

What Are Disjoint Events? (Definition & Examples)

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Disjoint events are a set of events that have no outcomes in common, meaning that they cannot occur at the same time. In other words, if one event happens, the other cannot occur simultaneously. This is also known as mutually exclusive events. For example, rolling a 4 on a dice and rolling a 6 are disjoint events, as they cannot happen together on one roll. Another example is drawing a red card and drawing a black card from a deck of playing cards. These events have no overlapping outcomes and are therefore considered disjoint.

What Are Disjoint Events? (Definition & Examples)

Disjoint events are events that cannot occur at the same time.

Written in probability notation, events A and B are disjoint if their is zero. This can be written as:

$$P(A \text{ and } B) = 0 \quad P(A \cap B) = 0$$

For example, suppose we select a random card from a deck. Let event A be the event that the card is a Spade or a Club and let event B be the event that the card is a Heart or a Diamond.

We would define the for the events as follows:

$$A = \{\text{Spade, Club}\} \quad B = \{\text{Heart, Diamond}\}$$

Notice that there is no overlap between the two sample spaces. Thus, events A and B are disjoint events

because they both cannot occur at the same time.

Note: Disjoint events are also said to be .

Examples of Disjoint Events

Here are a few more examples of disjoint events.

Example 1: Coin Toss

Suppose you flip a coin. Let event A be the event that the coin lands on heads and let event B be the event that the coin lands on tails.

Event A and event B would be disjoint because they both cannot occur at the same time. The coin cannot land on heads *and* tails.

Example 2: Dice Roll

Suppose you roll a dice. Let event A be the event that the dice lands on an odd number and let event B be the event that the dice lands on an even number.

Event A and event B would be disjoint because they both cannot occur at the same time. The dice cannot land on an even number *and* an odd number.

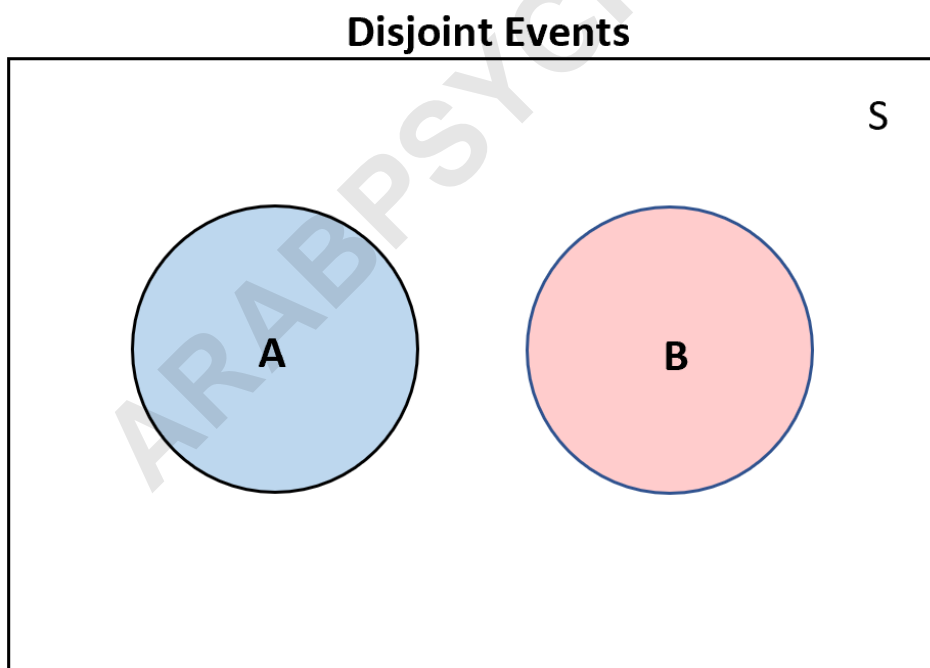
Example 3: Pro Bowl Location

Event A and event B would be disjoint because they both cannot occur at the same time. Miami and San Diego cannot both be selected.

Visualizing Disjoint Events

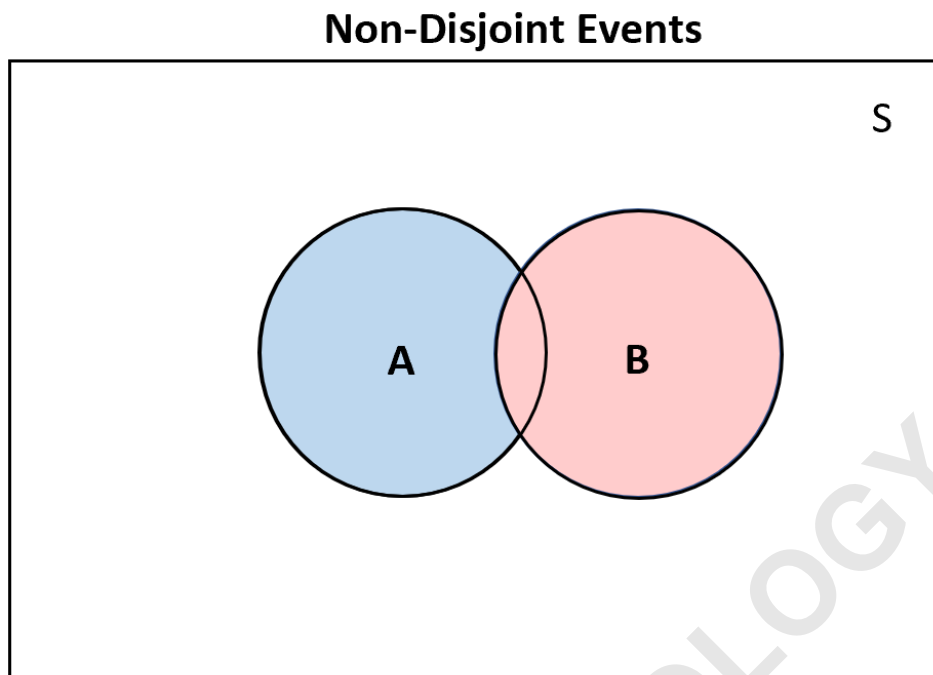
One useful way to visualize disjoint events is by creating a Venn diagram.

If two events are disjoint then they would not overlap at all in a Venn diagram:



Conversely, if two events are non-disjoint then there

would be at least some overlap in the Venn diagram:



The Probability of Disjoint Events

As mentioned earlier, if two events are disjoint then the probability that they both occur at once is zero.

$$P(A \cap B) = 0$$

Similarly, the probability that *either* event occurs can be calculated by adding up their individual probabilities.

$$P(A \cup B) = P(A) + P(B)$$

For example, let event A be the event that a dice lands

on a 1 or a 2 and let event B be the event that a dice lands on a 5 or a 6.

We would define the sample space for the events as follows:

$$A = \{1, 2\} B = \{5, 6\}$$

We would calculate the probability the event A or event B occurs as:

$$P(A \cup B) = P(A) + P(B) \quad P(A \cup B) = 2/6 + 2/6 \quad P(A \cup B) = 4/6 = 2/3$$

The probability that event A or event B occurs is 2/3.

The following tutorials provide explanations for other common topics in probability: