Chapter Exercises

15. Phones Recent research suggests that 73% of Americans have a home phone, 83% have a cell phone, and 58% of people have both. What is the probability that an American has

a) a home or cell phone?
b) neither a home phone nor a cell phone?
c) a cell phone but no home phone?

16. Travel Suppose the probability that a U.S. resident has traveled to Canada is 0.18, to Mexico is 0.09, and to both countries is 0.04. What's the probability that an American chosen at random has

a) traveled to Canada but not Mexico?
b) traveled to either Canada or Mexico?
c) not traveled to either country?

17. Amenities A check of dorm rooms on a large college campus revealed that 38% had refrigerators, 52% had TVs, and 21% had both a TV and a refrigerator. What's the probability that a randomly selected dorm room has

a) a TV but no refrigerator?
b) a TV or a refrigerator, but not both?
c) neither a TV nor a refrigerator?

18. Workers Employment data at a large company reveal that 72% of the workers are married, that 44% are college graduates, and that half of the college grads are married. What's the probability that a randomly chosen worker

a) is neither married nor a college graduate?
b) is married but not a college graduate?
c) is married or a college graduate?

19. Global survey The marketing research organization GfK Roper conducts a yearly survey on consumer attitudes worldwide. They collect demographic information on the roughly 1500 respondents from each country that they survey. Here is a table showing the number of people with various levels of education in five countries:

Educational Level by Country					
	Post-Graduate	College	Some High School	Primary or Less	No Answer	Total
China	7	315	671	506	3	1502
France	69	388	766	309	7	1539
India	161	514	622	227	11	1535
U.K.	58	207	1240	32	20	1557
U.S.	84	486	896	87	4	1557
Total	379	1910	4195	1161	45	7690

If we select someone at random from this survey,

a) what is the probability that the person is from the United States?
b) what is the probability that the person completed his or her education before college?

c) what is the probability that the person is from France *or* did some post-graduate study?
d) what is the probability that the person is from France *and* finished only primary school or less?

20. Birth order A survey of students in a large Introductory Statistics class asked about their birth order $(1 = $ oldest or only child) and which college of the university they were enrolled in. Here are the data:

	Birth Order		
	1 or Only	2 or More	Total
Arts & Sciences	34	23	57
Agriculture	52	41	93
Human Ecology	15	28	43
Other	12	18	30
Total	113	110	223

Suppose we select a student at random from this class. What is the probability that the person is

a) a Human Ecology student?
b) a firstborn student?
c) firstborn *and* a Human Ecology student?
d) firstborn *or* a Human Ecology student?

21. Cards You draw a card at random from a standard deck of 52 cards. Find each of the following conditional probabilities:

a) The card is a heart, given that it is red.
b) The card is red, given that it is a heart.
c) The card is an ace, given that it is red.
d) The card is a queen, given that it is a face card.

22. Pets In its monthly report, the local animal shelter states that it currently has 24 dogs and 18 cats available for adoption. Eight of the dogs and 6 of the cats are male. Find each of the following conditional probabilities if an animal is selected at random:

a) The pet is male, given that it is a cat.
b) The pet is a cat, given that it is female.
c) The pet is female, given that it is a dog.

23. Health The probabilities that an adult American man has high blood pressure and/or high cholesterol are shown in the table.

		Blood Pressure	
		High	OK
Cholesterol	High	0.11	0.21
	OK	0.16	0.52

What's the probability that

a) a man has both conditions?
b) a man has high blood pressure?
c) a man with high blood pressure has high cholesterol?
d) a man has high blood pressure if it's known that he has high cholesterol?

24. Immigration The table shows the political affiliations of U.S. voters and their positions on supporting stronger immigration enforcement.

		Stronger Immigration Enforcement		
		Favor	Oppose	No Opinion
Party	Republican	0.30	0.04	0.03
	Democrat	0.22	0.11	0.02
	Other	0.16	0.07	0.05

a) What's the probability that
i)   a randomly chosen voter favors stronger immigration enforcement?
ii) a Republican favors stronger enforcement?
iii) a voter who favors stronger enforcement is a Democrat?

b) A candidate thinks she has a good chance of gaining the votes of anyone who is a Republican or in favor of stronger enforcement of immigration policy. What proportion of voters is that?

25. Global survey, take 2 Look again at the table summarizing the Roper survey in Exercise 19.

a) If we select a respondent at random, what's the probability we choose a person from the United States who has done post-graduate study?

b) Among the respondents who have done post-graduate study, what's the probability the person is from the United States?

c) What's the probability that a respondent from the United States has done post-graduate study?

d) What's the probability that a respondent from China has only a primary-level education?

e) What's the probability that a respondent with only a primary-level education is from China?

26. Birth order, take 2 Look again at the data about birth order of Intro Stats students and their choices of colleges shown in Exercise 20.

a) If we select a student at random, what's the probability the person is an Arts and Sciences student who is a second child (or more)?

b) Among the Arts and Sciences students, what's the probability a student was a second child (or more)?

c) Among second children (or more), what's the probability the student is enrolled in Arts and Sciences?

d) What's the probability that a first or only child is enrolled in the Agriculture College?

e) What is the probability that an Agriculture student is a first or only child?

