Wackerley et al.

Which of the following are independent events?

a A and D

b B and D

c C and D

2.75 Cards are dealt, one at a time, from a standard 52-card deck.

a If the first 2 cards are both spades, what is the probability that the next 3 cards are also spades?

b If the first 3 cards are all spades, what is the probability that the next 2 cards are also spades?

c If the first 4 cards are all spades, what is the probability that the next card is also a spade?

2.76 A survey of consumers in a particular community showed that 10% were dissatisfied with plumbing jobs done in their homes. Half the complaints dealt with plumber A, who does 40% of the plumbing jobs in the town. Find the probability that a consumer will obtain

a an unsatisfactory plumbing job, given that the plumber was A.

b a satisfactory plumbing job, given that the plumber was A.

2.77 A study of the posttreatment behavior of a large number of drug abusers suggests that the likelihood of conviction within a two-year period after treatment may depend upon the offender's education. The proportions of the total number of cases falling in four education–conviction categories are shown in the following table:

	Status within 2 Years after Treatment		
Education	B Convicted	Not Convicted	*Total*
A = 10 years or more	.10	.30	.40
9 years or less	.27	.33	.60
Total	.37	.63	1.00

Suppose that a single offender is selected from the treatment program. Define the events:

A: The offender has 10 or more years of education.
B: The offender is convicted within two years after completion of treatment.

Find the following:

a $P(A)$.

b $P(B)$.

c $P(A \cap B)$.

d $P(A \cup B)$.

e $P(\overline{A})$.

f $P(\overline{A \cup B})$.

g $P(\overline{A \cap B})$.

h $P(A|B)$.

i $P(B|A)$. and compare $P(B|\overline{A})$.

2.78 In the definition of the independence of two events, you were given three equalities to check: $P(A|B) = P(A)$ or $P(B|A) = P(B)$ or $P(A \cap B) = P(A)P(B)$. If any one of these equalities

b We leave it to you to show that

$$
\begin{aligned}
P(\text{exactly one match}) &= P(A_1) + P(A_2) + P(A_3) \\
&\quad - 2[P(A_1 \cap A_2) + P(A_1 \cap A_3) + P(A_2 \cap A_3)] \\
&\quad + 3[P(A_1 \cap A_2 \cap A_3)] \\
&= (3)(1/3) - (2)(3)(1/6) + (3)(1/6) = 1/2.
\end{aligned}
$$

■

The best way to learn how to solve probability problems is to learn by doing. To assist you in developing your skills, many exercises are provided at the end of this section, at the end of the chapter, and in the references.

Exercises

2.110 Of the items produced daily by a factory, 40% come from line I and 60% from line II. Line I has a defect rate of 8%, whereas line II has a defect rate of 10%. If an item is chosen at random from the day's production, find the probability that it will not be defective.

2.111 An advertising agency notices that approximately 1 in 50 potential buyers of a product sees a given magazine ad, and 1 in 5 sees a corresponding ad on television. One in 100 sees both. One in 3 actually purchases the product after seeing the ad, 1 in 10 without seeing it. What is the probability that a randomly selected potential customer will purchase the product?

2.112 Three radar sets, operating independently, are set to detect any aircraft flying through a certain area. Each set has a probability of .02 of failing to detect a plane in its area. If an aircraft enters the area, what is the probability that it

a goes undetected?
b is detected by all three radar sets?

2.113 Consider one of the radar sets of Exercise 2.112. What is the probability that it will correctly detect exactly three aircraft before it fails to detect one, if aircraft arrivals are independent single events occurring at different times?

2.114 A lie detector will show a positive reading (indicate a lie) 10% of the time when a person is telling the truth and 95% of the time when the person is lying. Suppose two people are suspects in a one-person crime and (for certain) one is guilty and will lie. Assume further that the lie detector operates independently for the truthful person and the liar. What is the probability that the detector

a shows a positive reading for both suspects?
b shows a positive reading for the guilty suspect and a negative reading for the innocent suspect?
c is completely wrong—that is, that it gives a positive reading for the innocent suspect and a negative reading for the guilty?
d gives a positive reading for either or both of the two suspects?