## **Chapter 24 Textbook Questions**

## **EXERCISES**

- 1. **Dogs and calories.** In July 2007, *Consumer Reports* examined the calorie content of two kinds of hot dogs: meat (usually a mixture of pork, turkey, and chicken) and all beef. The researchers purchased samples of several different brands. The meat hot dogs averaged 111.7 calories, compared to 135.4 for the beef hot dogs. A test of the null hypothesis that there's no difference in mean calorie content yields a P-value of 0.124. Would a 95% confidence interval for  $\mu_{Meat} \mu_{Beef}$  include 0? Explain.
- of beef and meat hot dogs. The resulting 90% confidence interval for  $\mu_{Meat} \mu_{Beef}$  is (-6.5, -1.4).
- a) The endpoints of this confidence interval are negative numbers. What does that indicate?
- b) What does the fact that the confidence interval does not contain 0 indicate?
- c) If we use this confidence interval to test the hypothesis that  $\mu_{Meat} \mu_{Beef} = 0$ , what's the corresponding alpha level?

**3. Dogs and fat.** The *Consumer Reports* article described in Exercise 1 also listed the fat content (in grams) for samples

- b) If we had created a 98% CI, would the margin of error be larger or smaller?
- c) Explain what the calculated interval means in context.
- d) Does this result suggest that students who learn Mathematics with CPMP will have significantly higher mean scores in Algebra than those in traditional programs? Explain.

7. Learning math. The Core Plus Mathematics Project (CPMP) is an innovative approach to teaching Mathematics that engages students in group investigations and mathematical modeling. After field tests in 36 high schools over a three-year period, researchers compared the performances of CPMP students with those taught using a traditional curriculum. In one test, students had to solve applied Algebra problems using calculators. Scores for 320 CPMP students were compared to those of a control group of 273 students in a traditional Math program. Computer software was used to create a confidence interval for the difference in mean scores. (Journal for Research in Mathematics Education, 31, no. 3[2000])

Conf level: 95% Variable: Mu(CPMP) - Mu(Ctrl) Inter val: (5.573, 11.427)

a) What's the margin of error for this confidence interval?

**Children's cereals:** 40.3, 55, 45.7, 43.3, 50.3, 45.9, 53.5, 43, 44.2, 44, 47.4, 44, 33.6, 55.1, 48.8, 50.4, 37.8, 60.3, 46.6

**Adults' cereals:** 20, 30.2, 2.2, 7.5, 4.4, 22.2, 16.6, 14.5, 21.4, 3.3, 6.6, 7.8, 10.6, 16.2, 14.5, 4.1, 15.8, 4.1, 2.4, 3.5, 8.5, 10, 1, 4.4, 1.3, 8.1, 4.7, 18.4

- 11. Commuting. A man who moves to a new city sees that there are two routes he could take to work. A neighbor who has lived there a long time tells him Route A will average 5 minutes faster than Route B. The man decides to experiment. Each day he flips a coin to determine which way to go, driving each route 20 days. He finds that Route A takes an average of 40 minutes, with standard deviation 3 minutes, and Route B takes an average of 43 minutes, with standard deviation 2 minutes. Histograms of travel times for the routes are roughly symmetric and show no outliers.
  - a) Find a 95% confidence interval for the difference in average commuting time for the two routes.
  - b) Should the man believe the old-timer's claim that he can save an average of 5 minutes a day by always driving Route A? Explain.

15. Reading. An educator believes that new reading activities for elementary school children will improve reading comprehension scores. She randomly assigns third graders to an eight-week program in which some will use these activities and others will experience traditional teaching methods. At the end of the experiment, both groups take a reading comprehension exam. Their scores are shown in the back-to-back stem-and-leaf display. Do these results suggest that the new activities are better? Test an appropriate hypothesis and state your conclusion.

New Activities		Control
	1	07
4	2	068
3	3	377
96333	4	1222223 <i>8</i> 355
9876432	5	355
721	6	02
1	7	
	8	5
'		

Name A agreement of the Company

13. Cereal. The data below show the sugar content (as a percentage of weight) of several national brands of children's and adults' cereals. Create and interpret a 95% confidence interval for the difference in mean sugar content. Be sure to check the necessary assumptions and conditions.