27. Sick kids Seventy percent of kids who visit a doctor have a fever, and 30% of kids with a fever also have sore throats. What's the probability that a kid who goes to the doctor has a fever and a sore throat?

28. Sick cars Twenty percent of cars that are inspected have faulty pollution control systems. The cost of repairing a pollution control system exceeds $100 about 40% of the time. When a driver takes her car in for inspection, what's the probability that she will end up paying more than $100 to repair the pollution control system?

29. Cards You are dealt a hand of three cards, one at a time. Find the probability of each of the following.
a) The first heart you get is the third card dealt.
b) Your cards are all red (that is, all diamonds or hearts).
c) You get no spades.
d) You have at least one ace.

30. Another hand You pick three cards at random from a deck. Find the probability of each event described below.
a) You get no aces.
b) You get all hearts.
c) The third card is your first red card.
d) You have at least one diamond.

31. Batteries A junk box in your room contains a dozen old batteries, five of which are totally dead. You start picking batteries one at a time and testing them. Find the probability of each outcome.
a) The first two you choose are both good.
b) At least one of the first three works.
c) The first four you pick all work.
d) You have to pick five batteries to find one that works.

32. Shirts The soccer team's shirts have arrived in a big box, and people just start grabbing them, looking for the right size. The box contains 4 medium, 10 large, and 6 extra-large shirts. You want a medium for you and one for your sister. Find the probability of each event described.
a) The first two you grab are the wrong sizes.
b) The first medium shirt you find is the third one you check.
c) The first four shirts you pick are all extra-large.
d) At least one of the first four shirts you check is a medium.

33. Eligibility A university requires its biology majors to take a course called BioResearch. The prerequisite for this course is that students must have taken either a Statistics course or a computer course. By the time they are juniors, 52% of the Biology majors have taken Statistics, 23% have had a computer course, and 7% have done both.
a) What percent of the junior Biology majors are ineligible for BioResearch?
b) What's the probability that a junior Biology major who has taken Statistics has also taken a computer course?
c) Are taking these two courses disjoint events? Explain.
d) Are taking these two courses independent events? Explain.

34. Benefits Fifty-six percent of all American workers have a workplace retirement plan, 68% have health insurance, and 49% have both benefits. We select a worker at random.

a) What's the probability he has neither employer-sponsored health insurance nor a retirement plan?

b) What's the probability he has health insurance if he has a retirement plan?

c) Are having health insurance and a retirement plan independent events? Explain.

d) Are having these two benefits mutually exclusive? Explain.

35. Cell phones in the home A survey found that 73% of Americans have a home phone, 83% have a cell phone and 58% of people have both.

a) If a person has a home phone, what's the probability that they have a cell phone also?

b) Are having a home phone and a cell phone independent events? Explain.

c) Are having a home phone and a cell phone mutually exclusive? Explain.

36. On the road again According to Exercise 16, the probability that a U.S. resident has traveled to Canada is 0.18, to Mexico is 0.09, and to both countries is 0.04.

a) What's the probability that someone who has traveled to Mexico has visited Canada too?

b) Are traveling to Mexico and to Canada disjoint events? Explain.

c) Are traveling to Mexico and to Canada independent events? Explain.

37. Cards If you draw a card at random from a well-shuffled deck, is getting an ace independent of the suit? Explain.

38. Pets, again The local animal shelter in Exercise 22 reported that it currently has 24 dogs and 18 cats available for adoption; 8 of the dogs and 6 of the cats are male. Are the species and sex of the animals independent? Explain.

39. Unsafe food Early in 2010, *Consumer Reports* published the results of an extensive investigation of broiler chickens purchased from food stores in 23 states. Tests for bacteria in the meat showed that 62% of the chickens were contaminated with campylobacter, 14% with salmonella, and 9% with both.

a) What's the probability that a tested chicken was not contaminated with either kind of bacteria?

b) Are contamination with the two kinds of bacteria disjoint? Explain.

c) Are contamination with the two kinds of bacteria independent? Explain.

40. Birth order, finis In Exercises 20 and 26, we looked at the birth orders and college choices of some Intro Stats students. For these students:

a) Are enrolling in Agriculture and Human Ecology disjoint? Explain.

b) Are enrolling in Agriculture and Human Ecology independent? Explain.

c) Are being firstborn and enrolling in Human Ecology disjoint? Explain.

d) Are being firstborn and enrolling in Human Ecology independent? Explain.

41. Men's health again Given the table of probabilities from Exercise 23, are high blood pressure and high cholesterol independent? Explain.

		Blood Pressure	
		High	OK
Cholesterol	High	0.11	0.21
	OK	0.16	0.52

42. Politics Given the table of probabilities from Exercise 24, are party affiliation and position on immigration independent? Explain.

