8. *Basic Types of Quantitative Comparisons*

PROBLEM SET

1. Identify the type of quantitative comparison used in each of the following statements:

   a. "Yesterday, New York City received 5.5 inches of snow."
   b. "Ian Thorpe's margin of victory in the 400-meter freestyle was 0.74 seconds."
   c. "A 30-year-old man has 0.59 times the odds of migrating as a 20-year-old man."
   d. "The Dow Jones Industrial Average dropped 0.6% since this morning's opening."
   e. "Women's GPAs are on average 0.26 points higher than men's GPAs."
   f. "Cornstarch has twice the thickening power of flour; for each teaspoon of flour called for in a recipe, substitute one-half teaspoon of cornstarch."
   g. "Median income for the metro region was $31,750."
   h. "Among males, self-esteem averages nearly half a standard deviation unit lower among widowers than among nonwidowers."
   i. "Sixty-eight percent of registered voters turned out for the primary election."
   j. "State U was seeded first in the tournament."

2. In the 2000 presidential election, Al Gore received 50,996,116 votes while George W. Bush received 50,456,169 votes.

   a. Write a sentence to describe the ranks of the two candidates.
   b. Calculate the difference between the numbers of votes each candidate received. What impression does that information alone convey?
   c. Calculate the percentage difference between the numbers of votes each candidate received. What impression does that information give?

3. Indicate whether each of the following statements is correct. If not, rewrite the second part of the sentence to agree with the first.

   a. "Brand X lasts longer than Brand T, with an average lifetime 40% as high as Brand T's."

   b. "The unemployment rate increased 25% since last year, from 4.0% to 5.0%."

   c. "The ratio of flour to butter in shortbread is 2:1; the recipe uses twice as much butter as flour."

   d. "At this time of year, reservoirs are usually 90% full. Currently, with reservoirs at 49% of capacity, water levels are only about 54% of normal."

   e. "Nadia's test score was higher than 68% of students nationwide ($Z = 1.0$)."

   f. "A panel of 200 consumers rated ISP A four to one over ISP B. In other words, four more panelists preferred Company A as their Internet service provider."

   g. "Matt is in the top decile for height. He is among the tallest 10% of boys his age."

   h. "The coefficient dropped 15% between the unadjusted and adjusted models, decreasing from 2.0 to 1.7."

   i. "The value of mutual fund ABCD tripled since last year, going from 100 to 33."

4. In the 1999 Diallo case in New York City, 41 bullets hit the victim. Write down the criteria that you would intuitively use to interpret that number: against what are you comparing the number of bullets?

5. Each of the following statements correctly describes part of table 8A, but each description is incomplete. Fill in the missing information.

TABLE 8A. Median income by race and Hispanic origin, United States, 1999

Race/Hispanic origin	Median income
White	$42,504
Black	$27,910
Asian/Pacific Islander	$51,205
Hispanic (can be of any race)	$30,735

Source: US Bureau of the Census, *Statistical Abstract of the United States*, 2001, table 662.

   a. "Asians make about twice as much income."

   b. "Hispanics earn $2,825 more."

   c. "Whites rank second."

   d. "The percentage difference for Asians was 20%."

6. Use table 8B to perform the tasks listed below.

TABLE 8B. Price per gallon for regular unleaded gasoline at selected gas stations, June 2011 and June 2012

Gas station	June 2011	June 2012
AAA	$1.45	$1.71
Bosco	$1.37	$1.75
Cargo	$1.48	$1.68
Dart	$1.30	$1.66
Essow	$1.46	$1.74

a. Rank the stations from highest to lowest gas price for each of the two dates.
b. Write a description of the distribution of prices in each year. Use difference and ratio in your description to compare the two distributions.
c. Describe how you might use rank in conjunction with difference or ratio in deciding where to buy gas.

7. For each of the phrases listed below, identify other phrases on the list that have the same meaning; write the equivalent dollar value, assuming comparison against a price of $200; and write the corresponding ratio. For statement a, for example, the equivalent dollar value would be $50 and the corresponding ratio would be 0.25.

a. "25% of the original price"
b. "costs 25% less than . . ."
c. "costs 25% more than . . ."
d. "priced 25% off"
e. "125% of the original price"
f. "marked down 75%"
g. "75% of the original price"
h. "costs 75% as much as . . ."

8. The homicide rate in Texas dropped from 16 homicides per 100,000 persons in 1990 to 10 per 100,000 in 1995. Calculate and write sentences to describe

a. the differences between the homicide rates in the two periods;
b. the ratio of the homicide rates in the two periods;
c. the percentage change between the two periods using
    i. the 1990 rate as the denominator;
    ii. the average of the two rates as the denominator.

9. In table 8C, fill in the z-score for height for each boy in the sample.

TABLE 8C.1. Heights of a sample of six-year-old boys

Name	Height (cm)	Z-score
David	117.51	
Jamal	113.90	
Ryan	124.81	
Luis	115.45	
JC	112.73	

SD = standard deviation (standard population: mean = 115.12 cm; SD = 4.78 cm)

a. Describe how Ryan's, Luis's, and JC's heights compare to the national norms for boys their age based on their z-scores. (See table 8.3 in *Writing about Multivariate Analysis*, *2nd Edition* for ways to avoid using the phrase "z-scores" as you write).

    b. Two boys have heights about equidistant from the mean—one above and one below average. Who are they and about how far are their heights from those of average six-year-old boys? Report the difference in terms of standard deviation units.

    c. A new boy, Mike, joins the class. He is one standard deviation taller than the average six-year-old boy. How tall is Mike?

10. One thousand people lived in Peopleland in 2000 and the population was growing at an annual rate (r) of 2.0% per year.

TABLE 8D. Population of Peopleland, 2000–2010

Year	Population	Increase from previous year	Cumulative increase since 2000	Percentage change since 2000
2000	1,000			
2001				
2002				
2003				
2004				
2005				
2006				
2007				
2008				
2009				
2010				

    a. Use the formula $P_t = P_0 \times e^{rt}$ to fill the population for each year into table 8D. The year 2000 is year 0, t is the number of years since 2000, r (the annual growth rate, expressed as a proportion) is 0.02, and e is the base of the natural logarithms (2.718).

    b. Calculate the increase in population from the preceding year. Write a sentence explaining the pattern of annual population increase across the 10-year period.

    c. The cumulative increase is the total number of people added to the population since 2000. How many more people live in Peopleland in 2010 than in 2000?

    d. Calculate the percentage change relative to 2000 for each year. Write a sentence to describe the percentage change in population between 2000 and 2010.

    e. What is the ratio of the population size for 2010 compared to 2000? How does that ratio relate to the percentage change over that 10-year period?

    f. How do the annual rate of growth and the percentage change between 2000 and 2010 relate?

11. Suppose the adjusted odds ratio of hospital admission for diabetics compared to nondiabetics is 3.5.

    a. If 5% of the population is diabetic, calculate the attributable risk of hospital admission associated with diabetes.

    b. Write a sentence explaining that result without using the term "attributable risk."