CHAPTER 2 ANSWERS

Section 2.1

Statistical Literacy and Critical Thinking

1 Qualitative data consist of values that can be placed in different non-numerical categories, (such as male, female, or Democrat, Republican), whereas quantitative data consist of values representing counts or measurements.

2 No. The numbers are a different way to represent names and they don't represent counts or measurements of anything, so they are qualitative data.

3 Yes. Data consist of either qualities or quantities (numbers), so all data are either qualitative or quantitative.

4 No. The zip codes do not consistently measure distance from the east coast or from any other reference point, so they are qualitative data.

Concepts and Applications

5 Blood groups are qualitative because they don't measure or count anything.

6 White blood cell counts are quantitative because they consist of the numbers of white blood cells per microliter of blood.

7 Reaction times are quantitative because they consist of measurements.

8 Specialties of surgeons are qualitative because they don't measure or count anything.

9 The answers to multiple choice questions are qualitative because they don't measure or count anything.

10 The yes/no responses are qualitative because they don't measure or count anything.

11 The television shows are qualitative data because they don't measure or count anything.

12 The number of households with a television in use when surveyed by Nielsen Media Research is quantitative because it consists of a count.

13 Head circumferences are quantitative because they consist of measurements.

14 Shoe sizes are quantitative data because they consist of measurements, even though the measurements are rounded.

15 The grade point averages are quantitative data since they are measures of course grades.

16 The area codes of the telephones of survey subjects are qualitative because they don't measure or count anything.

17 These data are discrete because they are obtained by counting the numbers of checked baggage pieces.

18 The weights are continuous data because they can be any value within some range of values. Nothing is being counted.

19 The numbers of flights are discrete because only the counting numbers (non-negative integers) are used. No values between any of these numbers are possible.

20 The lengths of time are continuous because they are measurements which can be any value within a range of values.

21 These data are continuous because they are measurements of time and can be any value within some range of values.

22 These data are continuous because they are measurements of time and can be any value within some range of values.

23 The numerical test scores are discrete data because they can be counting numbers only.

24 The numbers of cars crossing the Golden Gate Bridge each hour are discrete data because they can only be counting numbers.

25 The speeds of cars are continuous data because they are obtained by measuring

and can be any number within some range of values.

26 Movie ratings are discrete data because they can be only one of several values (not necessarily integers), with no values in between. Note that they are not the result of counting anything.

27 The numbers of stars are discrete data because they can be counting numbers only.

28 The amounts can be any number within some range of values, so they are continuous data.

29 Weights of textbooks are at the ratio level of measurement because there is a true zero.

30 Movie ratings are at the ordinal level of measurement because they can be put in order. They are not at the interval or ratio level of measurement because it is not possible to say that the differences between consecutive ratings are all the same.

31 Types of movies are qualitative data that cannot be ordered and thus can only be at the nominal level of measurement.

32 Body temperatures are usually measured on the Fahrenheit or Celsius scale. These are at the interval level of measurement because a zero temperature does not represent a status of "no heat."

33 Classifications of cars as subcompact, compact, intermediate, or full-size are ordinal data because they can be put in an increasing order. They are not at the interval level because there is no way to say the difference between a subcompact and a compact car is the same as the difference between a compact and an intermediate car.

34 These clinical trial results are at the nominal level of measurement. They have no numerical values and cannot be ordered. The categories are just names.

35 Final course grades are at the ordinal level because they are qualitative data that can be arranged in a meaningful order. We can say that an A is higher than a B, but the difference between an A and a B is not necessarily the same as the difference between a B and a C (or even between another A and B).

36 Distances traveled are at the ratio level of measurement because there is a true zero for distances.

37 Social Security Numbers are at the nominal level of measurement. Each one represents the name of a person.

38 Weights of Diet Coke are at the ratio level of measurement because there is a true zero for weights.

39 Numbers of words spoken are at the ratio level of measurement because there is a true zero.

40 Car safety ratings are at the ordinal level since they can be put in a sensible order, but it is not possible to say that the difference between a 0 and a 1 is the same as the difference between a 1 and a 2.

41 The ratio level does not apply. The ratio is not meaningful because the stars don't measure or count anything. Differences between star values are not meaningful, so the ratings are not even at the interval level, let alone the ratio level.