		Stronger Immigration Enforcement		
		Favor	Oppose	No Opinion
Party	Republican	0.30	0.04	0.03
	Democrat	0.22	0.11	0.02
	Other	0.16	0.07	0.05

43. Phone service According to estimates from the federal government's 2010 National Health Interview Survey, based on face-to-face interviews in 16,676 households, approximately 63.6% of U.S. adults have both a landline in their residence and a cell phone, 25.4% have only cell phone service but no landline, and 1.8% have no telephone service at all.

a) Polling agencies won't phone cell phone numbers because customers object to paying for such calls. What proportion of U.S. households can be reached by a landline call?

b) Are having a cell phone and having a landline independent? Explain.

44. Snoring After surveying 995 adults, 81.5% of whom were over 30, the National Sleep Foundation reported that 36.8% of all the adults snored. 32% of the respondents were snorers over the age of 30.

a) What percent of the respondents were under 30 and did not snore?

b) Is snoring independent of age? Explain.

45. Gender A 2009 poll conducted by Gallup classified respondents by sex and political party, as shown in the table. Is party affiliation independent of the respondents' sex? Explain.

	Democrat	Republican	Independent
Male	32	28	34
Female	41	25	26

46. Cars A random survey of autos parked in student and staff lots at a large university classified the brands by country of origin, as seen in the table. Is country of origin independent of type of driver?

		Driver	
		Student	Staff
Origin	American	107	105
	European	33	12
	Asian	55	47

47. Luggage Leah is flying from Boston to Denver with a connection in Chicago. The probability her first flight leaves on time is 0.15. If the flight is on time, the probability that her luggage will make the connecting flight in Chicago is 0.95, but if the first flight is delayed, the probability that the luggage will make it is only 0.65.
a) Are the first flight leaving on time and the luggage making the connection independent events? Explain.
b) What is the probability that her luggage arrives in Denver with her?

48. Graduation A private college report contains these statistics:
70% of incoming freshmen attended public schools.
75% of public school students who enroll as freshmen eventually graduate.
90% of other freshmen eventually graduate.
a) Is there any evidence that a freshman's chances to graduate may depend upon what kind of high school the student attended? Explain.
b) What percent of freshmen eventually graduate?

49. Late luggage Remember Leah (Exercise 47)? Suppose you pick her up at the Denver airport, and her luggage is not there. What is the probability that Leah's first flight was delayed?

50. Graduation, part II What percent of students who graduate from the college in Exercise 48 attended a public high school?

51. Absenteeism A company's records indicate that on any given day about 1% of their day-shift employees and 2% of the night-shift employees will miss work. Sixty percent of the employees work the day shift.
a) Is absenteeism independent of shift worked? Explain.
b) What percent of employees are absent on any given day?

52. E-readers In 2011, 12% of Americans owned an electronic reader of some sort. Suppose that 43% of people with e-readers read at least 3 books last year, while people without an e-reader, only 11% read 3 or more books in the course of the year.
a) Explain how these statistics indicate that owning an e-reader and reading 3 or more books are not independent.

b) What's the probability that a randomly selected American has read 3 or more books?

53. Absenteeism, part II At the company described in Exercise 51, what percent of the absent employees are on the night shift?

54. E-readers II Given the e-reader data presented in Exercise 52, if a randomly selected American has read 3 or more books, what's the probability that he or she owns an e-reader?

55. Drunks Police often set up sobriety checkpoints—roadblocks where drivers are asked a few brief questions to allow the officer to judge whether or not the person may have been drinking. If the officer does not suspect a problem, drivers are released to go on their way. Otherwise, drivers are detained for a Breathalyzer test that will determine whether or not they will be arrested. The police say that based on the brief initial stop, trained officers can make the right decision 80% of the time. Suppose the police operate a sobriety checkpoint after 9:00 p.m. on a Saturday night, a time when national traffic safety experts suspect that about 12% of drivers have been drinking.
a) You are stopped at the checkpoint and, of course, have not been drinking. What's the probability that you are detained for further testing?
b) What's the probability that any given driver will be detained?
c) What's the probability that a driver who is detained has actually been drinking?
d) What's the probability that a driver who was released had actually been drinking?

56. No-shows An airline offers discounted "advance-purchase" fares to customers who buy tickets more than 30 days before travel and charges "regular" fares for tickets purchased during those last 30 days. The company has noticed that 60% of its customers take advantage of the advance-purchase fares. The "no-show" rate among people who paid regular fares is 30%, but only 5% of customers with advance-purchase tickets are no-shows.
a) What percent of all ticket holders are no-shows?
b) What's the probability that a customer who didn't show had an advance-purchase ticket?
c) Is being a no-show independent of the type of ticket a passenger holds? Explain.

57. Dishwashers Dan's Diner employs three dishwashers. Al washes 40% of the dishes and breaks only 1% of those he handles. Betty and Chuck each wash 30% of the dishes, and Betty breaks only 1% of hers, but Chuck breaks 3% of the dishes he washes. (He, of course, will need a new job soon. . . .) You go to Dan's for supper one night and hear a dish break at the sink. What's the probability that Chuck is on the job?

58. Parts A company manufacturing electronic components for home entertainment systems buys electrical