

# What is collectively exhaustive events?

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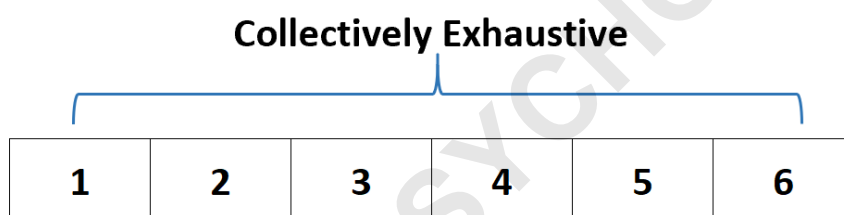
Collectively exhaustive events are a set of events or outcomes that are mutually exclusive and cover all possibilities. This means that the events in the set cannot overlap and combined, they must represent the entire possible set of outcomes. This is important in statistics, probability and decision making as it allows for accurate analysis of data.

A set of events is **collectively exhaustive** if at least one of the events *must* occur.

For example, if we roll a die then it must land on one of the following values:

1  
2  
3  
4  
5  
6

Thus, we would say that the set of events {1, 2, 3, 4, 5, 6} is **collectively exhaustive** because the die *must* land on one of those values.



In other words, that set of events, as a *collection*, *exhausts* all possible outcomes.

The following examples show some more situations that illustrate collectively exhaustive events:

### Example 1: Flipping a Coin

Suppose we flip a coin one time. We know that the coin must land on one of the following values:

Heads

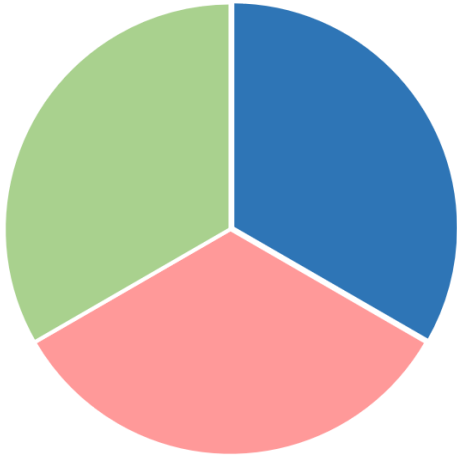
Tails

Thus, the set of events {**Heads**, **Tails**} would be collectively exhaustive.

## Example 2: Spinning a Spinner

Suppose we have a spinner that has three different colors: red, blue and green.

Spinner



If we spin it one time then it must land on one of the following values:

Red

Blue

Green

Thus, the set of events **{Red, Blue, Green}** would be collectively exhaustive.

## Example 3: Types of Basketball Players

Suppose we have a survey that asks individuals to select their favorite basketball player position. The only potential responses are:

Point Guard

Shooting Guard

Small Forward

Power Forward

Center

Thus, the set of events **{Point Guard, Shooting Guard, Small Forward, Power Forward, Center}** would be collectively exhaustive.

However, the set of events **{Point Guard, Shooting Guard, Small Forward}** would *not* be

collectively exhaustive because it does not contain all possible outcomes.

## The Importance of Collectively Exhaustive Events in Surveys

When designing surveys, it's particularly important that the responses to the questions are collectively exhaustive.

For example, suppose a survey asks the following question:

***What is your favorite basketball player position?***

And suppose the potential responses were:

Point Guard  
Shooting Guard  
Small Forward  
Power Forward

Since the position *Center* was left out, these responses are not collectively exhaustive.

This means that someone who prefers *Center* as their favorite position will have to pick one of the other options, which means the responses to the survey won't reflect the true opinions of the respondents.

## Collectively Exhaustive vs. Mutually Exclusive

Events are if they cannot occur at the same time.

For example, let event A be the event that a die lands on an even number and let event B be the event that a die lands on an odd number.

We would define the for the events as follows:

$A = \{2, 4, 6\}$

$B = \{1, 3, 5\}$

Notice that there is no overlap between the two sample spaces, which means they're mutually exclusive. They also happen to be collectively exhaustive because combined they're able to account for all the potential outcomes of the die roll.

However, suppose we define event A and event B as follows:

$A = \{1, 2, 3, 4\}$

$B = \{3, 4, 5, 6\}$

In this case, there is some overlap between A and B so they are not mutually exclusive. However, combined they're still able to account for all the potential outcomes of the die roll.

This illustrates an important point: **A set of events can be collectively exhaustive without being mutually exclusive.**

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