42 The ratio level applies since there is a true zero for speed.

43 The ratio level does not apply. IQ scores do not measure intelligence on the type of scale required for the ratio level. Essentially, they tell you where a person's intelligence falls within the population, so neither differences nor ratios are meaningful.

44 The ratio level does not apply to temperatures given in degrees Fahrenheit since zero degrees is an arbitrary setting and does not represent "no heat." Thus, the ratio of "twice" is not meaningful.

45 Since the age of anything cannot be less than zero, there is a true zero for age and the ratio level applies to ages.

46 The ratio level does apply to ages since there is a true zero for age. Thus

the word "twice" is meaningful.

47 The ratio level applies to salaries since there is a true zero for salaries. A salary of zero means "no pay."

48 The ratio level does not apply. SAT scores are on a scale from 600 to 2400. Since there is no true zero, SAT scores are not on a ratio level of measurement.

49 Times of runners are quantitative data, are on a ratio level of measurement, and are continuous. (There is a true zero and fractional values of seconds are possible.)

50 The home nations of runners are qualitative data and on an nominal level of measurement.

51 The ID numbers are qualitative and are at the nominal level of measurement. They are just another way to express the employees' names.

52 The data are quantitative and are at the ratio level of measurement. There is a true zero for length of service. The data are continuous since they represent time. While they may be reported to the nearest day, the times could be any value within some range.

53 The years in which employees were hired are quantitative and are at the interval level of measurement. The data are discrete because they consist of whole numbers only. The years are measured from an arbitrary reference point for year 0, not a natural zero starting point. Differences between the years are meaningful, but ratios are not meaningful.

54 The party data are qualitative and are at the nominal level of measurement. Even though numbers are used, they do not represent measurements or counts of anything.

55 The rating data are qualitative at the ordinal level of measurement. The ratings can be ordered, but they are not counts or measurements.

56 The data are qualitative at the nominal level of measurement. They represent categories only, not measurements or counts.

Section 2.2
Statistical Literacy and Critical Thinking

1 It is a random error because there is no way to predict when the clerk will write a number incorrectly, or whether the number will be too high or too low.

2 The absolute error is the difference between the true weight and the measured weight, 1.002 kg – 1.000 kg = 0.002 kg. The relative error is the ratio of the absolute error to the true value, 0.002/1.000 = 0.002 or 0.2%.

3 Accuracy is measured by the relative error, (1.2034278 – 1)/1 = 0.2034278 or 20.3%. Thus the measurement is off by 20.3%. This is not very accurate given the ease of carrying out the measurement. The measurement is very precise because the recorded height has 7 decimal places.

4 The reported population is very precise; in fact, it is exact. However, it not likely to be very accurate because it is impossible to keep track of births, deaths, and immigration well enough to know exactly what the population is at any given time.

5 This statement does not make sense. The number is too precise. Someone has found references to this many species, so there should be at least this many. However, there may be some species that are known to only a small number of people, and there may be some species that have not yet been found.

6 This statement does not make sense. Since relative error is the ratio of the absolute error and the true size of the thing being measured, the relative error takes the true size of the object into account. It is possible to have a 1% relative error for a distance measured in light years and a 3% error for something microscopic.

7 This statement is reasonable. If errors are random, we expect that about half of the errors will be in favor of the supermarket and half will be in

favor of the customer.

8 This statement does not make sense. The number is very precise because it is carried out to three decimal places, but that does not mean that it is accurate.

Concepts and Applications

9 Mistakes should lead to random errors. Dishonesty should lead to systematic errors that benefit the taxpayer.

10 This is a systematic error resulting in altimeter readings that are too low by 2780 feet throughout the entire flight.

11 Because about half of the batteries have voltages higher than 3.7 volts and half have less than 3.7 volts, these appear to be random errors in measurement or random errors in the manufacturing process.

12 This is a systematic error that results in an underestimation of the true fatality rate where alcohol is involved.

13 Random errors could occur when reported incomes are recorded incorrectly or when survey respondents don't know their exact donations. Systematic errors could occur when people tend to report higher donations than they actually have in order to lower their taxable income and pay less in taxes.

