**Conditional Probability**-

Conditional probability is a fundamental concept in probability theory that measures the likelihood of an event occurring given that another event has already occurred. It allows us to update our knowledge and revise probabilities based on new information.

Here are the key aspects of conditional probability:

1. Notation: The conditional probability of an event A occurring given that event B has occurred is denoted as P(A|B), read as "the probability of A given B." The vertical bar "|" represents "given" or "conditional on."
2. Calculation: The conditional probability of A given B is calculated by dividing the probability of the joint occurrence of A and B by the probability of event B: P(A|B) = P(A ∩ B) / P(B)
3. Interpretation: P(A|B) represents the probability of event A occurring, considering that event B has already occurred or is true. It reflects the updated probability based on the additional information provided by event B.
4. Dependency and Independence: The concept of conditional probability helps assess the relationship between events A and B.
   * If P(A|B) ≠ P(A), it indicates that A is dependent on B. In other words, the occurrence of B affects the probability of A.
   * If P(A|B) = P(A), it implies that A and B are independent events. The occurrence or non-occurrence of B does not impact the probability of A.
5. Multiplication Rule: The multiplication rule is a useful formula for calculating the joint probability of two events: P(A ∩ B) = P(A|B) \* P(B) or P(A ∩ B) = P(B|A) \* P(A) It allows us to express the joint probability in terms of conditional probabilities and individual probabilities.
6. Law of Total Probability: The law of total probability states that for a set of mutually exclusive and exhaustive events {B1, B2, ..., Bn} that partition the sample space, the probability of event A can be expressed as the sum of the conditional probabilities of A given each event Bi, weighted by the probabilities of the events Bi: P(A) = Σ [P(A|Bi) \* P(Bi)]
7. Bayes' Theorem: Bayes' theorem provides a way to update probabilities based on new evidence. It states that for events A and B: P(A|B) = (P(B|A) \* P(A)) / P(B) Bayes' theorem allows us to reverse the conditioning and calculate the posterior probability of A given B, using the prior probability of A and the likelihood of B given A.

Conditional probability is widely applied in various fields, including statistics, machine learning, finance, medical diagnostics, and decision-making under uncertainty. It enables us to make more informed predictions and decisions by incorporating new information and adjusting probabilities accordingly.