# AE Additional Exercises

**1.** A couple plans to have three children.

- **a.** List all possible outcomes for the sexes of the three children.
- **b.** Find the probability that the couple will have three girls.
- **c.** Find the probability that the couple will have at least one boy.

**2.** 671 registered voters were surveyed and asked their political affiliation and whether or not they favor a national healthcare policy. The results of the survey are displayed in the table below.

| Survey Results | | | |
|---|---|---|---|
| **Position on National Healthcare** | **Democrat** | **Independent** | **Republican** |
| Favor | 161 | 40 | 130 |
| Do Not Favor | 110 | 40 | 190 |

If one of the surveyed voters is randomly selected, answer the following questions.

- **a.** What is the probability that the voter will be a Republican?
- **b.** What is the probability that the voter will not favor a national healthcare policy?
- **c.** What is the probability that the voter will be a Democrat or an Independent?
- **d.** What is the probability that the voter will be a Democrat and favor a national healthcare policy?
- **e.** Given that the voter is a Republican, what is the probability that the voter will favor a national healthcare policy?
- **f.** If the voter does not favor a national healthcare policy, what is the probability that the voter is an Independent?
- **g.** Are the events {voter is a Democrat} and {voter favors national healthcare policy} independent? Explain.

**3.** A roulette wheel has 38 outcomes labeled 1 through 36 plus 0 and 00. The wheels are supposed to be designed so that each outcome is equally likely. The numbers 0 and 00 are often referred to as house numbers because the only way that a player can win when these outcomes are observed is by directly betting on the numbers. A great deal of the money wagered on a roulette wheel is wagered on odd or even numbers, or columns or rows of numbers. The numbers 0 and 00 are not in any row or column, nor are they odd or even.

- **a.** What is the probability of observing an even number (0 and 00 are neither odd nor even)?
- **b.** What is the probability of observing a number between 1 and 12, inclusive?
- **c.** What is the probability of observing 0 or 00?
- **d.** What is the probability of observing a 4?
- **e.** What is the probability of not observing 7, 13, or 21?

**4.** A survey of customers in a particular retail store showed that 10% were dissatisfied with the customer service. Half of the customers who were dissatisfied dealt with Bill, the senior customer service representative. If Bill responds to 40% of all customer service inquiries in the retail store, find the following probabilities.

**a.** The probability that a customer will be unhappy, given that the representative was Bill.

**b.** The probability that the service representative was not Bill, given that the customer complained.

**5.** A package of documents needs to be sent to a given destination, and it is important that it arrive within one day. To maximize the chances of on-time delivery, three copies of the documents are sent via three different delivery services. Service A is known to have a 90% on-time delivery record, Service B has an 88% on-time delivery record, and Service C has a 91% on-time delivery record. Assuming that the delivery services and their records are independent, what is the probability that at least one copy of the documents will arrive at its destination on time?

**6.** A boxcar contains six complex electronic systems. Two of the six are to be randomly selected for thorough testing and then classified as defective or not defective. If two of the six systems are actually defective:

**a.** find the probability that at least one of the two systems tested will be defective.

**b.** find the probability that both are defective.

**7.** *Odds in favor of* and *odds against* are often used to express chances of occurrences. For example, if the odds are 5 to 2 that it will rain tomorrow then we would be wise to carry an umbrella with us. How exactly are odds related to probabilities? If the probability of event $A$ occurring is $p$, then the odds in favor of $A$ occurring are $a$ to $b$ such that $\frac{a}{b} = \frac{p}{(1-p)}$. The odds against $A$ occurring are $b$ to $a$.

**a.** What are the odds of rolling a six when a single die is thrown?

**b.** What are the odds against getting a head when a coin is tossed?

**c.** What are the odds against getting 3 consecutive heads when a coin is tossed 3 times?

**d.** Suppose the odds in favor of your favorite athletic team winning this weekend are 8 to 3. What is the probability that they will win?

**8.** Consider a well-shuffled deck of cards with 13 hearts, 13 spades, 13 clubs, and 13 diamonds.

**a.** Find the probability that the first card dealt is a heart.

**b.** Find the probability that the first card dealt is a spade.

**c.** Find the probability that the first card dealt is not a spade.

**d.** If you know that the first card dealt will not be a spade, find the probability that it will be a heart.

**e.** Suppose you saw the bottom card, and it was the queen of hearts. What is the probability that the first card dealt will be a heart?

**9.** A box contains eighteen large marbles and ten small marbles. Each marble is either green or white. Twelve of the large marbles are green and four of the small marbles are white. If a marble is randomly selected from the box, what is the probability that it is white or large?

**10.** User passwords for a certain computer network consist of four letters followed by two numbers. How many different passwords are possible?

**11.** Hydraulic assemblies for landing coming from an aircraft rework facility are each inspected for defects. Historical records indicate that 8% have defects in shafts only, 6% have defects in bushings only, and 2% have defects in both shafts and bushings. One of the hydraulic assemblies is selected randomly. What is the probability that:

**a.** the assembly has a bushing defect?

**b.** the assembly has a shaft or bushing defect?

**c.** the assembly has exactly one of the two types of defects?

**d.** the assembly has neither type of defect?