

## PROBLEM SET 9.3

1. The team roster for the NBA Boston Celtics basketball team (2003–2004 season) and the players' heights and weights are given in the following table.

Player	Height, in inches	Weight, in pounds
Marcus Banks	74	200
Mark Blount	84	250
Ricky Davis	79	195
Brandon Hunter	79	260
Mike James	74	188
Jumaine Jones	80	218
Raef LaFrentz	83	240
Walter McCarty	82	230
Chris Mihm	84	265
Chris Mills	79	220
Kendrick Perkins	82	280
Paul Pierce	78	230
Michael Stewart	82	230
Jiri Welsch	79	215

Source: www.espn.com.

- a. Find the mean, median, and mode for the players' heights.
- b. Find the mean, median, and mode for the players' weights.
- c. Suppose Marcus Banks is cut from the team. Recalculate the mean, median, and mode for the height data. Which of these value(s) did not change? Explain why.
- d. Suppose Kendrick Perkins is cut from the team. Recalculate the mean, median, and mode for the weight data. Which of these values changed the most? Explain why.

2. The team roster for the WNBA Los Angeles Sparks basketball team (2003–2004 season) and the players' heights and weights are given in the following table.

Player	Height, in inches	Weight, in pounds
Tamecka Dixon	69	148
Isabelle Fijalkowski	77	200
Jennifer Gillom	75	180
Chandra Johnson	75	185
Lisa Leslie	77	170
Mwadi Mabika	71	165
DeLisha Milton-Jones	73	172
Vanessa Nygaard	73	175
Lynn Pride	74	180
Nikki Teasley	72	169
Teresa Weatherspoon	68	161
Shaquala Williams	66	135
Sophia Witherspoon	70	145

Source: www.wnba.com.

- a. Find the mean, median, and mode for the players' heights.
- b. Find the mean, median, and mode for the players' weights.
- c. Suppose a new 77-inch-tall player joins the team. Recalculate the mean, median, and mode for the height data. Did any of these three values stay the same? Explain why or why not.
- d. Suppose Shaquala Williams is cut from the team. Recalculate the mean, median, and mode for the weight data. Which of these values changed the most? Explain why.

3. The following table contains homicide rates per 100,000 for the years from 1980 through 1999 in the United States.

Year	Homicide Rate per 100,000	Year	Homicide Rate per 100,000
1980	10.2	1990	9.4
1981	9.8	1991	9.8
1982	9.1	1992	9.3
1983	8.3	1993	9.5
1984	7.9	1994	9.0
1985	7.9	1995	8.2
1986	8.6	1996	7.4
1987	8.3	1997	6.8
1988	8.4	1998	6.3
1989	8.7	1999	5.7

Source: U.S. Bureau of Justice Statistics.

- Find the mean and median of the homicide rates for the years 1980 through 1989.
- Find the mean and median of the homicide rates for the years 1990 through 1999.
- If you were a member of a political group and wanted to emphasize the idea that crime prevention policies were working, which would you report, the mean or the median, for each period in parts (a) and (b) and why?

4. The following table contains salaries for all players on two NBA basketball teams for the 2003–2004 season.

Annual Salary, Memphis Grizzlies	Annual Salary, Minnesota Timberwolves
\$6,834,444	\$27,995,000
\$6,600,000	\$13,475,000
\$6,187,500	\$8,000,000
\$6,187,500	\$5,250,000
\$5,955,000	\$4,917,000
\$4,917,000	\$4,498,514
\$4,592,418	\$2,475,000
\$3,416,520	\$1,500,000
\$3,380,457	\$938,679
\$2,533,440	\$938,679
\$1,580,702	\$709,224
\$1,325,000	\$698,800
\$1,285,440	\$638,679
\$1,143,360	\$184,355
\$1,063,680	\$134,541
\$366,931	\$114,727
	\$83,464

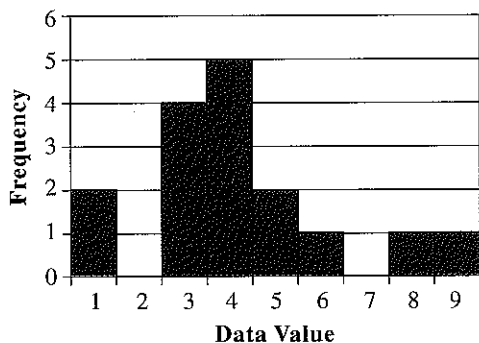
Source: www.hoopshype.com/salaries.