14 Random errors could occur when taxpayers make honest mistakes or when the income amounts are recorded incorrectly. Systematic errors could occur if all or most of the tax returns were prepared using a computer program that calculated incomes incorrectly, but the same way for everyone.

15 Random errors could occur when passengers don't know their exact weight; systematic errors could result when passengers lie about their weight by reporting a weight that is considerably lower than their actual weight.

16 Random errors could occur with reading the scale or with a scale that is inaccurate. A systematic error occurs by incorrectly including the weight of the cup with the weight of each M&M.

17 Random errors could occur with an inaccurate radar gun or with honest mistakes made when the officer records the speeds. Systematic errors could occur with a radar gun that is incorrectly calibrated so that it consistently reads too high or too low.

18 Random errors occur with mistakes made in the calculations or honest mistakes made in assigning values to the products. Systematic errors could occur with counterfeit products that are bought and sold without the knowledge of the police, or the tendency of the police to exaggerate the value of the counterfeit goods sold.

19 Random errors occur with errors in calculations or by cigarettes that are bought outside the city and smoked inside (or vice versa). A systematic error might occur if there are cigarettes illegally obtained without tax stamps and no tax is therefore reported. The number of packs sold would then be systematically underreported.

20 Random errors occur when the groundskeeper positions the rule too far or too short from the previous measurement. A systematic error occurs if the groundskeeper consistently locates the rule too far from its previous position (or overlaps its previous position), or by measuring along a path that is not parallel to the ends or sides of the field.

21 The absolute error is \$1750. The correct bill is \$2995 - \$1750 = \$1245. Therefore the relative error is \$1750/\$1245 = 1.41 or 141%.

22 The absolute error is 20 oz – 18 oz = 2 oz. The relative error is 2/18 = 0.111 or 11.1%.

23 The absolute error is \$1.75 - \$2.75 = -\$1.00; the relative error is –\$1.00/\$2.75 or -36.4%.

24 The absolute error in the menu is 12 – 13 = -1 doughnut. The relative error is -1/13 = -0.077 or -7.7%.

25 a) These errors are random. If they were systematic, there would be a

tendency for the measurements all to be too high or all to be too low.

b) It is better to report the average of the 25 measurements. It is likely to be in error by less than most of the individual measurements and is more reliable than any single measurement.

c) Systematic errors might result from a problem with the measuring device or with the definition of the "length of the room" or from measuring along a path that is not perpendicular to the end walls of the room. They could also occur if all the students had been incorrectly taught how to use the tape measure.

d) No. If there is a systematic error in the measurements, that same error will be present in the average.

26 a) These errors are random. If they were systematic, there would be a tendency for the measurements to be all too high or to be all too low.

b) It is better to report the average of the 10 measurements. It is likely to be in error by less than most of the individual measurements and is more reliable than any single measurement.

c) Systematic errors might result from the weighing device consistently showing a weight that is higher (or lower) than the actual weights.

d) No. If there is a systematic error in the measurements, that same error will be present in the average.

27 The Department of Transportation is more precise because its weights are given to the nearest 0.1 lb. This is more precise than the nearest 10 pounds of the manufacturer's scale. The manufacturer's scale is more accurate because it is in error by only 23 pounds while the DOT scale is in error by 25.2 pounds.

28 The 175.5 cm is more precise because it is given to the nearest .1 cm, but the 175 cm is more accurate because 175 is closer to 175.2 than is 175.5.

29 The digital scale is more precise (0.01 kg < .5 kg), and the digital scale is more accurate since 52.88 is closer to 52.55 than 53 is to 52.55. (This assumes that your actual weight is what you thought it was.)

30 The digital scale is more precise (0.01 kg < .5 kg), but the clinic scale is more accurate since 52.5 is closer to 52.55 than 51.48 is to 52.55. (This assumes that your actual weight is what you thought it was.)

31 No one could possibly know the exact population of the United States today, let alone in 1860, so the claim as to the exact value of the population is not believable.

32 The given number is very precise, but it is not likely to be accurate. Some crash victims died long after the crash and may not be included in the total. Some reporting errors are likely, and some deaths might have questionable causes such as death due to a heart attack just before or during a crash.

