percents).
- **Step 3** For each class, construct a vertical bar whose height equals the frequency (relative frequency, percent) of that class.
- **Step 4** Label the bars with the classes, as explained in Definition 2.9, the horizontal axis with the name of the variable, and the vertical axis with “Frequency” (“Relative frequency,” “Percent”).

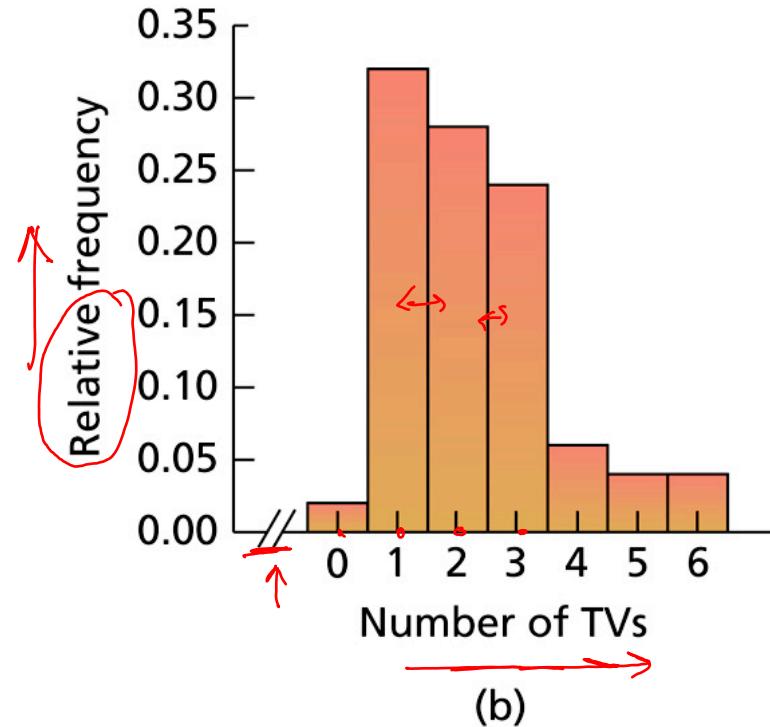
# Figure 2.4

Single-value grouping. Number of TVs per household:  
(a) frequency histogram; (b) relative-frequency histogram

