Additional Exercises

1. Suppose you are the administrator of a public school system. What kinds of variables would you measure and how would you collect the measurements on the following subjects:

- **a.** Student learning
- **b.** School discipline
- **c.** Teacher preparation
- **d.** Absenteeism (pupil and teacher)
- **e.** Cafeteria food quality

2. The head of the Veterans Administration has been receiving complaints from a Vietnam Veterans organization concerning disability checks. The organization claims that checks are continually late. The checks are to arrive no later than the tenth of each month.

- **a.** What variables would you measure to explore this problem?
- **b.** How would you collect measurements on these variables?

3. How would you make informed investment decisions with a sizable sum of money that has been unexpectedly bequeathed to you by a family member?

- **a.** What specific measurements would you use to evaluate potential investments?
- **b.** What types of data and information would you need to consider to make informed decisions?

4. Flying Eagle Airlines advertises that it surpasses all other airlines in flights that arrive on time. A competitor states that it has a better on-time record than any other airline. Can both claims be correct? Explain.

5. Two local grocery stores both claim to have the lowest prices in town. Develop a measurement that you believe could be used as a criterion to determine which store actually has the lowest prices.

6. At the end of 2001, the United States had 32.9 million people living in poverty according to the Census Bureau.[89] This was an increase of 1.3 million from the previous year. Poverty was defined by the Census Bureau as having a cash income less than $14,255 a year. The Census Bureau does not include in their income measurement any part of $167 billion spent on Medicaid, a federal program by which medical care is provided to the poor. The Census Bureau only includes $34.9 billion out of the $205 billion spent annually on public welfare. Forty percent of those classified as impoverished own their own homes. How do you think poverty should be defined?

7. The quality movement has compelled American businesses to address the problem of measuring customer satisfaction. How would you measure customer satisfaction if you owned a car dealership?

8. Identify the following variables as discrete or continuous.

- **a.** Average test score on a test ranging from 0 to 100
- **b.** Number of boot errors on a computer

c. A stock's earnings per share

d. Energy usage in a production process

9. Determine the level of measurement for each of the following variables.

a. Golf score in relation to par

b. SAT score

c. Rating from 1 to 5 of quality of service in a restaurant

d. Make and model of a vehicle

e. The number of students with a business major

10. According to a Danish researcher, if you drop your average daily activity level by taking elevators instead of stairs, by parking your car in the closest space, or by never walking to run errands, you increase your risk of diabetes, heart disease, and premature death. The researcher studied two groups of healthy men (eight in the first group with an average age of 27 and an average body mass index (BMI) of 22.9, which is well within the normal range; and ten in the second group with an average age of 23.8 years and a BMI of 22.1). In addition to age and BMI, researchers also collected information such as number of steps per day (each group of men was fitted with pedometers), height, weight, and race. With the first group of men, the researchers asked that they reduce their daily activity (steps) by taking cars on short trips and elevators instead of stairs. The insulin levels were also measured for each group and the researchers found that with the reduced activity, insulin levels rose by nearly 60 percent after two weeks of inactivity, thus increasing the risk of diabetes and heart disease.[90] However, the good news is that by increasing activity over a two-week period of time, one can begin to reduce his or her risk of diabetes and heart disease.

a. List the different variables measured in this study.

b. Which variables are quantitative and which are qualitative?

c. Of the variables that are quantitative, are they discrete or continuous?

d. Give the levels of measurement for these variables.

Data

The data set is available on stat.hawkeslearning.com under **Discovering Statistics and Data, Fourth Edition > Data Sets > World Crude Oil Production**.

11. Consider the world production of crude oil given in millions of barrels per day.

World Production of Crude Oil

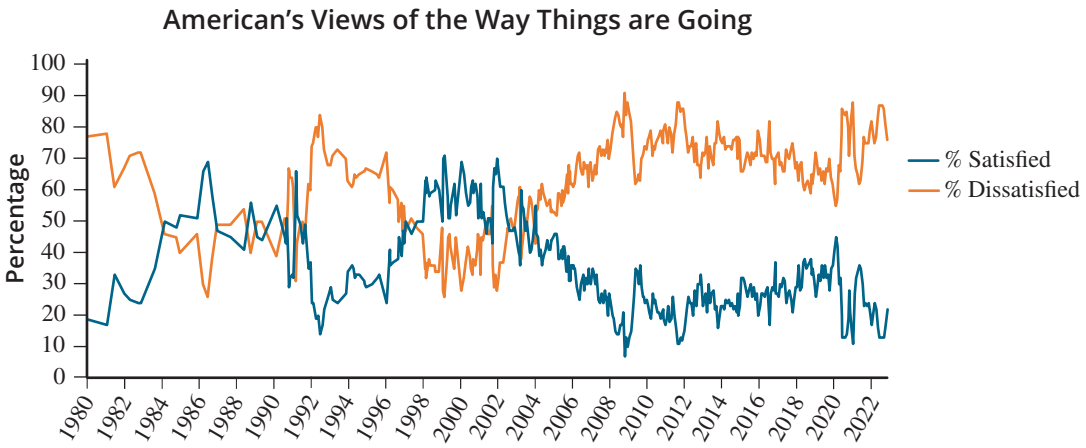
Year	World Crude Oil Production (Million barrels per day)	Year	World Crude Oil Production (Million barrels per day)
1972	53.7	1997	70.4
1973	55.9	1998	71
1974	59.1	1999	71.6
1975	59	2000	72.2
1976	60.9	2001	73.2
1977	62.7	2002	72.8
1978	63.6	2003	73.6
1979	63.9	2004	73.1

