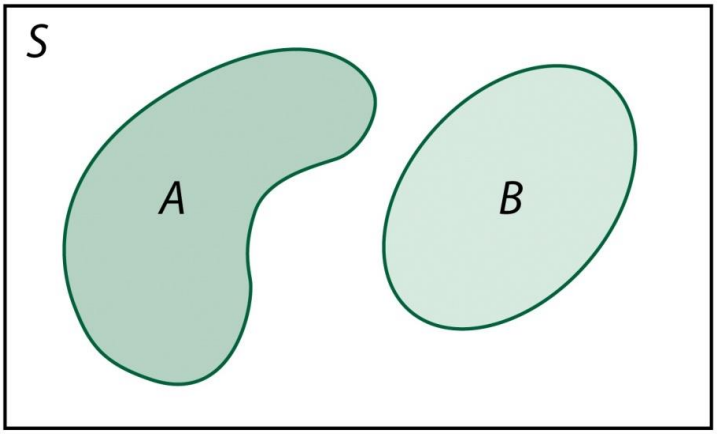
Mutually Exclusive Events

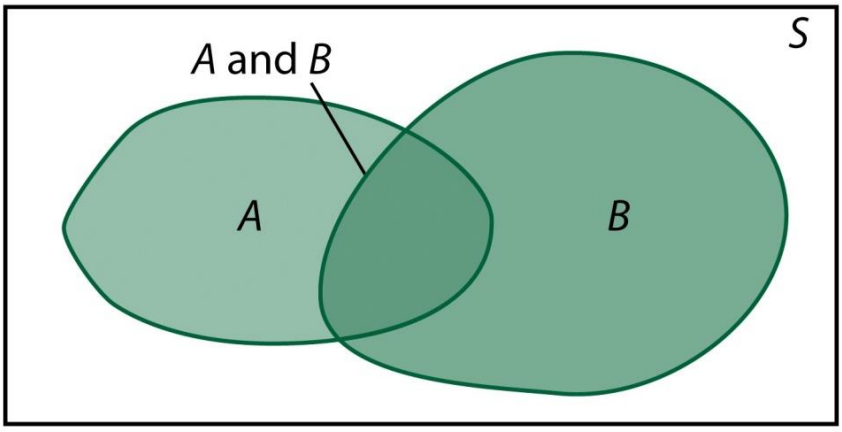
Definition 1: Two events A and B of the same experiment E are said to be mutually exclusive if they have nothing in common. In other words, A and B will not happen at the same time.

For instance, let E be the experiment of picking a card randomly from a standard deck of 52 cards, let A be the event of picking a Diamond (♦), and let B be the event of picking a Spade (♠). Then clearly they are disjoint because we cannot find a card that is both a Diamond and a Spade.

Definition 2: The union of two events A and B is the event that occurs if either A or B or both occur on a single performance of the experiment. We denote the union of events A and B by the symbol $A \cup B$. $A \cup B$ consists of all the sample points that belong to A or B or both.



Definition 3: The intersection of two events A and B is the event that occurs if both A and B occur on a single performance of the experiment. We denote the intersection of events A and B by the symbol $A \cap B$. $A \cap B$ consists of all the sample points that belong to A and B.



Rule 1: The probability of the union of events A and B is the sum of the probability of events A and B minus the probability of the intersection of events A and B, that is

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

If A and B are mutually exclusive events of the same experiment E, then

$$P(A \text{ or } B) = P(A) + P(B)$$

Example 1: What is the probability that on one roll of a die, I get a 3 or a 4.

The events are mutually exclusive so the probability is: P(3 or 4)=P(3) + P(4) = (1/6) + (1/6) = (2/6) =.333

Example 2: The table below lists the number of people who smokes and drinks coffee, use the information in the table to find the probability that:

	Coffee	No Coffee	Total
Smoker	60	40	100
Non-Smoker	115	85	200
Total	175	125	300

1) A randomly selected person from the sample either smokes or drinks coffee.

Event A: A person smokes

Event B: A person drinks coffee

These are not mutually exclusive events because some people smoke and drink coffee.

P(A or B) = P(A) + P(B) – P(A and B)

$$P(A \text{ or } B) = \frac{100}{300} + \frac{175}{300} - \frac{60}{300} = \frac{215}{300}$$

2) A randomly selected person from the sample is a non-smoker or drinks coffee.

Event A: A person is a non-smoker

Event B: A person drinks coffee

These are not mutually exclusive events because some non-smokers and drink coffee.

P(A or B) = P(A) + P(B) – P(A and B)

$$P(A \text{ or } B) = \frac{200}{300} + \frac{175}{300} - \frac{115}{300} = \frac{260}{300}$$