33 The given number is very precise, but it is not likely to be accurate. There are many people in China who are not counted. In addition, the population of China changed often during the year and probably during the census. The census of any nation is likely to be in error by considerable amounts just due to the inherent difficulties of conducting a national census.

34 It is easy to accurately measure the height of a building with precision to the nearest foot, so the claim is believable. It would be a good idea to verify the source before quoting this number.

35 It is easy to accurately measure the height of a structure with a reasonable degree of precision, say to the nearest 0.1 foot, but the given number has far too much precision, to the nearest 10 billionth of a foot, so the claim is not believable.

36 The number of cell phone users is constantly changing, and it probably cannot be determined with great accuracy, but the reported number is not very precise, so it is believable, though we would need more information to know if it really is accurate.

37 The number of college students is constantly changing with new enrollments, graduations, and dropouts, so the given number must be an estimate. The

precision of the given number is probably unjustified. The number given may be approximately correct, but we would need more information to know if it is really accurate.

38 The government actually maintains a list of the species endangered or threatened, and it is easy to count the species on the list, so the claim is believable. Of course, the number should be verified before you use it since species are periodically added to the list while some species have been removed from the list.

Section 2.3
Statistical Literacy and Critical Thinking

1 a) The absolute change in the budget is $5333 million – $4919 million $414 million.

b) The relative change in the budget is $414 million/ $4919 million = 0.084 or 8.4%.

c) The percentage change is (5185 – 5333)/5333 = -0.028 or -2.8%. Thus, there is a decrease of 2.8%.

d) 5% of $5333 million is 0.05 x $5333 million = $266.65 million. Thus, the new budget will be $5333 million - $266.65 million = $5066.35 million.

2 If all of the plaque is removed, 100% of it is removed. It is not possible to remove any more, so the 300% figure is incorrect.

3 There is a distinction to be made between percent and percentage points. The actual margin of error is 3 percentage points, meaning that we are 95% confident that the true percent is somewhere in the range from 22% to 28%. By saying that the margin of error is 3.0%, the statement (probably unintentionally) implies that the error can be up to 3.0% of 25%, or 0.75%. This would mean that the confidence interval had a much smaller range, from 24.25% to 25.75%.

4 Forty-four percent of 1072 is 0.44(1072) = 472. Five percent more than 1072 is 1072 + 0.05(1072) = 1126.

5 The statement does not make sense. The **number** of people with cell phones may have increased by 1.2 million people, but 1.2 million people is not a percentage.

6 The statement does not make sense. The two percentages refer to different base amounts, so they are not the same. The 5% cut is more than the 5% increase. For example, if an employee has a $100,000 salary, the 5% cut would reduce that salary to $95000, but the 5% raise would increase the salary to $95000 + 0.05(95000) = $99750.

7 This makes sense. The 100% increase indicates that the loan rate doubled. For example, if the loan rate went from 4% to 8%, the increase was (8 – 4)/4 = 1.00 or 100%, and the rate was doubled.

8 This does not make sense. For example, if the annual loan rate were 5%, an increase of 100 percentage points would make the new loan rate 105% - far higher than any reputable bank would charge. The bank would not likely be able to make any loans at that rate due to the competition of other banks.

Concepts and Applications

9 a) 75% is the same as 75/100 = 3/4 = 0.75 (or 75%)

b) 3/8 = 0.375 = 37.5%

c) 0.4 is the same as 4/10 or 2/5 = 0.40 = 40%

d) 80% is the same as 80/100 or 4/5 = 0.80 = 80%

10 a) 350% is the same as 350/100 or 7/2 = 3.5 = 350%

b) 2.5 is the same as 5/2 = 250/100 = 250%

c) -0.44 is the same as -44/100 or -11/25 = -0.44 = -44%

d) -200% is the same as -200/100 or -2/1 = -2.00 or -200%

11 a) 956 of 1348 pled guilty. This is 956/1348 = 0.71 or 71%
b) 392 + 58 = 450 were sent to prison. Thus 450/1348 = 0.33 = 33%, so 33% were sent to prison.
c) 392/956 = 0.41 = 41%, so 41% of those pleading guilty were sent to prison.
d) 58/72 = 0.81 = 81%, so 81% of those pleading not guilty were sent to prison.