Television Sets per Household

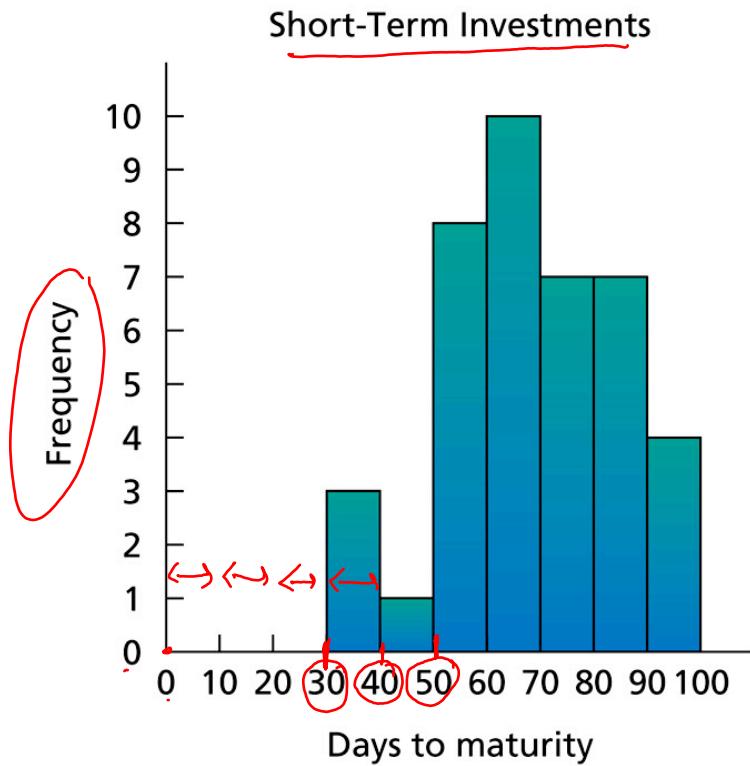


Television Sets per Household

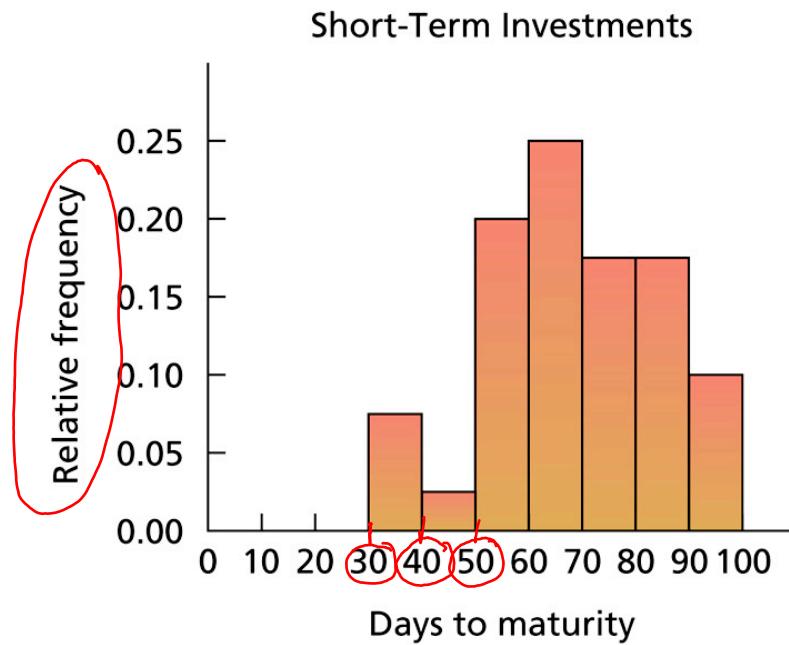


# Figure 2.5

Limit grouping. Days to maturity: (a) frequency histogram; (b) relative-frequency histogram



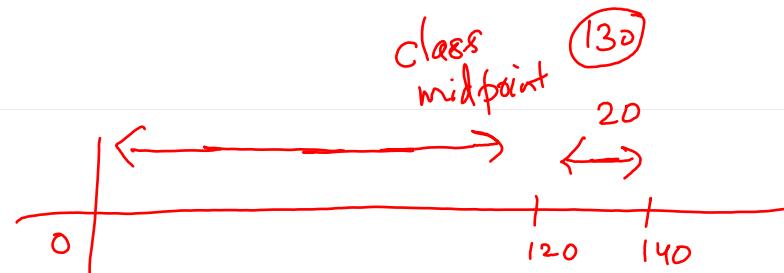
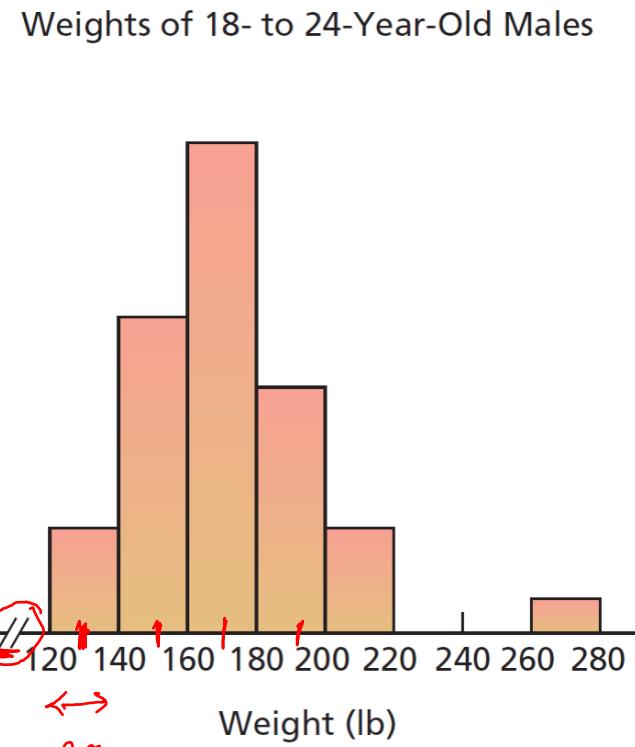
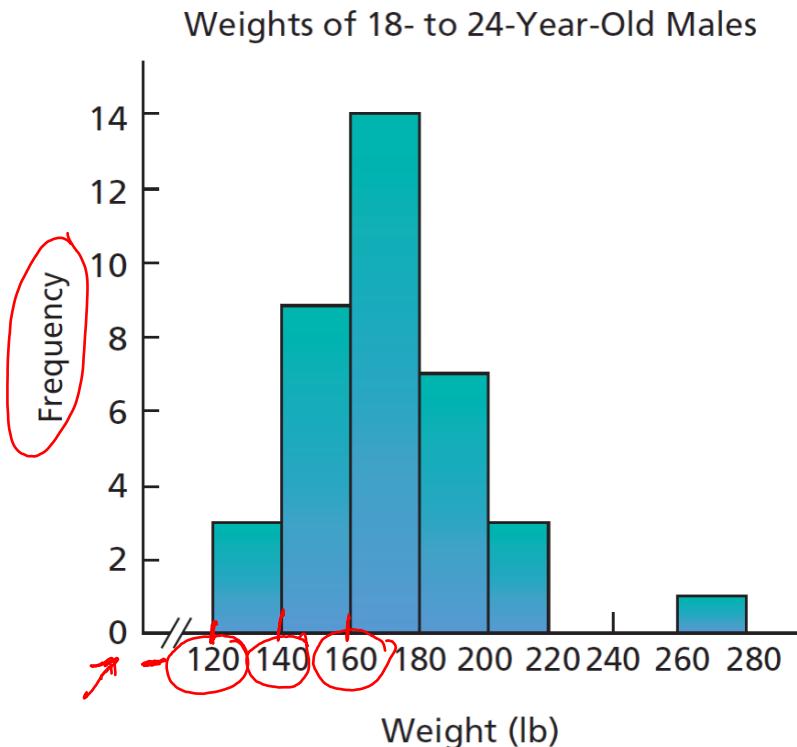
(a)



