1. Q: What is the Bayesian interpretation of probability?

   A: The Bayesian interpretation of probability views probability as a measure of our subjective belief or uncertainty about the likelihood of an event occurring. It incorporates prior knowledge or beliefs, and updates them based on new evidence using Bayes' theorem. It allows for the quantification of uncertainty and the updating of beliefs as new information becomes available.

2. Q: Define the probability of a union of two events and provide the equation.

   A: The probability of the union of two events, denoted as $P(A \cup B)$, represents the probability that at least one of the two events A or B occurs. The equation for the probability of a union is given by: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, where $P(A)$ and $P(B)$ are the probabilities of events A and B, respectively, and $P(A \cap B)$ is the probability of their intersection.

3. Q: What is joint probability? What is its formula?

   A: Joint probability refers to the probability of two or more events occurring simultaneously. It is denoted as $P(A \cap B)$ and represents the intersection of events A and B. The formula for joint probability is: $P(A \cap B) = P(A) \times P(B|A)$, where $P(A)$ is the probability of event A and $P(B|A)$ is the conditional probability of event B given that event A has occurred.

4. Q: What is the chain rule of probability?

   A: The chain rule of probability, also known as the multiplication rule, allows us to compute the probability of the joint occurrence of multiple events. It states that the joint probability of n events can be calculated by multiplying the conditional probabilities of each event given the previous events. Mathematically, it can be expressed as: $P(A_1 \cap A_2 \cap ... \cap A_n) = P(A_1) \times P(A_2|A_1) \times P(A_3|A_1 \cap A_2) \times ... \times P(A_n|A_1 \cap A_2 \cap ... \cap A_{n-1})$.

5. Q: What does conditional probability mean? What is the formula for it?

   A: 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 represents the probability of event A given event B. The formula for conditional probability is: $P(A|B) = P(A \cap B) / P(B)$, where $P(A \cap B)$ is the joint probability of events A and B, and $P(B)$ is the probability of event B.

6. Q: What are continuous random variables?

   A: Continuous random variables are variables that can take on any value within a specific range or interval. They can assume an infinite number of possible values, typically within a continuous spectrum. Examples of continuous random variables include measurements such as height, weight, time, or temperature.

7. Q: What are Bernoulli distributions? What is the formula for it?

   A: The Bernoulli distribution models a single binary outcome, typically characterized as success or failure. It is used when there are only two possible outcomes, each with a fixed probability. The formula for the Bernoulli distribution is: $P(X = k) = p^k \times (1 - p)^{(1-k)}$, where X is the random variable, p is the probability of success, and k is the outcome (0 for failure, 1 for success).

8. Q: What is the binomial distribution? What is the formula?

   A: 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: the number of trials (n) and the probability of success in each trial (p). The formula for the binomial distribution is: $P(X = k) = (n \text{ choose } k) \times p^k \times (1 - p)^{(n-k)}$, where X is the random variable representing the number of successes, n is the number of trials, p is the probability of success, and (n choose k) represents the binomial coefficient.

9. Q: What is the Poisson distribution? What is the formula?

   A: The Poisson distribution is a discrete probability distribution that models the number of events occurring in a fixed interval of time or space, given a known average rate. It is often used to describe rare events. The formula for the Poisson distribution is: $P(X = k) = (e^{(-\lambda)} \times \lambda^k) / k!$, where X is the random variable representing the number of events, λ is the average rate of events, e is the base of

the natural logarithm (approximately 2.71828), k is the number of events, and k! denotes the factorial of k.

10. Q: Define covariance.

A: Covariance is a measure of how two random variables vary together. It quantifies the relationship between two variables, indicating the direction and strength of their linear association. A positive covariance indicates a direct relationship (when one variable increases, the other tends to increase), while a negative covariance indicates an inverse relationship (when one variable increases, the other tends to decrease). However, covariance does not provide information about the magnitude or scale of the relationship.

11. Q: Define correlation.

A: Correlation is a statistical measure that determines the strength and direction of the linear relationship between two variables. It assesses the degree to which the variables move together. The correlation coefficient ranges from -1 to +1, where -1 indicates a perfect negative correlation, +1 indicates a perfect positive correlation, and 0 indicates no linear correlation. Correlation takes into account both the direction and magnitude of the relationship between variables.

12. Q: Define sampling with replacement and provide an example.

A: Sampling with replacement refers to a sampling method where each selected item is returned to the population before the next selection is made. This means that each item has an equal chance of being selected at each draw, and it allows for the same item to be selected multiple times. For example, if you have a bag with 5 red balls (R) and 3 blue balls (B), and you randomly select a ball and then put it back before the next selection, you could select a red ball, put it back, and then select the same red ball again in the subsequent draw.

13. Q: What is sampling without replacement? Provide an example.

A: Sampling without replacement is a sampling method where 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 no longer available for subsequent selections. For example, if you have a deck of playing cards and you randomly draw one card from the deck, without putting it back, and then draw another card, this would be an example of sampling without replacement.

14. Q: What is a hypothesis? Provide an example.

A: A hypothesis is a proposed explanation or statement that can be tested through observation or experimentation. It is an educated guess or a tentative explanation for a phenomenon or a relationship between variables. Hypotheses are often used in scientific research to formulate predictions and guide the collection and analysis of data. For example, a hypothesis could be that increasing the amount of fertilizer applied to plants will lead

to an increase in their growth rate.