

12-1

3. **Late Flight Comparison Across Airlines.** The sample data below represent the number of late and on time flights for Delta, United, and US Airways.

Flight	Airline		
	Delta	United	US Airways
Late	39	51	56
On Time	261	249	344

- Formulate the hypotheses for a test that will determine if the population proportion of late flights is the same for all three airlines.
 - Conduct the hypothesis test with a .05 level of significance. What is the p -value and what is your conclusion?
 - Compute the sample proportion of late flights for each airline. What is the overall proportion of late flights for the three airlines?
7. **Use of Social Media.** Social media is becoming more and more popular around the world. *Statista.com* provides estimates of the number of social media users in various countries in 2017 as well as the projections for 2022. Assume that the results for surveys in the United Kingdom, China, Russia, and the United States are as follows.

Use Social Media	Country			
	United Kingdom	China	Russia	United States
Yes	480	215	343	640
No	320	285	357	360

- Conduct a hypothesis test to determine whether the proportion of adults using social media is equal for all four countries. What is the p -value? Using a .05 level of significance, what is your conclusion?
- What are the sample proportions for each of the four countries? Which country has the largest proportion of adults using social media?
- Using a .05 level of significance, conduct multiple pairwise comparison tests among the four countries. What is your conclusion?

12-2

10. The following table contains observed frequencies for a sample of 240. Test for independence of the row and column variables using $\alpha = .05$.

Row Variable	Column Variable		
	A	B	C
P	20	30	20
Q	30	60	25
R	10	15	30

17. **Amount of Sleep by Age Group.** The National Sleep Foundation used a survey to determine whether hours of sleep per night are independent of age. A sample of individuals was asked to indicate the number of hours of sleep per night with categorical options: fewer than 6 hours, 6 to 6.9 hours, 7 to 7.9 hours, and 8 hours or more. Later in the survey, the individuals were asked to indicate their age with categorical options: age 39 or younger and age 40 or older. Sample data follow.

Hours of Sleep	Age Group	
	39 or younger	40 or older
Fewer than 6	38	36
6 to 6.9	60	57
7 to 7.9	77	75
8 or more	65	92

- Conduct a test of independence to determine whether hours of sleep are independent of age. Using a .05 level of significance, what is the p -value and what is your conclusion?
- What is your estimate of the percentages of individuals who sleep fewer than 6 hours, 6 to 6.9 hours, 7 to 7.9 hours, and 8 hours or more per night?

12-3

19. Test the following hypotheses by using the χ^2 goodness of fit test.

$$H_0: p_A = .40, p_B = .40, \text{ and } p_C = .20$$

$$H_a: \text{The population proportions are not } p_A = .40, p_B = .40, \text{ and } p_C = .20$$

A sample of size 200 yielded 60 in category A, 120 in category B, and 20 in category C. Use $\alpha = .01$ and test to see whether the proportions are as stated in H_0 .

- Use the p -value approach.
- Repeat the test using the critical value approach.

23. **Shareholder Scoreboard Ratings.** *The Wall Street Journal's* Shareholder Scoreboard tracks the performance of 1000 major U.S. companies. The performance of each company is rated based on the annual total return, including stock price changes and the reinvestment of dividends. Ratings are assigned by dividing all 1000 companies into five groups from A (top 20%), B (next 20%), to E (bottom 20%). Shown here are the one-year ratings for a sample of 60 of the largest companies. Do the largest companies differ in performance from the performance of the 1000 companies in the Shareholder Scoreboard? Use $\alpha = .05$.

A	B	C	D	E
5	8	15	20	12