12 a) 29015/49437 = 0.59 = 59%, so 59% of the trials involved flipping pennies.
b) 20422/49437 = 0.41 = 41%, so 41% of the trials involved spinning pennies.
c) 14709/29015 = 0.51 = 51%, so 51% of the flips resulted in heads.
d) 9197/20422 = 0.45 = 45%, so 45% of the spins resulted in heads.

13 (1387 – 2226)/2226 = -0.37 = -37%, so there is a 37% decrease in the number of daily newspapers from 1900 in the U.S.

14 (143,781,202 - 121,601,000)/121,601,000 = 0.18 = 18%, there is an 18% increase from 1980 in registered passenger cars.

15 (751183 – 634343)/634343 = 0.18 = 18%, so there is an 18% increase in passenger flights from 1996.

16 (1,531,997 – 1,276,900)/1,276,900 = 0.20 = 20%, so there is a 20% increase in the number of bankruptcies filed from the year 2000.

17 (2.09 million – 1.83 million)/ 1.83 million = 0.14 = 14%, so the *Wall Street Journal* circulation is 14% more than the *USA Today* circulation, or 114% of the *USA Today* circulation.

18 (18830 – 18341)/18,341 = 0.03 = 3%, so the Toyota Camry sold 3% more cars than the Honda Civic.

19 (67 million – 89 million)/89 million = -0.25 = -25%, so O'Hare handled 25% fewer passengers than Atlanta's Hartsfield Airport.

20 (78 million – 58 million)/58 million = 0.34 = 34%, so France had 34% more international tourists than did the U.S.

21 4.8% of 1385 = 0.048(1385) = 66, so 66 said that they do not make personal phone calls.

22 47% of 150 = 0.47(150) = 71, so 71 executives said that the most common interview mistake is to have little or no knowledge of the company.

23 83% of 1005 = 0.83(1005) = 834, so 834 of those adults surveys reported having more than one television at home.

24 89% of 9132 = 0.89(9132) = 8127, so 8127 of 9132 adults surveyed reported using a cell phone.

25 40% more than 100% is 140%, so the truck's weight is 140% of the car's weight.

26 Norway's area is 24% more than 100% of Colorado's area, so Norway's area is 124% of Colorado's area.

27 The population of Montana is 20% less than 100% of the population of New Hampshire, so Montana's population is 80% of New Hampshire's population.

28 The Vice-President's salary is 42% less than 100% of the President's salary, so the Vice-President's is 58% of the President's salary.

29 Yes. Reporting the error as 3% would imply that it was 3% of 89% or 0.03(0.89) = 0.0267 or 2.67 percent. The correct confidence interval is from 86% to 92%, whereas the implied confidence interval would be from 86.33% to 91.67%. In practical terms, there is not much difference in this case, but there is a very large difference when the reported percentage is small, say 11% instead of 89%.

30 The range from 14% to 18% can also be expressed as 16% $\pm$ 2%, so the margin of error is 2 percentage points.

31 The decrease in the percentage of high school seniors using alcohol is 68.2% - 52.7% = 15.5% or 15.5 percentage points. Since (52.7 – 68.2)/68.2 = -0.23 = -23%, there has been a 23% decrease from 1975 to now in the percent of high school seniors using alcohol.

32 Since 27.1% – 19.5% = 7.6%, there has been a decrease of 7.6 percentage points in the number of people living in developed countries from 1970 to now. The relative change is (19.5 – 27.1)/27.1 = -0.28 = -28%. There has been a 28% decrease in the percentage of the world's population living in developed countries from 1970 to now.

33 The five-year survival rate for Caucasians for all forms of cancer increased 22 percentage points between the 1960s and the 1990s. This is a relative change of (new value - reference value)/ reference value = (61 - 39)/39 = 22/39 = 0.564 = 56.4% or an increase of 56.4%.

34 The five-year survival rate for blacks for all forms of cancer increased 21 percentage points between the 1960s and now. This is a relative change of (new value - reference value)/ reference value = (48 - 27)/27 = 21/27 = 0.778 = 77.8% or an increase of 77.8%.