World Production of Crude Oil			
Year	World Crude Oil Production (Million barrels per day)	Year	World Crude Oil Production (Million barrels per day)
1980	63	2005	73
1981	59	2006	72.2
1982	58.4	2007	73.3
1983	58.7	2008	74.2
1984	59.8	2009	68.1
1985	60.7	2010	68.7
1986	62.1	2011	70.3
1987	62.2	2012	71.5
1988	62.7	2013	72.2
1989	62.8	2014	73
1990	63.3	2015	73.7
1991	64.3	2016	77.4
1992	66.9	2017	80.9
1993	67.8	2018	82.2
1994	68.5	2019	80.6
1995	68.9	2020	91.1
1996	69.8		

a. What is the level of measurement of the data?

b. Is the data time series or cross-sectional? If the data is time series, plot the data. Does the series appear to be stationary or nonstationary? Explain your answer.

12. Consider the graph of the number of respondents (in percentages) who think things in the U.S. are now on the wrong track versus those that think the country is going in the right direction. The data was collected using a survey asking the question, *In general, are you satisfied or dissatisfied with the way things are going in the United States at this time?*[91]



a. Are the opinions on the outlook of the country presented as time series or cross-sectional data? Justify your answer.

b. If the data is time series data, does the series appear to be stationary or nonstationary? Explain your answer.

13. Can you think of a process that would yield measurements that did not have any variability? Would studying such a process be very interesting?

Data

The data set is available on stat.hawkeslearning.com under **Discovering Statistics and Data, Fourth Edition > Data Sets > Fertility Rates**.

14. One of the measurements that population experts use in predicting trends in population growth is the fertility rate. The total fertility rate is sometimes defined as the number of likely births one woman will have in her lifetime. The accompanying table gives the fertility rate from 1960 to 2020.[92] If the data is time series data, plot the data in a line chart. Make observations based on the graph as to whether the series is stationary or nonstationary. If the time series is nonstationary, identify any noticeable trends.

Fertility Rates

Year	Fertility Rate	Year	Fertility Rate	Year	Fertility Rate
1960	3.6540	1981	1.8120	2002	2.0205
1961	3.6200	1982	1.8275	2003	2.0475
1962	3.4610	1983	1.7990	2004	2.0515
1963	3.3190	1984	1.8065	2005	2.0570
1964	3.1900	1985	1.8440	2006	2.1080
1965	2.9130	1986	1.8375	2007	2.1200
1966	2.7210	1987	1.8720	2008	2.0720
1967	2.5580	1988	1.9340	2009	2.0020
1968	2.4640	1989	2.0140	2010	1.9310
1969	2.4560	1990	2.0810	2011	1.8945
1970	2.4800	1991	2.0625	2012	1.8805
1971	2.2660	1992	2.0460	2013	1.8575
1972	2.0100	1993	2.0195	2014	1.8625
1973	1.8790	1994	2.0015	2015	1.8435
1974	1.8350	1995	1.9780	2016	1.8205
1975	1.7740	1996	1.9760	2017	1.7655
1976	1.7380	1997	1.9710	2018	1.7295
1977	1.7900	1998	1.9990	2019	1.7060
1978	1.7600	1999	2.0075	2020	1.6375
1979	1.8080	2000	2.0560		
1980	1.8395	2001	2.0305		

15. One of the problems associated with the management of solid waste is the NIMBY (not in my backyard) syndrome. In separate surveys taken in 1988, 1989, and 1990 the National Solid Waste Management Association asked, *Would you object to a new landfill in your community?* The percentage response is given in the table below.

Survey Results			
Survey Date	**Don't Object**	**Object**	**Not Sure**
March 1990	36	59	5
February 1989	23	65	12
February 1988	30	62	8

a. What is the level of measurement of the survey data?

b. Is the data time series or cross-sectional?

c. What other information would be useful in evaluating the results of the study?

16. In a recent study of four leading anesthetics, three hundred patients were randomly selected and assigned to be given one of the four products during a surgery. One of the products performed significantly better than the rest. Is this an observational study or a controlled experiment?

17. In the fall of 2022, Hurricane Ian swept through Florida causing billions of dollars of damage. Suppose you were the finance manager for one of the insurance companies which insured primarily residential housing. You need to be sure that adequate funds are available to pay the anticipated claims. The morning after the hurricane you sit in your office in Hartford, Connecticut, and begin wondering what kind of data you might collect in order to anticipate the company's financial obligations resulting from the hurricane. What variable(s) would you measure, and how would you collect the measurements?

18. Do seat belts affect the types and degree of injuries sustained in an automobile crash? What kind of data should you obtain to answer this question? Will the data be experimental or observational?

19. An article on the BBC website titled "Higher temperatures linked to EU asylum figures" discusses a study which found that as temperatures rise above average in agricultural areas, more people are seeking refuge abroad.[93] The researchers believe these "weather shocks" happen due to decreased agricultural yield, which in turn damages national GDP. They also believe the heat increases aggressive behavior. The lead author of the study told BBC News "I feel very confident that what we discovered for 2000-2014 is a causal relationship between weather and asylum applications." What variables would you measure to try and establish this link?