

Probability Exercises

Things to Remember:

- The probability of any outcome is the number of times that outcome can occur divided by the total number of outcomes.
- If there are n equally likely outcomes to one event, then the probability of each outcome is 1 divided by n .
- To determine the probability that any of several outcomes will occur for one event, such as the draw of **one** card, **one** spin of the roulette wheel, etc., **add** the separate probabilities together.
- To determine the probability of two separate events occurring at the same time, **multiply** the separate probabilities together.

Conversions:

Fraction to decimal

$$\begin{aligned} 3/5 &= 3 \div 5 = 0.6 \\ 3/20 &= 3 \div 20 = 0.15 \end{aligned}$$

Decimal to fraction

$0.1 = 1/10$	one in ten
$0.01 = 1/100$	one in a hundred
$0.001 = 1/1000$	one in a thousand

Percent to probability

$$50\% = 50/100 = 0.50 \text{ probability}$$

Probability to percent

$$\begin{aligned} 0.50 \text{ probability} &= 0.50 \times 100 = 50\% \\ 0.35 \text{ probability} &= 0.35 \times 100 = 35\% \end{aligned}$$

Conversion Exercises:

- Convert the following to a fraction.
 - $0.25 = \underline{\hspace{2cm}}$
 - $0.60 = \underline{\hspace{2cm}}$
 - $0.934 = \underline{\hspace{2cm}}$
- Convert the following from percent to probability.
 - $25\% = \underline{\hspace{2cm}}$
 - $33\% = \underline{\hspace{2cm}}$
 - $75\% = \underline{\hspace{2cm}}$
- Convert the following from probability to percent.
 - $0.2 = \underline{\hspace{2cm}}$
 - $0.64 = \underline{\hspace{2cm}}$
 - $0.934 = \underline{\hspace{2cm}}$
- In flipping a coin six times, the following sequence was observed: H,T,T,T,T,T. What is the probability that on the seventh flip the coin will come up tails?
- Draw one card from an ordinary deck of cards. (Express answers as fractions and decimals.)
 - What is the probability that it is the queen of hearts?
 - What is the probability that it is either the king or the queen of hearts?
- Draw two cards from an ordinary deck. What is the probability of getting both the king and queen of hearts?
- Draw five cards. What is the probability of drawing the A, K, Q, J, or 10 of hearts? What is the probability of drawing any royal flush?
- Two basketball teams of equal skill are involved in a four-game tournament. What is the probability of one of the teams winning the tournament in four straight games?

Challenge Level Exercises:

1. A typical roulette wheel has 38 slots that are numbered 1, 2, 3, ..., 34, 35, 36, 0, and 00. The 0 and 00 slots are green. Of the remaining slots, half are red and half are black. Also half of the integers from 1 to 36 are even and half are odd. 0 and 00 are defined as neither even or odd. A ball is rolled around the wheel and ends up in one of the slots. We assume that each slot has an equal chance.
 - a) What is the probability of the ball landing in each slot?
 - b) What is the probability of the ball landing in a green slot? A red slot? A black slot?
 - c) What is the probability of the ball landing on an even number?
 - d) What is the probability of getting a 1, 12, 24, or 36?

For the following questions, to calculate the “expected” value of an event, multiply the consequence (profit or loss) under each outcome by the probability of the outcome and add them together. For example, if you bet \$1.00 on the flip of a coin, there is a 0.50 probability that you win and a 0.50 probability that you lose. The expected value of this game is $0.50(\$1.00) + 0.50(0) = \$0.50 + \$0 = \0.50

2. In a particular lottery, 2,000,000 tickets are sold each week for \$0.50 each. Each week there are 12,009 tickets drawn and awarded prizes: 12,000 people receive \$25; 6 people win \$10,000; 2 people win \$50,000; and 1 person wins \$200,000.
 - a) Determine the probability of winning each prize.
 - b) If you play this game, what is your “expected” payoff?
3. Suppose you must choose between two products (A and B) to sell in your shop. Your choice depends on what the economy is going to do. If the economy goes up, you will make a profit of \$100,000 on product A or \$60,000 on product B. If the economy stays the same, you will earn a profit of \$50,000 on product A and \$40,000 on product B. And, if the economy goes down, you will lose \$20,000 on product A, but can still earn \$10,000 on product B.

You don't know for sure what the economy is going to do, but you might know the probabilities of these things happening. Suppose the probability of the economy going up is 0.4, the probability of it staying the same is 0.4, and the probability of it going down is 0.2.

Determine the expected profit for each product. Which product would you choose and why?