

8.3 Expected Value

- ▶ Find an expected value involving two events.
- ▶ Find an expected value involving multiple events.
- ▶ Use expected value to make investment decisions.

Finding an Expected Value Involving Two Events

The **expected value** of an “experiment” is the long-run average—if the experiment could be repeated many times, the expected value is the average of all the results.

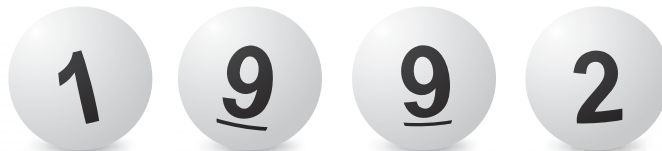
Expected Value

Consider an experiment that has only two possible events. The expected value of the experiment is

$$\text{Expected value} = \left(\begin{array}{l} \text{probability} \\ \text{of event 1} \end{array} \right) \left(\begin{array}{l} \text{payoff for} \\ \text{event 1} \end{array} \right) + \left(\begin{array}{l} \text{probability} \\ \text{of event 2} \end{array} \right) \left(\begin{array}{l} \text{payoff for} \\ \text{event 2} \end{array} \right).$$

EXAMPLE 1 Finding an Expected Value

In a state lottery, a single digit is drawn from each of four containers. Each container has 10 balls numbered 0 through 9. To play, you choose a 4-digit number and pay \$1. If your number is drawn, you win \$5000. If your number is not drawn, you lose your dollar. What is the expected value for this game?



SOLUTION

The probability of winning is $1/10,000$. The probability of losing is $9999/10,000$.

$$\text{Expected value} = \left(\frac{1}{10,000} \right) (4999) + \left(\frac{9999}{10,000} \right) (-1) = -\$0.50$$

Probability of win

Payoff for win

Probability of lose

Payoff for lose

So, on average, you should expect to lose \$0.50 each time you play the game.

✓ Checkpoint

Help at Math.andYOU.com

Play the *Lottery Simulator* at *Math.andYou.com*. Set the number of games to 100,000. Discuss your results in the context of expected value. States are often criticized for falsely raising people’s expectations of winning and for encouraging a form of regressive tax on the poor. What is your opinion of this?