- Find the mean and median of the salaries for the Memphis Grizzlies.
  - Find the mean and median of the salaries for the Minnesota Timberwolves.
  - Which measure of central tendency is a better representation of a typical salary in each case? Explain your reasoning.
5. Students in a class took a 10-point quiz. The class received one grade of 5, three grades of 6, eight grades of 7, six grades of 8, five grades of 9, and three grades of 10.
- Make a histogram of these quiz scores.
  - Find the mean, median, and mode of the quiz scores.
  - Is the data set symmetric, skewed right, skewed left, or none of these? Justify your answer.
6. Students fill out course evaluation forms near the end of a course. The course is given an overall rating by each student. Students rate the course 0, 1, 2, 3, or 4, with 4 being the highest possible rating. The

course received one evaluation with a rating of 0, one evaluation with a rating of 1, sixteen evaluations with a rating of 2, nine evaluations with a rating of 3, and eight evaluations with a rating of 4.

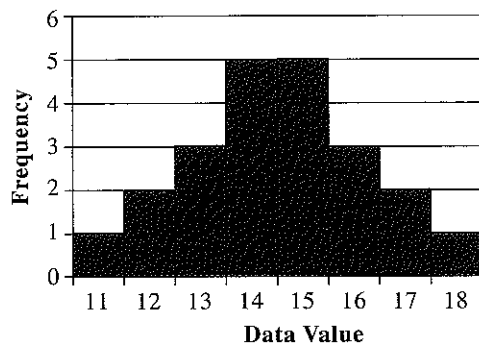
- Make a histogram of the student ratings.
- Find the mean, median, and mode of the student ratings.
- Is the data set symmetric, skewed right, skewed left, or none of these? Justify your answer.

7. Consider the following histogram.



- Find the mean, median, and mode of the data.
- Compare the mean and the median. How could you have predicted which of the two would be larger just by looking at the histogram?
- Is it possible to add a single number to the data set that causes the mean, median, and mode to change? If it is possible, give an example. If it is not, explain why.

8. Consider the following histogram.



- Find the mean, median, and mode of the data.
- How do the mean and the median compare? How could you have predicted the relationship between the two just by looking at the histogram?
- Is it possible to add a single number to the data set that causes the mean, median, and mode to change? If it is possible, give an example. If it is not, explain why.

**Problems 9 and 10**

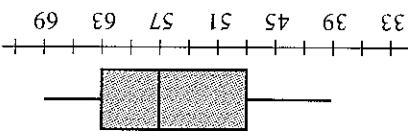
Identify whether the mean, median, or mode might be the most appropriate measure of central tendency to use in each case. Give a reason for your choice.

- A medical study needs to record normal human body temperatures.
  - A shoe store manager must determine how many of each size of shoes to order.
- A company lists its typical salary on its website to attract new employees.
  - The National Center for Health Statistics reports the life expectancy for females.
- Use the data in Table 9.4 to determine the 2002 per-capita personal income for the following group of West Coast states: Hawaii, Alaska, Washington, Oregon, and California.
- Use the data in Table 9.4 to determine the 2002 per-capita personal income for the following group of East Coast states: Maine, Massachusetts, Rhode Island, Connecticut, and New Jersey.
- Create one example of a data set with five values such that the mean is 50, the median is 55, and the mode is 61.
  - Create one example of a data set with six values such that the range is 27, the mean is 14, the median is 12, and there is no mode.
- Create one example of a data set with five values such that the mean is 19, the median is 15, and the two modes are 10 and 15.
  - Create one example of a data set with six values such that the range is 10, the mean is 10, the median is 9.5, and the smallest value is 5.

**Problems 15 through 18**

For each set of data shown, do the following.

- Find the range.
  - Find the median.
  - Find the first and third quartiles.
  - Find the interquartile range.
  - Find the five-number summary.
  - Create a box-and-whisker plot.
- 10, 8, 9, 3, 12, 15, 4, 6, 1, 5, 11
  - 2, 5, 10, 20, 6, 4, 12, 15, 9, 8, 16
  - 10, 21, 13, 6, 12, 24, 14, 26, 9, 18
  - 7, 3, 5, 13, 20, 6, 4, 12, 15, 10, 9, 16

19. Consider the following box-and-whisker plot, which represents a data set.
- 
- 33 39 45 51 57 63 69
- a. Estimate the values for the five-number summary for each plot.
- b. Describe three conclusions you might draw about poverty in the West African countries and in the South American countries based on a comparison of the box-and-whisker plots.

