Chapter One

Sections 1.1 - 1.2

1.1 1) **Statistics** refers to numerical facts such as the age of a student or the income of a family.

2) Statistics refers to the field or discipline of study. Statistics is a group of methods used to collect, analyze, present, and interpret data and to make decisions.

1.2 **Descriptive statistics** consists of methods that help us organize, display, and describe data using tables, graphs, and summary measures. **Inferential statistics** consists of methods that use sample results to help make decisions or predictions about a population.

Section 1.3

1.3 A **population** is the collection of all elements whose characteristics are being studied. A s**ample** is a portion of the population selected for study. A r**epresentative sample** is a sample that represents the characteristics of the population as closely as possible, and a **random sample** is a sample drawn in such a way that each element of the population has a chance of being included in the sample. **Sampling with replacement** refers to a sampling procedure in which the item selected at each selection is put back in the population before the next item is drawn; s**ampling without replacement** is a sampling procedure in which the item selected at each selection is not replaced in the population.

1.4 Consider a standard deck of 52 cards. Suppose we randomly select one card from the deck and record the value and suit. If we put this card back in the deck before we randomly select a second card, this is an example of **sampling with replacement**. If we lay the first card aside and randomly select the second card from the 51 cards remaining in the deck, this is an example of **sampling without replacement**.

1.5 A **census** is a survey that includes every member of the population. A survey based on a portion of the population is called a **sample survey**. A sample survey is preferred over a census for the following reasons:

1) Conducting a census is very expensive because the size of the population is often very large.
2) Conducting a census is very time consuming.
3) In many cases it is impossible to identify each element of the target population.

1.6 a. Population b. Sample c. Population d. Population e. Sample

1.7 a. Population b. Sample c. Population d. Sample e. Population

Section 1.4

1.8 An **element** is a specific subject or object about which the information is collected. A **variable** is a characteristic under study that assumes different values for different elements. An **observation** is the value of a variable for a single element. A **data set** is a collection of observations on one or more variables.

1.9 With reference to this table, we have the following definitions:

- Member: Each city included in the table
- Variable: Number of dog bites reported
- Measurement: Number of dog bites in a specific city
- Data set: Collection of dog bite numbers for the six cities listed in the table.

1.10 With reference to this table, we have the following definitions:

- Member: Each country included in the table
- Variable: Quantity of crude oil reserves
- Measurement: Number of barrels for a specific country
- Data set: Collection of quantities of crude oil reserves for the six countries listed in the table

1.11 a. Number of dog bites b. Six c. Six (cities)

1.12 a. Quantity of crude oil reserves b. Six c. Six (countries)

Section 1.5

1.13 a. A **quantitative variable** is a variable that can be measured numerically.

b. A variable that cannot assume a numeric value but can be classified into two or more nonnumeric categories is called a **qualitative variable**.

c. A **discrete variable** is a variable whose values are countable.

d. A variable that can assume any numerical value over a certain interval or intervals is called a **continuous variable**.

e. Data collected on a quantitative variable is called **quantitative data**.

f. **Qualitative data** is data collected on a qualitative variable.

1.14 a. Quantitative b. Qualitative c. Qualitative d. Quantitative e. Quantitative

1.15 a. Quantitative b. Quantitative c. Qualitative d. Quantitative e. Quantitative

1.16 a. Discrete d. Continuous e. Discrete

1.17 a. Discrete b. Continuous d. Discrete e. Continuous

Sections 1.6 - 1.7

1.18 Data collected on different elements at the same time or for the same period of time are called **cross-section data**. Total sales for the 2005 Christmas season at 10 stores in a particular mall is an example of cross-section data. Data collected on the same element for the same variable for different periods of time are called **time-series data**. Total sales for one particular store for the Christmas season for the years 1995 to 2004 is an example of time-series data.

