Chapter 22

1. Human births If there is no seasonal effect on human births, we would expect equal numbers of children to be born in each season (winter, spring, summer, and fall). A student takes a census of their statistics class and finds that of the 120 students in the class, 25 were born in winter, 35 in spring, 32 in summer, and 28 in fall. They wonder if the excess in the spring is an indication that births are not uniform throughout the year.
a) What is the expected number of births in each season if there is no "seasonal effect" on births?
b) Compute the χ^2 statistic.
c) How many degrees of freedom does the χ^2 statistic have?

3-ish: Human births, again For the births in Exercise 1, what are H_0 and H_A ? What's the P-value? What should we conclude about H_0?

5. Customer ages An analyst at a local bank wonders if the age distribution of customers coming for service at their branch in town is the same as at the branch located near the mall. They select 100 transactions at random from each branch and research the age information for the associated customer. Here are the data:

	Age			
	Less Than 30	30–55	56 or Older	Total
In-Town Branch	20	40	40	100
Mall Branch	30	50	20	100
Total	50	90	60	200

a) What is the null hypothesis?
b) What type of test is this?
c) What are the expected numbers for each cell if the null hypothesis is true?
d) Find the χ^2 statistic.
e) How many degrees of freedom does it have?
f) Find the P-value.
g) What do you conclude?

13. Dice After getting trounced in a children's game, you suspect the die may be unfair. To check, you roll it 60 times, recording the number of times each face appears. Do these results cast doubt on the die's fairness?

Face	Count
1	11
2	7
3	9
4	15
5	12
6	6

a) If the die is fair, how many times would you expect each face to show?
b) To see if these results are unusual, will you test goodness-of- fit, homogeneity, or independence?
c) State your hypotheses.
d) Check the conditions.
e) How many degrees of freedom are there?
f) Find the χ^2 statistic and the P-value.
g) State your conclusion.

23. Childbirth, part 1 There is some concern that if a woman has an epidural to reduce pain during childbirth, the drug can get into the baby's bloodstream, making the baby sleepier and less willing to breastfeed. In December 2006, the *International Breastfeeding Journal* published results of a study conducted at Sydney University. Researchers followed up on 1178 births, noting whether the mother had an epidural and whether the baby was still nursing after 6 months. Below are their results.
a) What kind of test would be appropriate?
b) State the null and alternative hypotheses.

		Epidural?		
		Yes	No	Total
Breastfeeding at 6 Months?	Yes	206	498	704
	No	190	284	474
	Total	396	782	1178

25. Childbirth, part 2 In Exercise 23, the table shows results of a study investigating whether aftereffects of epidurals administered during childbirth might interfere with successful breastfeeding. We're planning to do a chi-square test.

a) How many degrees of freedom are there?

b) The smallest expected count will be in the epidural/no breastfeeding cell. What is it?

c) Check the assumptions and conditions for inference.

27. Childbirth, part 3 In Exercises 23 and 25, we've begun to examine the possible impact of epidurals on successful breastfeeding.

a) Calculate the component of chi-square for the epidural/no breastfeeding cell.

b) Find χ^2. What's the P-value?

c) State your conclusion.

33. Titanic Here is a table showing who survived the sinking of the *Titanic* based on whether they were crew members, or passengers booked in first-, second-, or third-class staterooms:

	Crew	First	Second	Third	Total
Alive	212	202	118	178	710
Dead	673	123	167	528	1491
Total	885	325	285	706	2201

e) Are *Survival* and *Ticket Class* related? State the null and alternative hypotheses.

f) Give the degrees of freedom for the test.

g) Use Minitab to find χ^2 and the P-value. State your conclusions about the hypotheses.

17. 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% Latinx, 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% Latinx, 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.