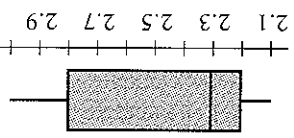
**Problems 23 and 24**

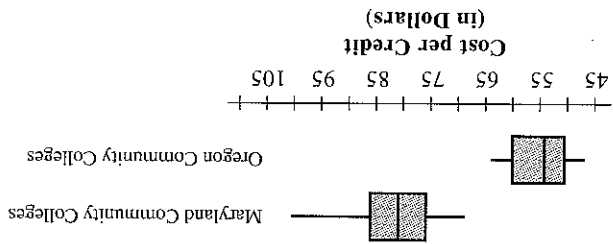
The following table contains earthquake magnitudes and depths for earthquakes in Hawaii during February and March 2004.

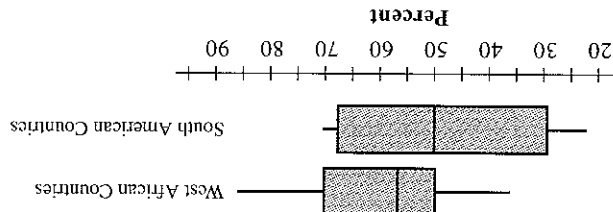
Magnitude	Depth (km)
2.0	2.7
2.0	0.2
2.3	3.4
2.0	2.7
2.0	30.0
2.0	2.2
2.3	1.7
2.1	3.1
2.5	4.0
2.3	33.1
2.0	47.2
2.1	2.9
2.0	4.2
2.0	2.2
2.3	3.2
2.5	3.2
2.3	2.5
2.0	2.2
2.1	3.5
2.3	2.4
2.0	2.2
2.0	2.2
2.1	4.2
2.0	2.2
2.0	33.6

Source: U.S. Geological Survey.

23. Consider the earthquake magnitude data.
- a. Find the five-number summary for the 24 data points.
- b. Draw the box-and-whisker plot for the data.
- c. Is the distribution symmetric, skewed right, or skewed left?
24. Consider the earthquake depth data.
- a. Find the five-number summary for the 24 data points.
- b. Draw the box-and-whisker plot for the data.
- c. Is the distribution symmetric, skewed right, or skewed left?

20. Consider the following box-and-whisker plot, which represents a data set.
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- 2.1 2.3 2.5 2.7 2.9
- a. List the five-number summary for the data set.
- b. Is the distribution symmetric or skewed? If it is skewed, is it skewed right or skewed left?

21. The following box-and-whisker plots summarize the cost per credit for community colleges in Maryland and Oregon. Sources: Maryland Association of Community Colleges and Oregon Community College Association.
- 
- 45 55 65 75 85 95 105 115 125
- Cost per Credit (in Dollars)
- a. Estimate the values for the five-number summary for each state.
- b. Describe three conclusions you might draw about the per-credit cost of community colleges in Maryland and Oregon based on a comparison of the box-and-whisker plots.

22. The following box-and-whisker plots summarize the percentages of the population below the poverty line in 9 South American countries and in 10 West African countries. (Source: www.nationmaster.com.)
- 
- 20 30 40 50 60 70 80 90
- Percent

25. Find the five-number summary and draw a box-and-whisker plot for the salary data for the Memphis Grizzlies using the table in problem 4.
26. Find the five-number summary and draw a box-and-whisker plot for the salary data for the Minnesota Timberwolves using the table in problem 4.
27. The heights, in inches, of the players on the Denver Nuggets basketball team during the 2003–2004 season are 82, 80, 77, 81, 65, 83, 84, 83, 76, 74, 82, 76, 84, and 81. The heights, in inches, of the players on the Houston Rockets basketball team during the 2003–2004 season are 83, 75, 77, 76, 75, 90, 76, 81, 81, 79, 81, 79, and 71. (*Source*: www.espn.com.)
- Find the five-number summary for the Denver Nuggets' heights.
  - Find the five-number summary for the Houston Rockets' heights.
  - Draw a box-and-whisker plot for the Denver Nuggets' data.
  - Draw a box-and-whisker plot for the Houston Rockets' data.
  - List three observations based on a comparison of the box-and-whisker plots from parts (c) and (d).
28. Yellowstone National Park is home to over 500 geysers, which are hot springs that erupt periodically. Old Faithful is a geyser that erupts more frequently than other geysers. However, it is not the largest or most regular geyser. A log book of geyser activity is kept by park rangers and others at the Old Faithful Visitors Center. Consider the following 1998 and 2003 data describing the duration of 27 Old Faithful eruptions for a 3-day period in August.