1.19 **Internal sources** of data are sources inside the organization conducting the study which make needed data available**. External sources** of data are the sources outside the organization from which data is available**.**

1.20 a. Time-series data b. Time-series data c. Cross-section data d. Cross-section data

1.21 a. Cross-section data b. Cross-section data c. Time-series data d. Time-series data

Section 1.8

1.22

m	f	f^2	mf	m^2f
5	12	144	60	300
10	8	64	80	800
17	6	36	102	1734
20	16	256	320	6400
25	4	16	100	2500
$\sum m = 77$	$\sum f = 46$	$\sum f^2 = 516$	$\sum mf = 662$	$\sum m^2f = 11{,}734$

a. $\sum m = 77$ b. $\sum f^2 = 516$ c. $\sum mf = 662$ d. $\sum m^2f = 11{,}734$

1.23

m	f	m^2	mf	m^2f
3	16	9	48	144
6	11	36	66	396
25	16	625	400	10,000
12	8	144	96	1152
15	4	225	60	900
18	14	324	252	4536
$\sum m = 79$	$\sum f = 69$	$\sum m^2 = 1363$	$\sum mf = 922$	$\sum m^2f = 17{,}128$

a. $\sum f = 69$ b. $\sum m^2 = 1363$ c. $\sum mf = 922$ d. $\sum m^2f = 17{,}128$

1.24

x	y	xy	x^2	y^2
15	10	150	225	100
22	12	264	484	144
11	14	154	121	196
8	9	72	64	81
5	18	90	25	324
$\sum x = 61$	$\sum y = 63$	$\sum xy = 730$	$\sum x^2 = 919$	$\sum y^2 = 845$

a. $\sum x = 61$ b. $\sum y = 63$ c. $\sum xy = 730$ d. $\sum x^2 = 919$ e. $\sum y^2 = 845$

1.25

x	y	xy	x^2	y^2
4	12	48	16	144
18	5	90	324	25
25	14	350	625	196
9	7	63	81	49
12	12	144	144	144
20	8	160	400	64
$\sum x = 88$	$\sum y = 58$	$\sum xy = 855$	$\sum x^2 = 1590$	$\sum y^2 = 622$

a. $\sum x = 88$ b. $\sum y = 58$ c. $\sum xy = 855$ d. $\sum x^2 = 1590$ e. $\sum y^2 = 622$

1.26 a. $\sum y = 20 + 14 + 57 + 23 + 7 + 102 = \$223$ b. $(\sum y)^2 = (223)^2 = 49{,}729$

c. $\sum y^2 = (20)^2 + (14)^2 + (57)^2 + (23)^2 + (7)^2 + (102)^2 = 14{,}827$

1.27 a. $\sum y = 83 + 205 + 87 + 154 = \$529$ b. $(\sum y)^2 = (529)^2 = 279{,}841$

c. $\sum y^2 = (83)^2 + (205)^2 + (87)^2 + (154)^2 = 80{,}199$

1.28 a. $\sum x = 28 + 35 + 29 + 54 + 18 = \$164$ thousand b. $(\sum x)^2 = (164)^2 = 26{,}896$

c. $\sum x^2 = (28)^2 + (35)^2 + (29)^2 + (54)^2 + (18)^2 = 6090$

1.29 a. $\sum x = 7 + 39 + 21 + 16 + 3 + 43 + 19 = 148$ students b. $(\sum x)^2 = (148)^2 = 21{,}904$

c. $\sum x^2 = (7)^2 + (39)^2 + (21)^2 + (16)^2 + (3)^2 + (43)^2 + (19)^2 = 4486$

Supplementary Exercises

1.30 With reference to this table, we have the following definitions:

- Variable: Average attendance at interleague Major League baseball games
- Measurement: The average attendance figures at interleague Major League baseball games
- Data Set: Collection of the average attendance figures at interleague Major League baseball games for the six years listed in the table

1.31 With reference to this table, we have the following definitions

- Variable: Number of Americans who took cruises
- Measurement: Number of Americans who took cruises for a specific year
- Data Set: Collection of the number of Americans who took cruises for the 10 years listed in the table

1.32 Since the data set in Exercise 1.30 contains measurements collected on the same variable (average attendance) for different periods of time, it is a time-series data set. The data set in Exercise 1.31 also contains measurements on the same variable (Americans who took cruises) for different periods of time; it is also a time-series data set.