Section 2.4
Statistical Literacy and Critical Thinking

1 An index number is a ratio without any units, such as dollars. The number appears to be the actual cost of gasoline in 2011, not an index number.

2 Computer costs in 2012 are 15% of those in the year 2000.

3 Yes. The Consumer Price Index is based on the prices of goods, services, and housing, so if the prices in all three areas increase, the CPI must increase as well.

4 No. The Consumer Price Index is based on prices of goods, services, and housing, so wages can rise or fall independent of the CPI.

Concepts and Applications

5 $Index = \frac{Price\ Today}{Price\ 1980} = \frac{5.00}{1.22} = 4.098 = 409.8\%$
Thus the price index number for gasoline today is 409.8 with the 1980 price as the reference value.

6 $Index = \frac{Price\ in\ 2006}{Price\ 1980} = \frac{2.62}{1.22} = 2.148 = 214.8\%$. Thus the price index number for gasoline in 2006 was 214.8 with the 1980 price as the reference value.

7 The cost of gasoline in 1998 is the 1980 price multiplied by the 1998 price index expressed as a decimal or \$1.22(0.9) = \$1.10 per gallon.

8 The cost of gasoline in 2005 is the 1980 price multiplied by the 2005 price index expressed as a decimal or \$1.22(1.893) = \$2.31 per gallon.

9 To determine the gasoline price index using the 2000 price as the reference value, divide each of the other prices by the 2000 price and express the result as a percentage. For example, the 1960 price index is found from 0.31/1.56 = 0.199 = 19.9%, resulting in a price index of 19.9. The other price indices are found similarly.

Year	Price	Price as a Percentage of 2000 Price	Price Index (2000 = 100)
1960	$0.31	19.9%	19.9
1970	$0.36	23.1%	23.1
1980	$1.22	78.2%	78.2
1990	$1.23	78.8%	78.8
2000	$1.56	100.0%	100.0
2010	$2.84	182.1%	182.1

10 To determine the gasoline price index using the 1970 price as the reference value, divide each of the other prices by the 1970 price and express the result as a percentage. For example, the 1960 price index is found from 0.31/0.36 = 0.861 = 86.1%, resulting in a price index of 86.1. The other price indices are found similarly, dividing the price by the 1970 price.

Year	Price	Price as a Percentage of 1970 Price	Price Index (1970 = 100)
1960	$0.31	86.1%	86.1
1970	$0.36	100.0%	100.0
1980	$1.22	338.9%	338.9
1990	$1.23	341.7%	341.7
2000	$1.56	433.3%	433.3
2010	$2.84	788.9%	788.9

11 Using Table 2.1, which uses 1980 as the reference year, we see that the 2010 gasoline price index is 232.8. Since the gasoline costs are in the same ratio as the gasoline price indices,

$\frac{Cost\ in\ 2010}{Cost\ in\ 1980} = \frac{Price\ Index\ in\ 2010}{Price\ Index\ in\ 1980}$.

Therefore, $Cost\ in\ 2010 = (Cost\ in\ 1980)\frac{Price\ Index\ in\ 2010}{Price\ Index\ in\ 1980} = \$19.52\frac{232.8}{100.0} = \$45.44$

Note: Due to rounding in finding the gasoline price indices, this amount may be off by a penny or two.

12 Using the table constructed in Exercise 9, which uses 2000 as the reference year, we see that the 2010 gasoline price index is 182.1. This means that the 2010 cost will be 1.821 times the 2000 cost. Thus the 2010 cost will be 1.821 x $23.40 = $42.61.

13 The private college tuition in 2010 is $37000/5600 = 6.607 or 660.7% of the amount in 1980, but the CPI in 2010 is 218.1/82.4 = 2.647 or 264.7% of the CPI in 1980. Thus the cost of private college tuition rose much more than the cost of typical goods, services, and housing.

14 The public college tuition in 2010 is $16100/2550 = 6.314 or 631.4% of the amount in 1980, but the CPI in 2010 is 218.1/82.4 = 2.647 or 264.7% of the

CPI in 1980. Thus the cost of public college tuition rose much more than the cost of typical goods, services, and housing.

