1. **What is prior probability? Give an example.**

**ANSWER:** Prior probability refers to the probability assigned to an event or hypothesis before any evidence is taken into account. It represents the initial belief or knowledge about the likelihood of an event occurring.

Example: Let's say we are flipping a fair coin. The prior probability of getting a heads would be 0.5, as there is an equal chance of getting heads or tails before any coin tosses have been made.

1. **What is posterior probability? Give an example.**

**ANSWER:** Posterior probability refers to the updated probability of an event or hypothesis after considering the evidence or data. It is calculated using Bayes' theorem, which combines the prior probability and the likelihood of the data given the hypothesis.

Example: Continuing with the coin flip example, let's say we flip the coin five times and get heads on all five tosses. The posterior probability of getting heads would be updated based on this evidence. If we assume a prior probability of 0.5, the posterior probability would increase significantly, indicating a higher likelihood of the coin being biased towards heads.

1. **What is likelihood probability? Give an example.**

**ANSWER:** Likelihood probability refers to the probability of observing a particular set of data given a specific hypothesis. It measures how well the hypothesis explains the observed data.

Example: Suppose we have a bag of colored marbles, and we want to estimate the probability of drawing a red marble. We draw five marbles from the bag, and three of them are red. The likelihood probability would be the probability of obtaining three red marbles out of five, given the hypothesis that the bag contains a certain proportion of red marbles.

1. **What is Naïve Bayes classifier? Why is it named so?**

**ANSWER:** Naïve Bayes classifier is a probabilistic machine learning algorithm commonly used for classification tasks. It is named "naïve" because it assumes that the features (or attributes) used for classification are independent of each other, which is often an oversimplification. Despite this simplifying assumption, Naïve Bayes classifiers can still perform well in practice.

1. **What is optimal Bayes classifier?**

**ANSWER:** The optimal Bayes classifier, also known as the Bayes optimal classifier, is a theoretical concept that represents the best possible classifier for a given problem. It assigns labels to data points based on the class with the highest posterior probability. The optimal Bayes classifier is derived using Bayes' theorem and assumes complete knowledge of the true underlying probability distributions.

1. **Write any two features of Bayesian learning methods.**

**ANSWER:** Two features of Bayesian learning methods are:

a) Bayesian learning allows for the incorporation of prior knowledge or beliefs into the learning process. This prior knowledge can act as a regularizer and help improve the model's generalization performance, especially in situations with limited data.

b) Bayesian learning provides a framework for updating beliefs based on new evidence. It allows for iterative learning, where the model can be updated and refined as more data becomes available, resulting in improved predictions.

1. **Define the concept of consistent learning.**

**ANSWER**: Consistent learning refers to the property of a learning algorithm to converge to the true underlying function or model as the amount of training data increases. In other words, a learning algorithm is consistent if it can learn the true pattern or relationship between input and output variables given enough data.

1. **Write any two strengths of Bayes classifier.**

**ANSWER:** Two strengths of the Bayes classifier are:

a) Bayes classifiers are computationally efficient and relatively simple to implement. They have a low computational cost and can handle large amounts of data efficiently.

b) Bayes classifiers can handle both categorical and continuous input features, making them versatile for a wide range of applications. They can handle different types of data and can be adapted to different problem domains.

1. **Write any two weaknesses of Bayes classifier.**

**ANSWER:** Two weaknesses of the Bayes classifier are:

a) The naïve assumption of feature independence can lead to suboptimal results if the features are actually dependent on each other. This assumption may not hold in many real-world scenarios, and the classifier's performance can suffer as a result.

b) The Bayes classifier assumes that all features are equally important for classification. It assigns equal weights to each feature, which may not be accurate if certain features have more discriminative power than others. This can lead to suboptimal performance in situations where feature relevance varies.

1. **Explain how Naïve Bayes classifier is used for:**

**ANSWER:**

**Text classification:**  Naïve Bayes classifiers are commonly used for text classification tasks such as sentiment analysis, spam detection, and document categorization. The classifier can learn the conditional probabilities of words or features given different classes and use them to classify new text documents.

**Spam filtering:** Naïve Bayes classifiers have been widely used for spam filtering. By learning the probabilities of different words or features in spam and non-spam emails, the classifier can effectively classify incoming emails as either spam or legitimate.

**Market sentiment analysis:** Naïve Bayes classifiers can be employed for market sentiment analysis, where the goal is to determine the sentiment (positive, negative, or neutral) expressed in text data related to financial markets. By training the classifier on labeled data, it can be used to automatically analyze and classify large volumes of news articles, social media posts, or other textual data to gauge market sentiment.