1.33 a. Sample b. Population c. Sample d. Population

1.34 a. Population b. Sample c. Sample d. Population

1.35 a. This is an example of sampling without replacement because once a patient is selected, he/she will not be replaced before the next patient is selected.

b. This is an example of sampling with replacement because both times the selection is made from the same group of professors.

1.36 a. This is an example of sampling without replacement because once a city is selected it will not be replaced before the next city is selected.

b. This is an example of sampling with replacement because both times the selection is made from the same group of high school teachers.

1.37 a. $\sum x = 8 + 14 + 3 + 7 + 10 + 5 = 47$ shoe pairs b. $(\sum x)^2 = (47)^2 = 2209$

c. $\sum x^2 = (8)^2 + (14)^2 + (3)^2 + (7)^2 + (10)^2 + (5)^2 = 443$

1.38 a. $\sum y = 4 + 12 + 8 + 10 + 5 = 39$ restaurants b. $(\sum y)^2 = (39)^2 = 1521$

c. $\sum y^2 = (4)^2 + (12)^2 + (8)^2 + (10)^2 + (5)^2 = 349$

1.39

m	f	f^2	mf	m^2f	m^2
3	7	49	21	63	9
16	32	1024	512	8192	256
11	17	289	187	2057	121
9	12	144	108	972	81
20	34	1156	680	13,600	400
$\sum m = 59$	$\sum f = 102$	$\sum f^2 = 2662$	$\sum mf = 1508$	$\sum m^2f = 24{,}884$	$\sum m^2 = 867$

a. $\sum m = 59$ b. $\sum f^2 = 2662$ c. $\sum mf = 1508$ d. $\sum m^2f = 24{,}884$ e. $\sum m^2 = 867$

1.40

x	y	x^2	xy	x^2y	y^2
7	5	49	35	245	25
11	15	121	165	1815	225
8	7	64	56	448	49
4	10	16	40	160	100
14	9	196	126	1764	81
28	19	784	532	14,896	361
$\sum x = 72$	$\sum y = 65$	$\sum x^2 = 1230$	$\sum xy = 954$	$\sum x^2y = 19{,}328$	$\sum y^2 = 841$

a. $\sum y = 65$ b. $\sum x^2 = 1230$ c. $\sum xy = 954$ d. $\sum x^2y = 19{,}328$ e. $\sum y^2 = 841$

Self-Review Test

1. b **2.** c

3. a. Sample without replacement b. Sample with replacement

4. a. Qualitative b. Quantitative; continuous c. Quantitative; discrete d. Qualitative

5. With reference to this table, we have the following definitions:

- Member: Each player listed in the table
- Variable: Total number of career yards rushed
- Measurement: Total number of yards rushed for a specific player
- Data set: Collection of total number of yards rushed for the 10 players listed in the table

6. a. $\sum x = 2 + 5 + 3 + 12 + 7 = 29$ credit cards b. $(\sum x)^2 = (29)^2 = 841$

c. $\sum x^2 = (2)^2 + (5)^2 + (3)^2 + (12)^2 + (7)^2 = 231$

7.

m	f	m^2	mf	m^2f	f^2
3	15	9	45	135	225
6	25	36	150	900	625
9	40	81	360	3240	1600
12	20	144	240	2880	400
15	12	225	180	2700	144
$\sum m = 45$	$\sum f = 112$	$\sum m^2 = 495$	$\sum mf = 975$	$\sum m^2f = 9855$	$\sum f^2 = 2994$

a. $\sum m = 45$ b. $\sum f = 112$ c. $\sum m^2 = 495$ d. $\sum mf = 975$ e. $\sum m^2f = 9855$ f. $\sum f^2 = 2994$