August 1998 Eruption Duration, Minutes:Seconds			August 2003 Eruption Duration, Minutes:Seconds		
3:35	4:10	4:10	4:34	1:56	4:12
4:00	4:15	4:49	4:10	3:53	1:48
4:06	4:06	4:04	1:50	4:23	4:48
2:54	4:23	4:30	4:24	1:51	2:01
4:28	4:10	4:24	4:28	5:00	4:45
3:54	4:03	4:21	2:20	4:08	1:53
4:30	1:47	4:09	4:45	4:06	4:31
3:47	4:36	4:15	2:13	4:30	1:47
3:52	4:10	4:25	4:36	4:22	4:48

*Source*: www.geyserstudy.org/g\_logs.htm.

- Find the five-number summary for the 1998 eruption data.
  - Find the five-number summary for the 2003 eruption data.
  - Draw a box-and-whisker plot for the 1998 data.
  - Draw a box-and-whisker plot for the 2003 data.
  - List three observations based on a comparison of the box-and-whisker plots from parts (c) and (d).
29. Create a data set with five values, not all the same, so that the mean, median, and the mode are all exactly the same.
30. Create a data set with five values so that the mean is greater than the median and the mode is less than the median.
31. A set of 10 scores from a test in psychology has a mean of 80.7. When the professor goes back to check the grades at a later date, she finds that one score was not recorded. The scores she recorded are 66, 72, 75, 76, 81, 86, 88, 90, and 94. What is the missing score?
32. An instructor records 12 tests in a college history class. The mean of those scores is 76.5. The instructor discovers later that a score of 86 was incorrectly recorded as 68. What should the correct mean be?
33. For the data set 4, 10, 7, 1, 5, do the following.
- Find the mean of the data.
  - Find the deviation from the mean for each value in the set.
  - Square each deviation from the mean in part (b).
  - Add up the squared deviations from part (c) and divide the total by the number of data values. What is this value called?
34. For the data set 9.1, 7.4, 12.6, 15.6, 11.3, 10.9, do the following.
- Find the mean of the data.
  - Find the deviation from the mean for each value in the set.
  - Square each deviation from the mean in part (b).
  - Add up the squared deviations from part (c) and divide the total by the number of data values. What is this value called?
35. Find the sample mean, sample variance, and sample standard deviation for each of the following data sets.
- 4, 6, 7, 10, 13
  - 2, 2, 1, 2, 4, 12
  - 3, 4, 4, 4, 5, 5, 5, 6

36. Find the sample mean, sample variance, and sample standard deviation for each of the following data sets.
- 3, 0, 4, 5, 14
  - 1, 2, 3, 10, 12, 17
  - 5, 5, 5, 6, 10, 11, 11, 11
37. Consider the data set 3, 10, 9, 7, 15.
- Find the mean and the sample standard deviation.
  - Modify the data set by adding 5 to each data value, and then find the mean and the sample standard deviation of the new data set.
  - How do the means from parts (a) and (b) compare? Give an explanation of why this result will be true in general.
  - How do the sample standard deviations from parts (a) and (b) compare? Explain why this result will be true in general.
38. Consider the data set 6, 7, 9, 12, 15.
- Find the mean and the sample standard deviation.
  - Modify the data set by subtracting 3 from each data value, and then find the mean and the sample standard deviation of the new data set.
  - How do the means from parts (a) and (b) compare? Explain why this result will be true in general.
  - How do the sample standard deviations from parts (a) and (b) compare? Explain why this result will be true in general.
39. Consider the data set 9, 7, 3, 10, 15.
- Find the mean and the sample standard deviation.
  - Modify the data set by multiplying each data value by 3, and then find the mean and the sample standard deviation of the new data set.
  - How do the means from parts (a) and (b) compare? Explain why this result will be true in general.
  - How do the sample standard deviations from parts (a) and (b) compare? Explain why this result will be true in general.
40. Consider the data set 12, 9, 7, 15, 6.
- Find the mean and the sample standard deviation.
  - Modify the data set by dividing each data value by 10, then find the mean and the sample standard deviation of the new data set.
  - How do the means from parts (a) and (b) compare? Explain why this result will be true in general.
  - How do the sample standard deviations from parts (a) and (b) compare? Explain why this result will be true in general.
41. Find the sample variance and sample standard deviation for the Boston Celtics' heights in Problem 1.
42. Find the sample variance and sample standard deviation for the Boston Celtics' weights in Problem 1.
43. For each of the following data sets, give an example or explain why it is not possible.
- A set of five values such that the population variance is zero.
  - A set of five values such that the population variance is negative.
44. For each of the following data sets, give an example or explain why it is not possible.
- A set of five values such that the sample standard deviation is zero.
  - A set of five values such that the sample variance is less than the sample standard deviation.