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

**ANSWER:** The Bayesian interpretation of probability is a statistical interpretation that assigns probabilities to events based on prior knowledge and updating that knowledge with new evidence. It incorporates prior beliefs or information about the event and updates those beliefs using Bayes' theorem. In this interpretation, probability is seen as a measure of the degree of belief or confidence in an event's occurrence.

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

**ANSWER:** The probability of the union of two events, A and B, denoted as P(A ∪ B), can be calculated using the following equation:

P(A ∪ B) = P(A) + P(B) - P(A ∩ B)

where P(A) represents the probability of event A, P(B) represents the probability of event B, and P(A ∩ B) represents the probability of the intersection of events A and B.

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

**ANSWER:** Joint probability refers to the probability of two or more events occurring simultaneously. It represents the likelihood of the intersection of multiple events. The formula for joint probability depends on whether the events are independent or dependent. For independent events, the joint probability is calculated by multiplying the probabilities of the individual events. For dependent events, the joint probability is calculated using conditional probability.

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

**ANSWER:** The chain rule of probability is a formula that allows the calculation of the probability of a sequence of events by breaking it down into a series of conditional probabilities. It states that the joint probability of multiple events can be expressed as the product of the conditional probabilities of each event given the previous events in the sequence. Mathematically, it can be written as:

P(A₁, A₂, ..., Aₙ) = P(A₁) \* P(A₂|A₁) \* P(A₃|A₁, A₂) \* ... \* P(Aₙ|A₁, A₂, ..., Aₙ₋₁)

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

**ANSWER:** Conditional probability refers to the probability of an event occurring given that another event has already occurred. It is denoted as P(A|B), which means the probability of event A given event B. The formula for conditional probability is:

P(A|B) = P(A ∩ B) / P(B)

where P(A ∩ B) represents the probability of the intersection of events A and B, and P(B) represents the probability of event B.

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

**ANSWER:** Continuous random variables are variables that can take on any value within a certain range or interval. They can have an infinite number of possible values. Examples of continuous random variables include height, weight, temperature, and time. The probability distribution of continuous random variables is described by probability density functions (PDFs).

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

**ANSWER:** Bernoulli distributions model binary outcomes, where there are only two possible outcomes, typically referred to as success and failure. The Bernoulli distribution is characterized by a single parameter, p, which represents the probability of success. The formula for the Bernoulli distribution is:

P(X = k) = p^k \* (1 - p)^(1 - k)

where X is the random variable, k is the outcome (0 or 1), and p is the probability of success.

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

**ANSWER:** The binomial distribution is a discrete probability distribution that models the number of successes in a fixed number of independent Bernoulli trials. It is characterized by two parameters: n (the number of trials) and p (the probability of success in each trial). The formula for the binomial distribution is:

P(X = k) = C(n, k) \* p^k \* (1 - p)^(n - k)

where X is the random variable representing the number of successes, k is the number of successes, n is the number of trials, p is the probability of success in each trial, and C(n, k) represents the number of combinations.

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

**ANSWER:** The Poisson distribution is a discrete probability distribution that models the number of events occurring in a fixed interval of time or space, given the average rate of occurrence. It is characterized by a single parameter, λ (lambda), which represents the average rate of occurrence. The formula for the Poisson distribution is:

P(X = k) = (e^(-λ) \* λ^k) / k!

where X is the random variable representing the number of events, k is the number of events, λ is the average rate of occurrence, e is the base of the natural logarithm (approximately 2.71828), and k! represents the factorial of k.

1. **Define covariance.**

**ANSWER:** Covariance is a measure of the relationship between two random variables. It quantifies how changes in one variable are associated with changes in another variable. Covariance can be positive, indicating a positive relationship, or negative, indicating a negative relationship. The formula for covariance between two random variables X and Y is:

Cov(X, Y) = E[(X - E[X]) \* (Y - E[Y])]

1. **Define correlation**

**ANSWER:** Correlation is a measure of the linear relationship between two random variables. It determines the strength and direction of the linear association between variables. Correlation values range from -1 to 1, where -1 indicates a perfect negative correlation, 1 indicates a perfect positive correlation, and 0 indicates no linear correlation. The formula for correlation between two random variables X and Y is:

Corr(X, Y) = Cov(X, Y) / (σ(X) \* σ(Y))

where Cov(X, Y) is the covariance between X and Y, and σ(X) and σ(Y) are the standard deviations of X and Y, respectively.

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

**ANSWER:** Sampling with replacement refers to a sampling method in which each selected item is returned to the population before the next selection is made. This means that the same item can be selected more than once during the sampling process. For example, if you have a bag with 10 balls labeled from 1 to 10, and you randomly select a ball, note down its number, and put it back in the bag before selecting another ball, you are sampling with replacement.

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

**ANSWER**: Sampling without replacement refers to a sampling method in which each selected item is not returned to the population before the next selection is made. This means that once an item is selected, it is removed from the population and cannot be selected again. For example, if you have a deck of cards and you draw a card, note down its value, and do not return it to the deck before drawing the next card, you are sampling without replacement.

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

**ANSWER:** A hypothesis is a proposed explanation or prediction about a phenomenon or a scientific question. It is a statement that can be tested through observation or experimentation to determine its validity. Hypotheses are often formulated based on prior knowledge or observations and are used to make predictions or draw conclusions. For example, a hypothesis could be that increasing the amount of fertilizer will lead to higher crop yields. This hypothesis can then be tested by conducting experiments and analyzing the results to determine if the predicted relationship holds true.