

Note

4. **M&M's.** As noted in an earlier chapter, the Masterfoods Company says that until very recently yellow candies made up 20% of its milk chocolate M&M's, red another 20%, and orange, blue, and green 10% each. The rest are brown. On his way home from work the day he was writing these exercises, one of the authors bought a bag of plain M&M's. He got 29 yellow ones, 23 red, ~~16~~ 16 orange, 14 blue, 8 green, and 20 brown. Is this sample consistent with the company's stated proportions? Test an appropriate hypothesis and state your conclusion.

- If the M&M's are packaged in the stated proportions, how many of each color should the author have expected to get in his bag?
- To see if his bag was unusual, should he test goodness-of-fit, homogeneity, or independence?
- State the hypotheses.
- Check the conditions.
- How many degrees of freedom are there?
- Find χ^2 and the P-value.
- State a conclusion.

7. **NYPD and race.** Census data for New York City indicate that 29.2% of the under-18 population is white, 28.2% black, 31.5% Latino, 9.1% Asian, and 2% other ethnicities. The New York Civil Liberties Union points out that of 26,181 police officers, 64.8% are white, 14.5% black, 19.1% Hispanic, and 1.4% Asian. Do the police officers reflect the ethnic composition of the city's youth? Test an appropriate hypothesis and state your conclusion.

12. **NYPD and gender.** The table below shows the rank attained by male and female officers in the New York City Police Department. Do these data indicate that men and women are equitably represented at all levels of the department?

		Male	Female
Rank	Officer	21,900	4,281
	Detective	4,058	806
	Sergeant	3,898	415
	Lieutenant	1,333	89
	Captain	359	12

Handwritten notes: 4508 (sum of Officer ranks), 514 (sum of Detective ranks)

- What's the probability that a person selected at random from the NYPD is a female?
- What's the probability that a person selected at random from the NYPD is a detective?
- Assuming no bias in promotions, how many female detectives would you expect the NYPD to have?
- To see if there is evidence of differences in ranks attained by males and females, will you test goodness-of-fit, homogeneity, or independence?
- State the hypotheses.
- Test the conditions.
- How many degrees of freedom are there?
- Find χ^2 and the P-value.
- State your conclusion.
- If you concluded that the distributions are not the same, analyze the differences using the standardized residuals of your calculations.

22. **Full moon.** Some people believe that a full moon elicits unusual behavior in people. The table shows the number of arrests made in a small town during weeks of six full moons and six other randomly selected weeks during the same year. We wonder if there is evidence of a difference in the types of illegal activity that take place.

	Full Moon	Not Full
Violent (murder, assault, rape, etc.)	2	3
Property (burglary, vandalism, etc.)	17	21
Drugs/Alcohol	27	19
Domestic abuse	11	14
Other offenses	9	6

- Will you test goodness-of-fit, homogeneity, or independence?
- Write appropriate null hypotheses.
- Find the expected counts for each cell, and explain why the chi-square procedures are not appropriate for this table.

26. **Titanic, redux.** Newspaper headlines at the time, and traditional wisdom in the succeeding decades, have held that women and children escaped the *Titanic* in greater proportion than men. Here's a table with data by gender. Do you think that survival was independent of gender? Defend your conclusion.

	Female	Male	Total
Alive	323	387	710
Dead	147	1344	1491
Total	470	1731	2201

28. **Survival and gender, one more time.** In Exercise 26 you could have checked for a difference in the chances of survival for men and women using two-proportion z procedures.

- Find the z-value for this approach.
- Show that the square of your calculated value of z is the value of χ^2 you calculated in Exercise 26.
- Show that the resulting P-values are the same.

33. **Ranking universities.** In 2004 the Institute of Higher Education at Shanghai's Jiao Tong University evaluated the world's universities. Among their criteria were the size of the institution, the number of Nobel Prizes and Fields Medals won by faculty and alumni, and the faculty's research output. This ranking of the top 502 universities included 200 in North or Latin America, 209 in Europe, and 93 in the rest of the world (Asia/Pacific/Africa). A closer examination of the top 100 showed 55 in the Americas, 37 in Europe, and 8 elsewhere. Is there anything unusual about the geographical distribution of the world's top 100 universities?

18. **Fish diet.** Medical researchers followed 6272 Swedish men for 30 years to see if there was any association between the amount of fish in their diet and prostate cancer. ("Fatty Fish Consumption and Risk of Prostate Cancer," *Lancet* [June 2001])

Fish Consumption	Total Subjects	Prostate Cancers
Never/seldom	124	14
Small part of diet	2441	201
Moderate part	2906	209
Large part	612	42

- Is this a survey, a retrospective study, a prospective study, or an experiment? Explain.
- Is this a test of homogeneity or independence?
- Do you see evidence of an association between the amount of fish in a man's diet and his risk of developing prostate cancer?
- Does this study prove that eating fish does not prevent prostate cancer? Explain.