

What are disjoint events? (Definition & Examples)

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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:

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

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

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:

$$A = \{\text{Spade, Club}\}$$

$$B = \{\text{Heart, Diamond}\}$$

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

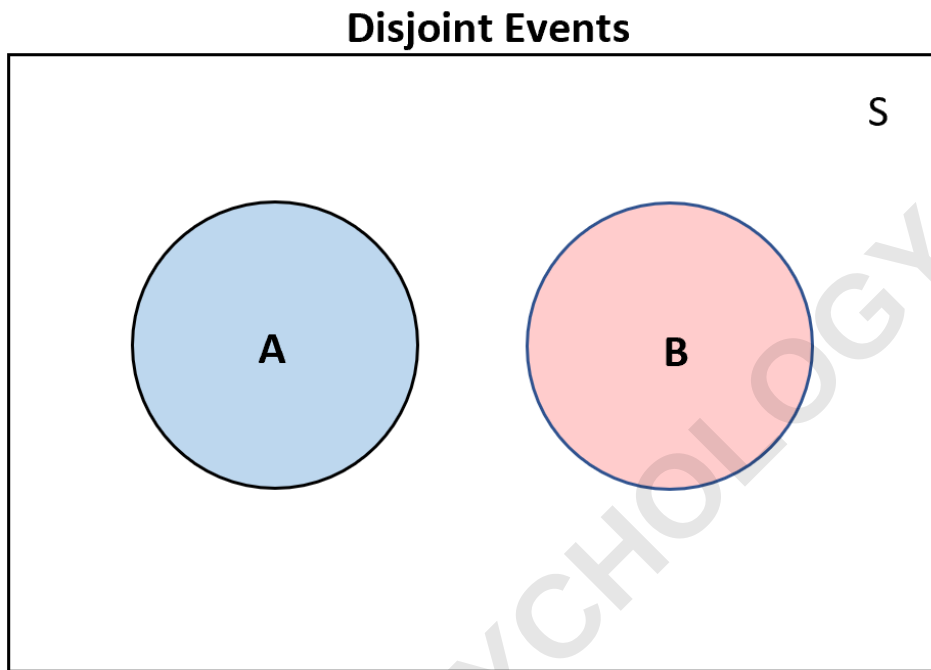
Event A and event B would be disjoint because they both cannot occur at the same time. Miami

and San Diego cannot both be selected.

Visualizing Disjoint Events

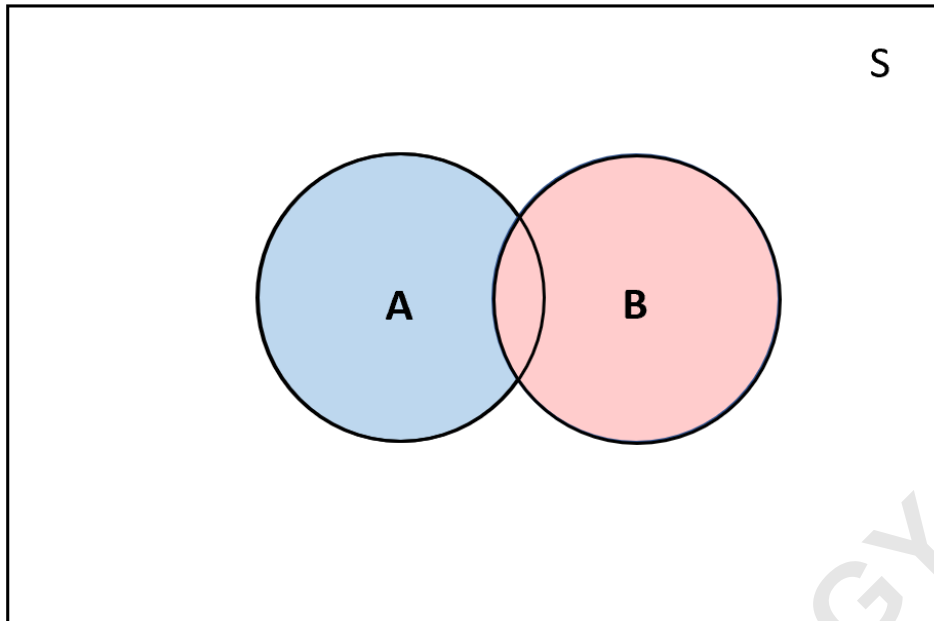
One useful way to visualize disjoint events is by creating a Venn diagram.

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:

Non-Disjoint Events



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:

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

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

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

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

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

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