(b)

# Figure 2.6

Cutpoint grouping. Weight of 18- to 24-year old males: (a) frequency histogram; (b) relative-frequency histogram



## Definition 2.10

### Dotplot

A **dotplot** is a graph in which each observation is plotted as a dot at an appropriate place above a horizontal axis. Observations having equal values are stacked vertically.

## Procedure 2.6

### To Construct a Dotplot

- Step 1** Draw a horizontal axis that displays the possible values of the quantitative data.
- Step 2** Record each observation by placing a dot over the appropriate value on the horizontal axis.
- Step 3** Label the horizontal axis with the name of the variable.

# Table 2.11 & Figure 2.7

Prices, in dollars, of 16 DVD players

			MIN
	210	219	214
MAX	224	219	197
	208	209	199
	212	212	199
			210

Prices of DVD Players



# Definition 2.11

## Stem-and-Leaf Diagrams

In a stem-and-leaf diagram (or stemplot), each observation is separated into two parts, namely, a stem—consisting of all but the rightmost digit—and a leaf, the rightmost digit.

## Procedure 2.7

172  
Stem Leaf

7.8  
Stem Leaf

### To Construct a Stem-and-Leaf Diagram

**Step 1** Think of each observation as a stem—consisting of all but the rightmost digit—and a leaf, the rightmost digit.