15 The median price in 2010 is 122000/75300 = 1.620 or 162.0% of the price in 1990 while the CPI in 2010 is 218.1/130.7 = 1.669 or 166.9% of the CPI in 1990. Thus the cost of homes in the South rose at a lower rate than the CPI.

16 The median price in 2010 is 235600/129600 = 1.818 or 181.8% of the price in 1990 while the CPI in 2010 is 218.1/130.7 = 1.669 or 166.9% of the CPI in 1990. Thus the cost of homes in the West rose at a higher rate than the CPI.

17 $Price\ in\ Miami = \frac{Index\ in\ Miami}{Index\ in\ Denver} XPrice\ in\ Denver = \frac{194}{100}(300{,}000) = \$582{,}000$

$Price\ in\ Cheyenne = \frac{Index\ in\ Cheyenne}{Index\ in\ Denver} XPrice\ in\ Denver = \frac{60}{100}(300{,}000) = \$180{,}000$

18 $Price\ in\ Baltimore = \frac{Index\ in\ Baltimore}{Index\ in\ Boston} XPrice\ in\ Boston = \frac{150}{358}(500{,}000) = \$209{,}497$

$Price\ in\ Phoenix = \frac{Index\ in\ Phoenix}{Index\ in\ Boston} XPrice\ in\ Boston = \frac{86}{358}(500{,}000) = \$120{,}112$

19 $Price\ in\ SF = \frac{Index\ in\ SF}{Index\ in\ Cheyenne} XPrice\ in\ Cheyenne = \frac{382}{60}(250{,}000) = \$1{,}591{,}667$

$Price\ in\ Boston = \frac{Index\ in\ Boston}{Index\ in\ Cheyenne} XPrice\ in\ Cheyenne = \frac{358}{60}(250{,}000) = \$1{,}491{,}667$

20 $Price\ in\ SF = \frac{Index\ in\ SF}{Index\ in\ Boston} XPrice\ in\ Boston = \frac{382}{358}(1{,}000{,}000) = \$1{,}067{,}039$

$Price\ in\ Cheyenne = \frac{Index\ in\ Cheyenne}{Index\ in\ Boston} XPrice\ in\ Boston = \frac{60}{358}(1{,}000{,}000) = \$167{,}598$

Chapter 2 Review Exercises

1 a) 26% of 2303 is the same as 0.26(2303) = 599
b) The data are discrete because only the counting numbers are used.
c) 1382/2303 = 0.60 or 60%
d) 53% of 1382 is the same as 0.53(1382) = 732
e) Ratio. There is a true zero for ages.
f) Nominal.

2 a) 36% of 671 is the same as 0.36(671) = 242
b) 40 out of 671 is 40/671 = 0.060 or 6.0%
c) Nominal
d) Since the respondents are self-selected, the sample is not likely to reflect the opinions of the general population.

3 2,500,000,000,000/80,000,000,000 = 31.25, so the cost of health care increased by a factor of 31.25 or 3125%. The CPI increased by a factor of 218.1/44.4 = 4.91 or 491%, so the cost of health care increased at a rate much higher than that for goods, services, and housing.

4 a) \$2.78
b) \$5.77
c) The minimum wage did not keep up with inflation, so workers earning the minimum wage had **relatively** lower wages in 2009 than they did in 1996.

Chapter 2 Quiz

1 The data are continuous since heights can take on any value within a given range.

2 The data are at the ratio level of measurement since there is a true zero for heights.

3 The absolute error is 91.4 cm – 89.0 cm = 2.4 cm.

4 The relative error = absolute error/ true value = 2.4/89.0 = 0.027 or 2.7%.

5 Nominal since states are just categories

6 38/750 = 0.051 = 5.1%

7 5% of 1038 is 0.05 x 1038 = 52, so 52 of the respondents said that second-hand smoke is not at all harmful.

8 The first makes an absolute error of -0.44 cm, while the second makes an error of 0.74 cm. The first one makes a smaller error and is therefore more accurate. The second measurement is more precise because it is recorded to more decimal places.

9 The index number for the second year is the ratio, in percent, of the second year net profit to that of the first year or 15257/12335 = 1.237 or 123.7%. Thus the index number for the second year is 123.7.

10 The projected profit for the sixth year is $47,296 + (0.12)($47,296) = $52,972.