1. **Define the Bayesian interpretation of probability.**

**Ans:** The Bayesian interpretation of probability is a mathematical framework for modeling uncertainty and reasoning under uncertainty. It views probability as a measure of belief or confidence in the likelihood of an event occurring, updated based on available evidence.

In Bayesian probability, probabilities are assigned to events based on prior knowledge or beliefs (prior probabilities) and are updated as new evidence becomes available using Bayes' theorem. It allows for the incorporation of prior information and the continuous refinement of beliefs.

1. **Define probability of a union of two events with equation.**

**Ans:** Probability of the Union of Two Events (A and B):

The probability of the union of two events A and B is denoted as P(A ∪ B) and is calculated using the addition rule:

Formula: P(A ∪ B) = P(A) + P(B) - P(A ∩ B)

Here, P(A) represents the probability of event A, P(B) represents the probability of event B, and P(A ∩ B) represents the probability of both events A and B occurring simultaneously.

1. **What is joint probability? What is its formula?**

**Ans:** Joint Probability:

Joint probability refers to the probability of two or more events occurring simultaneously. It is denoted as P(A and B) or P(A, B) and represents the likelihood of both events A and B happening together.

Formula: P(A and B) = P(A) \* P(B|A)

This formula calculates the joint probability by multiplying the probability of event A by the conditional probability of event B given that event A has occurred.

1. **What is chain rule of probability?**

**Ans:** Chain Rule of Probability:

The chain rule of probability is a fundamental rule used to calculate the joint probability of multiple events. It states that the joint probability of a set of events can be computed by multiplying the conditional probabilities of each event given the previous events.

Mathematically, for events A, B, C, ..., the chain rule is:

P(A ∩ B ∩ C ∩ ...) = P(A) \* P(B|A) \* P(C|A and B) \* ...

It allows for the decomposition of complex joint probabilities into a series of conditional probabilities.

1. **What is conditional probability means? What is the formula of it?**

**Ans:** Conditional Probability:

Conditional probability is the probability of an event occurring given that another event has already occurred. It is denoted as P(A|B) and is calculated using the formula:

Formula: P(A|B) = P(A and B) / P(B)

Here, P(A|B) represents the conditional probability of event A given event B.

1. **What are continuous random variables?**

**Ans:** Continuous Random Variables:

Continuous random variables are variables that can take on an infinite number of values within a given range. They are characterized by continuous probability distributions.

Examples include height, weight, temperature, and time. Probability density functions (PDFs) are used to describe the likelihood of specific values occurring within a continuous range.

1. **What are Bernoulli distributions? What is the formula of it?**

**Ans:** Bernoulli Distribution:

The Bernoulli distribution models a random experiment with two possible outcomes: success (usually denoted as 1) and failure (usually denoted as 0).

Formula: P(X = 1) = p, P(X = 0) = 1 - p, where p is the probability of success.

It is often used to model binary events such as coin flips (heads/tails) or the success/failure of a single trial.

1. **What is binomial distribution? What is the formula?**

**Ans:** Binomial Distribution:

The binomial distribution models the number of successes (k) in a fixed number of independent Bernoulli trials (n), where each trial has the same probability of success (p).

Formula: P(X = k) = C(n, k) \* p^k \* (1 - p)^(n - k), where C(n, k) represents the binomial coefficient.

It is used to model situations where there are a fixed number of trials with two possible outcomes (success/failure).

1. **What is Poisson distribution? What is the formula?**

**Ans:** Poisson Distribution:

The Poisson distribution models the number of events (k) occurring in a fixed interval of time or space, with events being rare and independent.

Formula: P(X = k) = (e^(-λ) \* λ^k) / k!, where λ (lambda) is the average rate of events.

It is commonly used for modeling rare events such as the number of customer arrivals at a store in an hour.

1. **Define covariance.**

**Ans:** Covariance:

Covariance measures the degree to which two random variables change together. It indicates whether the variables have a positive or negative relationship.

Formula: Cov(X, Y) = E[(X - μX)(Y - μY)], where E denotes the expected value, X and Y are random variables, and μX and μY are their means.

Positive covariance indicates that when one variable is above its mean, the other tends to be above its mean as well, and vice versa for negative covariance.

1. **Define correlation**

**Ans:** Correlation:

Correlation is a standardized measure of the linear relationship between two random variables. It quantifies both the strength and direction of the relationship.

Formula: Correlation(X, Y) = Cov(X, Y) / (σX \* σY), where σX and σY are the standard deviations of X and Y.

Correlation ranges from -1 (perfect negative correlation) to 1 (perfect positive correlation), with 0 indicating no linear correlation.

1. **Define sampling with replacement. Give example.**

**Ans:** Sampling with Replacement:

Sampling with replacement is a method of drawing elements from a population where each selected element is put back into the population before the next selection.

Example: Drawing a card from a deck, replacing it, and then drawing another card. The same card can be drawn more than once.

1. **What is sampling without replacement? Give example.**

**Ans:** Sampling without Replacement:

Sampling without replacement is a method of drawing elements from a population where each selected element is not returned to the population before the next selection.

Example: Drawing balls from an urn without putting them back. Once a ball is drawn, it is not available for subsequent draws.

1. **What is hypothesis? Give example.**

**Ans:** Hypothesis:

In statistics and hypothesis testing, a hypothesis is a statement or claim about a population or a parameter that is subject to testing and evaluation based on sample data.

Example:

Null Hypothesis (H0): There is no significant difference between the means of two groups.

Alternative Hypothesis (H1): There is a significant difference between the means of two groups.

Hypothesis testing involves making statistical inferences about the population based on sample data and predefined hypotheses.