Probability

Mutually Exclusive v. Overlapping EVENTS

Review

Outcome
The result of a single trial of an experiment.

Event
One or more outcomes.

Probability
The measure of how likely an event is (between 0 and 1)

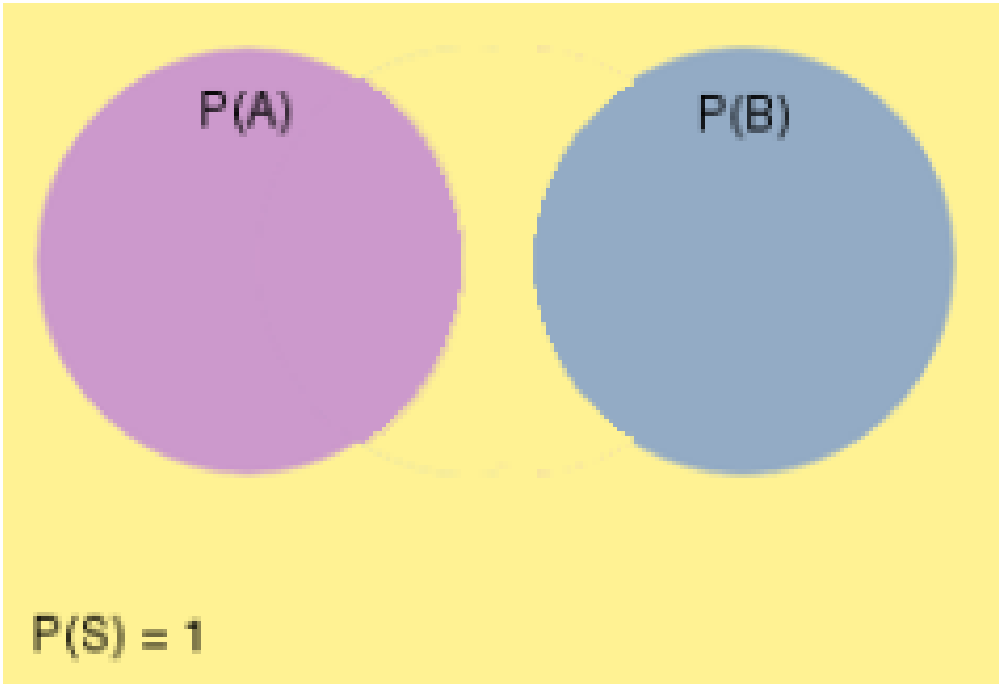
Mutually Exclusive Events

Two events are said to be mutually exclusive if they have no common outcomes.

Can even be odd?

Mutually Exclusive Events

Two events are mutually exclusive if they cannot occur at the same time (i.e., they have no outcomes in common).



In the Venn Diagram above, the probabilities of events A and B are represented by two disjoint sets (i.e., they have no elements in common).

For example:

1. Drawing an 8 or a king from a standard deck of playing cards.

   Possibilities:

   you draw an 8
   you draw a king

2. Given a 6-sided number cube (a die), the event of rolling an even or an odd number.

   Possibilities:

   you roll an even
   you roll an odd

Probability of Mutually Exclusive Events

Rule for Mutually Exclusive:
P(A or B) = P(A) + P(B)

For example:

1. What is the probability of drawing a 6 or a queen from a standard deck of playing cards?

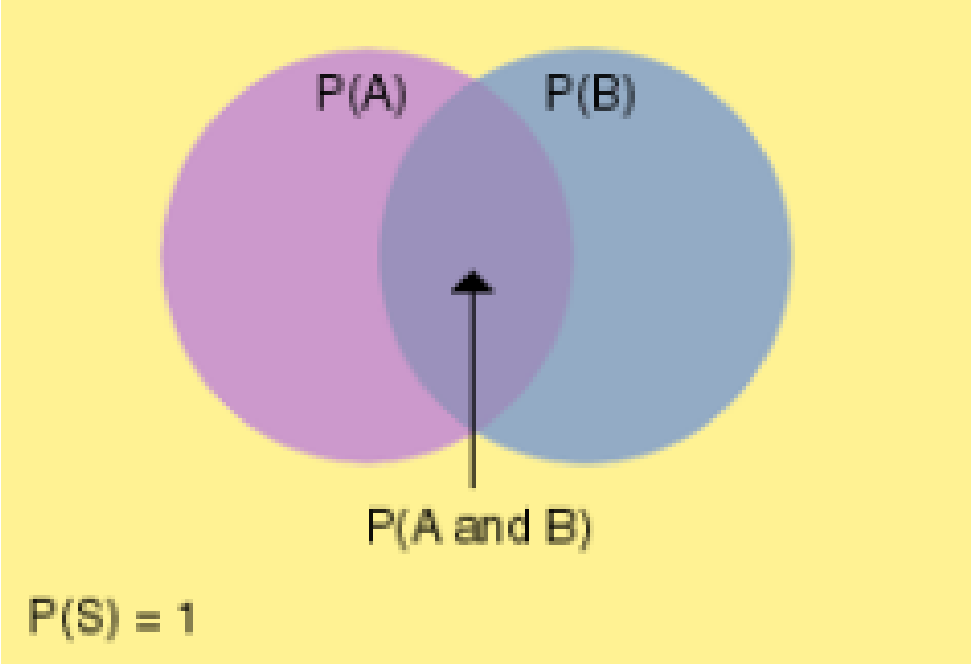
Overlapping Events

Events that have common outcomes

Can you draw a queen that is also a spade?

Non-Mutually Exclusive Events

Two events are non-mutually exclusive if they have one or more outcomes in common.



In the Venn Diagram above, the probabilities of events A and B are represented by two intersecting sets (i.e., they have some elements in common).

For example:

1. Rolling a 6-sided die and getting a 5 or an odd number
   - Possibilities:
     - you can roll a 5
     - you can roll an odd number
     - you can roll an odd number that is also 5

2. Drawing a heart or a king.
   - Possibilities:
     - you can draw a heart
     - you can draw a king
     - you can draw a king that is also a heart

Probability of Overlapping Events

Rule for Overlapping Events:
P(A or B) = P(A) + P(B) – P(A and B)

For examp

1. What is will draw a diamond or dard deck of playing ca

P(6 or Queen)

Solution:

Solution:

$$P(6 \text{ or Queen}) = P(6) + P(\text{Queen})$$

$$= \frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \frac{2}{13}$$

P(diamond or two)

Solution:

Solution:

$$P(\text{diamond or two}) = P(\text{diamond}) + P(2) - P(\text{diamond and } 2)$$

$$= \frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$$

Independent Events

Two events are independent if the outcome of the first event does not impact the outcome of the second event.

Rolling a die

Tossing a coin

Rule for independent events:

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

For example:

1. There are 6 red, 4 green , 8 black and 10 yellow marbles in a jar. You reach into the jar, without looking, and take out a marble. You replace the marble you took out and you take a second marble. What is the probability that the first marble is red and the second marble is yellow?

Solution:

$$P(\text{red and yellow}) = P(\text{red}) \bullet P(\text{yellow})$$

$$= \frac{6}{28} \bullet \frac{10}{28} = \frac{60}{784} = \frac{15}{196}$$