**Step 2** Write the stems from smallest to largest in a vertical column to the left of a vertical rule.

**Step 3** Write each leaf to the right of the vertical rule in the row that contains the appropriate stem.

**Step 4** Arrange the leaves in each row in ascending order.

# Table 2.12 & Figure 2.8

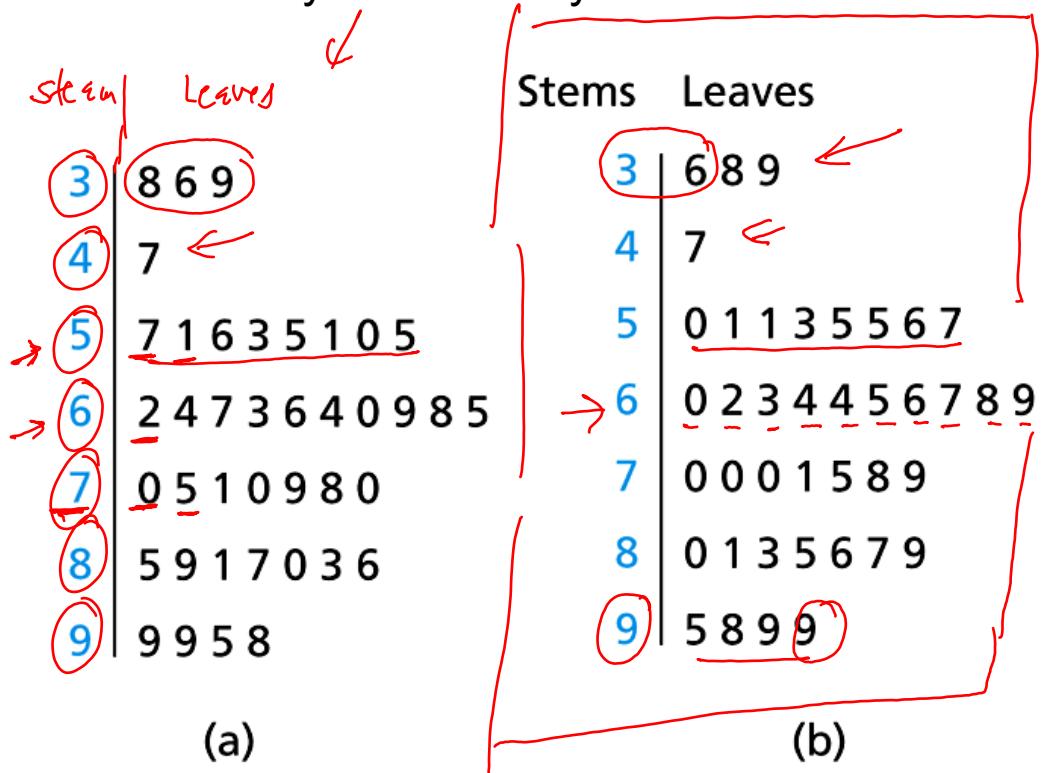
Days to maturity for  
40 short-term investments

70	64	99	55	64	89	87	65
62	38	67	70	60	69	78	39
75	56	71	51	99	68	95	86
57	53	47	50	55	81	80	98
51	36	63	66	85	79	83	70

KEY: 7 | 8  
= | 78

MIN = 36  
MAX = 99

Constructing a stem-and-leaf diagram  
for the days-to-maturity data



# Table 2.13 & Figure 2.9

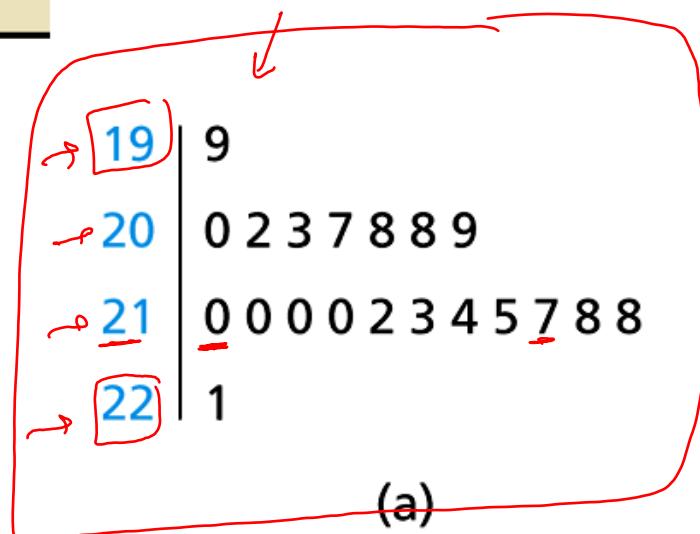
Cholesterol levels  
for 20 high-level patients

210	209	212	208
217	207	210	203
208	210	210	199
215	221	213	218
202	218	200	214

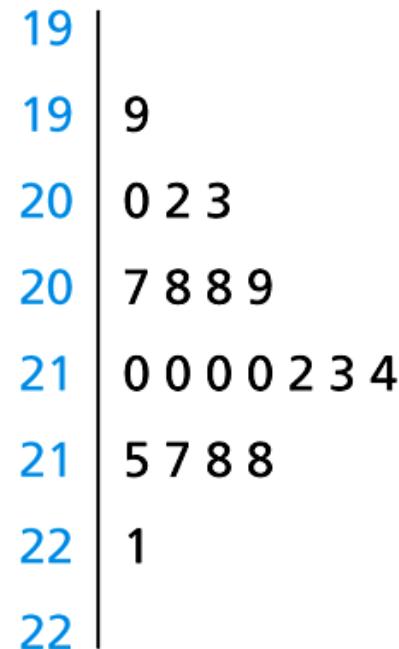
KEY: 21 | 8

= 218

Stem-and-leaf diagram for cholesterol levels:  
 (a) one line per stem; (b) two lines per stem



(a)



(b)