Independent vs. Dependent Probabilities

https://www.varsitytutors.com/hotmath/hotmath_help/topics/independent-dependent-events

Two events are **independent** if the outcome of the first event does not affect the probability of the second event.

Two events are **dependent** if the outcome of the first event affects the probability of the second event.

Example 1: INDEPENDENT PROBABILITIES

Let's say we have a box of 10 marbles: 4 red, 3 green, 2 blue, and 1 yellow. We select only one marble, which we will call our first marble.

The probability of our first selecting one of the 4 red marbles from the box of 10 marbles is

$$4/10 = 0.400 \text{ (or } 40\%)$$

The probability of our first selecting one of the 3 green marbles from the box of 10 marbles is

$$3/10 = 0.300 \text{ (or } 30\%)$$

The probability of our first selecting one of the 2 blue marbles from the box of 10 marbles is

$$2/10 = 0.200 \text{ (or } 20\%)$$

The probability of our first selecting the only 1 yellow marble from the box of 10 marbles is

$$1/10 = 0.100 \text{ (or } 10\%)$$

Let's also say that after we select our first marble, we replace that marble back into the box, before we select a second marble.

Because we replaced the first marble back into the box, the outcome of the first event (which color marble we got on our first selection) does not affect the probability of the second event (which color marble we will get on our second selection).

Example 2: DEPENDENT PROBABILITIES

Again, let's say we start with a box of 10 marbles: 4 red, 3 green, 2 blue, and 1 yellow. We select our first marble. But this time, after we have selected our first marble from the box, we don't replace that first marble back into the box before make our second selection.

Our second selection is no longer independent of our first selection. In fact, all the probabilities have changed, most notably because our box now contains only 9 marbles.

For example, if the first marble we selected first was a red marble, then the following is true:

The probability of our selecting, on our second selection, one of the remaining 3 red marbles from the box of 9 marbles on our second selection is

$$3/9 = 0.333 \text{ (or } 33\%)$$

The probability of our selecting, on our second selection, one of the remaining 3 green marbles from the box of 9 marbles is

$$3/9 = 0.333 \text{ (or } 33\%)$$

The probability of our selecting, on our second selection, one of the remaining 2 blue marbles from the box of 9 marbles is

$$2/9 = 0.222 \text{ (or } 22\%)$$

The probability of selecting, on our second selection, the only 1 yellow marble from the box of 9 marbles is

$$1/9 = 0.111 \text{ (or } 11\%)$$

As you can see from comparing the above probabilities to the probabilities on the first page, some probabilities have increased in likelihood (e.g., the probabilty of our selecting a green, blue or yellow for on our second selection). And some probabilities have decreased in likelihood (e.g., the probability of our selecting another red marble for our second selection).

If we continue to select from the box without replacing the marbles back into the box, all the probabilities will continue to change -- because these events are dependent.