- batters to hit the ball a long way. Do you think the 10.5 runs scored per game at Coors is unusual? Explain.
- d) Explain why you should not use two separate confidence intervals to decide whether the two leagues differ in average number of runs scored.

17. Baseball 2006. American League baseball teams play their games with the designated hitter rule, meaning that pitchers do not bat. The league believes that replacing the pitcher, traditionally a weak hitter, with another player in the batting order produces more runs and generates more interest among fans. Below are the average numbers of runs scored in American League and National League stadiums for the 2006 season.

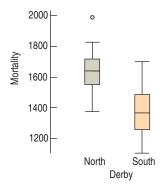
11.4 9.9 1	0.5	9.5
10.5 9.7 10	0.3	9.4
10.4 9.1 10	0.0	9.1
10.3 9.0 10	0.0	9.0
10.2 9.0	9.7	9.0
10.0 8.9	9.7	8.9
9.9 8.8	9.6	8.9
	9.5	7.9

- a) Create an appropriate display of these data. What do you see?
- b) With a 95% confidence interval, estimate the mean number of runs scored in American League games.
- c) Coors Field, in Denver, stands a mile above sea level, an altitude far greater than that of any other National League ball park. Some believe that the thinner air makes it harder for pitchers to throw curve balls and easier for

- 19. Double header 2006. Do the data in Exercise 17 suggest that the American League's designated hitter rule may lead to more runs?
  - a) Using a 95% confidence interval, estimate the difference between the mean number of runs scored in American and National League games.
  - b) Interpret your interval.
  - c) Does that interval suggest that the two leagues may differ in average number of runs scored per game?
- 20. Hard water. In an investigation of environmental causes of disease, data were collected on the annual mortality rate (deaths per 100,000) for males in 61 large towns in England and Wales. In addition, the water hardness was recorded as the calcium concentration (parts per million, ppm) in the drinking water. The data set also notes, for each town, whether it was south or north of Derby. Is there a significant difference in mortality rates in the two regions? Here are the summary statistics.

Summar y of:		mortality		
For categories in:		Derby		
Group	Count	Mean	Median	StdDev
North	34	1631.59	1631	138.470
South	27	1388.85	1369	151.114

- a) Test appropriate hypotheses and state your conclusion.
- b) On the next page, the boxplots of the two distributions show an outlier among the data north of Derby. What effect might that have had on your test?



	Program Type		
	Violent	Sexual	Neutral
No. of subjects Brands recalled	108	108	108
Mean	2.08	1.71	3.17
SD	1.87	1.76	1.77

- a) Do these results indicate that viewer memory for ads may differ depending on program content? A test of the hypothesis that there is no difference in ad memory between programs with sexual content and those with violent content has a P-value of 0.136. State your conclusion.
- b) Is there evidence that viewer memory for ads may differ between programs with sexual content and those with neutral content? Test an appropriate hypothesis and state your conclusion.

23. Sex and violence. In June 2002, the Journal of Applied Psychology reported on a study that examined whether the content of TV shows influenced the ability of viewers to recall brand names of items featured in the commercials. The researchers randomly assigned volunteers to watch one of three programs, each containing the same nine commercials. One of the programs had violent content, another sexual content, and the third neutral content. After the shows ended, the subjects were asked to recall the brands of products that were advertised. Here are summaries of the results:

27. **Hungry?** Researchers investigated how the size of a bowl affects how much ice cream people tend to scoop when serving themselves. 10 At an "ice cream social," people were randomly given either a 17 oz or a 34 oz bowl (both large enough that they would not be filled to capacity). They were then invited to scoop as much ice cream as they liked. Did the bowl size change the selected portion size? Here are the summaries:

Small Bowl		Large Bowl	
$\frac{n}{\overline{y}}$	26 5.07 oz 1.84 oz	$\frac{n}{\overline{y}}$	22 6.58 oz 2.91 oz

Test an appropriate hypothesis and state your conclusions. Assume any assumptions and conditions that you cannot test are sufficiently satisfied to proceed.