# Independent Events

Definition 1: Two events are independent if the occurrence of one of the events gives us no information about whether or not the other event will occur; that is, the events have no influence on each other.

Rule 1: In probability theory we say that two events, A and B, are independent if the probability that they both occur is equal to the product of the probabilities of the two individual events. That is: $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$

For instance, when you draw a card from a standard deck, there are just as many face cards in the hearts suit as in any other suit. Therefore "drawing a heart" and "drawing a face card" are independent events.

The idea of independence can be extended to more than two events.

Rule 2: A and B are independent; A and C are independent and B and C are independent (pair wise independence):

$$P(A \text{ and } B \text{ and } C) = P(A \cap B \cap C) = P(A) \times P(B) \times P(C)$$

Example 1: A man and a woman each have a pack of 52 playing cards. Each draws a card from his/her pack. Find the probability that each draw the ace of clubs.
We define the events:

A = probability that a man draws ace of clubs = $\frac{1}{52}$

B = probability that a woman draws ace of clubs = $\frac{1}{52}$

Clearly events A and B are independent so:

$$P(A \cap B)$$
$$= P(A) \times P(B)$$
$$= \frac{1}{52} \times \frac{1}{52}$$
$$= 0.00037$$

That is, there is a very small chance that the man and the woman will both draw the ace of clubs.