48. It is known that diskettes produced by a certain company will be defective with probability 0.01, independently of each other. The company sells the diskettes in packages of size 10 and offers a money-back guarantee that at most 1 of the 10 diskettes in the package will be defective. If someone buys 3 packages, what is the probability that he or she will return exactly 1 of them?

49. Suppose that 90 percent of the chips produced by a computer hardware manufacturer are defective. If we order 100 such chips, will the number of defective ones we receive be a binomial random variable?

50. Suppose that a biased coin that lands on heads with probability $p$ is flipped 10 times. Given that a total of 6 heads result, find the conditional probability that the first 3 outcomes are (a) $H, T, T$ (meaning that the first flip is heads, the second is tails, and the third is tails); (b) $T, H, T$.

53. Approximately 80,000 marriages took place in the state of New York last year. Estimate the probability that for at least one of these couples (a) both partners were born on April 30; (b) both partners celebrated their birthday on the same day of the year. State your assumptions.

40. Two dice are rolled. Let $X$ and $Y$ denote, respectively, the largest and smallest values obtained. Compute the conditional mass function of $Y$ given $X = i$, for $i = 1, 2, \ldots, 6$. Are $X$ and $Y$ independent? Why?

41. The joint probability mass function of $X$ and $Y$ is given by

$$
p(1, 1) = \frac{1}{6} \quad p(1, 2) = \frac{1}{4} \quad p(2, 1) = \frac{1}{6} \quad p(2, 2) = \frac{1}{2}
$$

(a) Compute the conditional mass function of $X$ given $Y = i$, $i = 1, 2$.

(b) Are $X$ and $Y$ independent?

(c) Compute $P(X = 3, Y \geq 3), P(X + Y > 2), P(X/Y > 1)$.

Let $n > 1$ be a positive integer and let $r(1), r(2), \ldots, r(n)$ be $n$ positive real numbers. Redo Example 4c on p344 under the following assumptions: there are $n$ doors; door 1 leads to safety after $r(1)$ hours of travel; doors $i$, $i = 2, 3, \ldots, n$, return the miner to the mine after $r(i)$ hours of travel; each of the $n$ doors is equally likely to be chosen, even if the miner returns repeatedly to the mine. As in Example 4c, calculate the expected length of time until the miner reaches safety.

5. The county hospital is located at the center of a square whose sides are 3 miles wide. If an accident occurs within this square, then the hospital sends out an ambulance. The road network is rectangular, so the travel distance from the hospital, whose coordinates are (0, 0), to the point $(x, y)$ is $|x| + |y|$. If an accident occurs at a point that is uniformly distributed in the square, find the expected travel distance of the ambulance.