Probability Defined

Learning Objective: Relate the probability of an event to the likelihood of this event occurring.

What is Probability?

Probability is a mathematical description of randomness and uncertainty. It is a way to measure or quantify uncertainty. Another way to think about probability is that it is the official name for "chance."

Probability is the Likelihood of Something Happening

One way to think of probability is that it is the **likelihood** that something will occur.

Probability is used to answer the following types of questions:

- What is the chance that it will rain tomorrow?
- What is the chance that a stock will go up in price?
- What is the chance that I will have a heart attack?
- What is the chance that I will live longer than 70 years?
- What is the likelihood that when rolling a pair of dice, I will roll doubles?
- What is the probability that I will win the lottery?

Each of these examples has some uncertainty. For some, the chances are quite good, so the probability would be quite high. For others, the chances are not very good, so the probability is quite low (especially winning the lottery).

Certainly, the chance of rain is different each day, and is higher during some seasons. Your chance of having a heart attack, or of living longer than 70 years, depends on things like your current age, your family history, and your lifestyle. However, you could use your intuition to predict some of those probabilities fairly accurately, while others you might have no hunches about at all.

Notation

We think you will agree that the word **probability** is a bit long to include in equations, graphs and charts, so it is customary to use some simplified notation instead of the entire word.

If we wish to indicate "the probability it will rain tomorrow," we use the notation "P(rain tomorrow)." We can abbreviate the probability of anything. If we let **A** represent what we wish to find the probability of, then **P(A)** would represent that probability.

We can think of "**A**" as an "**event**."

NOTATION	MEANING
P(win lottery)	the probability that a person who has a lottery ticket will win that lottery
P(A)	the probability that event A will occur
P(B)	the probability that event B will occur

Principle

The "probability" of an event tells us how likely it is that the event will occur.

What values can the probability of an event take, and what does the value tell us about the likelihood of the event occurring?

Probability of an Event

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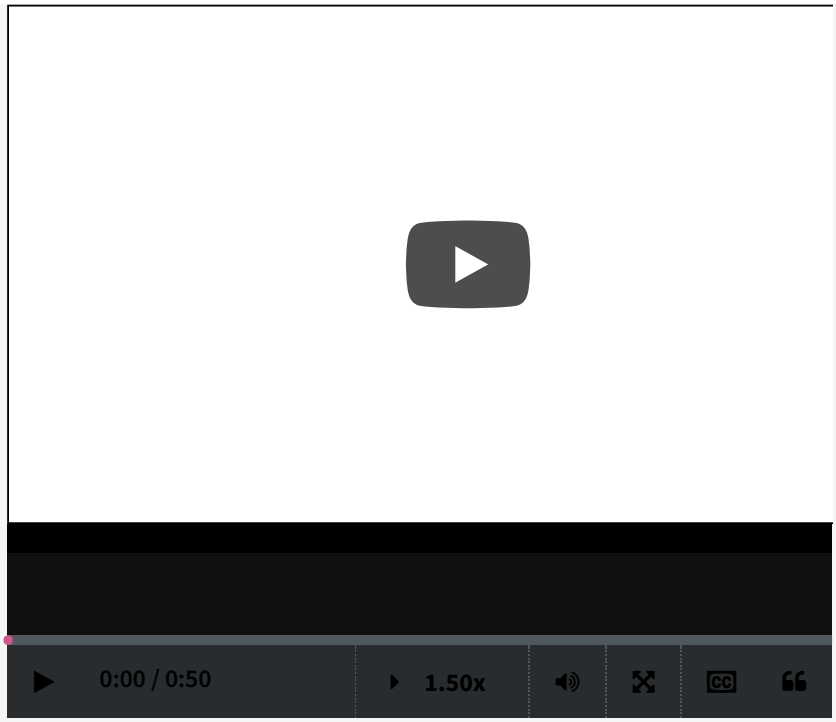
The probability of any event ranges from zero to one. Let's start with the extremes: zero and one.

The probability of zero means that the event has zero chance of



happening. It will never occur.

An event has probability one if it will occur for certain. In the middle,

a probability of one-half indicates that the event has 50% chance of happening.

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1/1 point (graded)

Probability is a measure of how likely an event is to occur. Choose the probability that best matches each of the following statements:

This event is impossible:

- (•) 0 ✔
- ( ) 0.01
- ( ) 0.30
- ( ) 0.60
- ( ) 0.99
- ( ) 1

Answer

Correct: A probability of 0 represents an event that can never occur.

Submit

Did I Get This

1/1 point (graded)

This event will occur more often than not, but is not extremely likely:

- 0
- 0.01
- 0.30
- 0.60 ✔
- 0.99
- 1

Answer

Correct:

A probability of 0.60 represents an event that will occur more often than not. Specifically, it will occur almost two-thirds (0.67) of the time.

Submit

Did I Get This

1/1 point (graded)

This event is extremely unlikely, but it will occur once in a while in a long sequence of trials:

- 0
- 0.01 ✔
- 0.30

- 0.60
- 0.99
- 1

Answer
Correct: A probability of 0.01 represents an event that is VERY unlikely, but is still possible.

Submit

Did I Get This

1/1 point (graded)
This event will occur for sure:

- 0
- 0.01
- 0.30
- 0.60
- 0.99
- 1 ✔

Answer
Correct: A probability of 1 represents an event that will occur for certain.

Submit

Principle

The probability that an event will occur is between 0 and 1 or $0 \leq P(A) \leq 1$.

Many people prefer to express probability in percentages. Since all probabilities are decimals, each can be changed to an equivalent percentage. Thus, the latest principle is equivalent to saying, **"The chance that an event will occur is between 0% and 100%**."

Probabilities can be determined in two fundamental ways. Keep reading to find out what they are.
