Conditional probability

Conditional probability is the probability of an event occurring given that another event has already occurred. It helps us understand how the probability of one event is affected by the occurrence or non-occurrence of another event.

Conditional probability is the likelihood of an event happening given that another event has already occurred. It helps us understand how the probability of one event is influenced by the occurrence or non-occurrence of another event.

Here's a simple explanation with an example:

Suppose you have a bag containing 3 red balls and 2 green balls. You randomly pick one ball from the bag. Let's define two events:

- Event A: Selecting a red ball.
- Event B: Selecting a green ball.

Now, let's calculate the conditional probability of selecting a red ball given that a green ball was not chosen:

1. **Calculating Individual Probabilities**:
   - The probability of selecting a red ball (Event A) without any condition is the proportion of red balls in the bag, which is $\left(P(A) = \frac{3}{5} \right)$.
   - The probability of not selecting a green ball (Event B') is the complement of selecting a green ball, which is $\left(P(B') = 1 - P(B) = 1 - \frac{2}{5} = \frac{3}{5} \right)$.
2. **Calculating Conditional Probability**:
   - The conditional probability of selecting a red ball given that a green ball was not chosen (Event B') is calculated using the formula for conditional probability: $\left[P(A \vee B') = \frac{P(A \cap B')}{P(B')} \right)$
   - Here, $\left(P(A \cap B') \right)$ represents the probability of selecting a red ball and not selecting a green ball, which is the same as the probability of selecting a red ball ((P(A))) since the two events are mutually exclusive.
   - Thus, $\left(P(A \vee B') = \frac{P(A)}{P(B')} = \frac{\frac{3}{5}}{\frac{3}{5}} = 1 \right)$.

So, the conditional probability of selecting a red ball given that a green ball was not chosen is 1, meaning that if a green ball was not chosen, then the probability of selecting a red ball is certain.

In summary, conditional probability helps us understand how the occurrence or non-occurrence of one event affects the probability of another event. In this example, knowing that a green ball was not chosen (Event B') increases the certainty of selecting a red ball (Event A).

Conditional Probability

A, B

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

given, $P(B) \neq 0$

* Two Dice Example
we are rolling 2 Dice Together.

D_1 D_2

Sample Space $\{(1,1), (1,2) \ldots (2,1), (2,2) \ldots (6,6)\}$ (36)

Sample - 36

D_2 \ D_1	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

① what is the probability of $D_1 \rightarrow 5$

$$P(A = 5) = \frac{1}{36}$$

② $D_1 + D_2 <= 10$

$$P(D_1 + D_2 <= 10) = \frac{33}{36} = \frac{11}{12}$$

Q. $D_1 = 5$ given $D_1 + D_2 <= 10$

A B

$P(D_1 = 5 \mid D_1 + D_2 <= 10)$

$$P(A|B) = \frac{5}{33}$$ cases

Using table

* Using formula of Conditional Probability

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

given $P(B) \neq 0$

$$\therefore P(A \cap B) = \frac{\frac{5}{36}}{\frac{33}{36}} = \frac{5}{33}$$

$P(A \cap B)$ over $\frac{5}{36}$; $P(B)$ over $\frac{33}{36}$

~~P(A∩B) = Both thing happening~~

Conditional Probability is the probability of an event occuring given that another event has already occurred.

It is calculated by multiplying the Prob of the previous event by Prob of succeeding event.