1. What is a Decision Tree, and how does it make decisions during test time?

Decision Tree is a supervised machine learning algorithm, which defines a hierarchy of rules to make a prediction. There are root nodes and internal nodes which test the rules. The leaf nodes or terminal nodes make prediction. During test time, it traverses the tree from root node to leaf node. In the root node, the feature which has the lowest entropy is used. For selecting the internal nodes, other features are checked for next lowest entropy and is used in internal node. The steps are repeated till leaf node is reached for making prediction.

2. How does Bagging improve the performance of a Decision Tree?

The bagging is short form for Bootstrap aggregating and is a ensemble approach. Since it is ensemble technique, it is used to reduce the overfitting seen in decision trees. It creates number of weak learners from bootstrap datasets and combining their predictions to increase the accuracy. The weak learners created from diverse datasets introduces diversity. The final model becomes less sensitive to fluctuations.

3. **In what situations might a Decision Tree overfit the training data, and how can this,**

be mitigated?

The overfitting in decision tree can be result from high depth of decision tree, small dataset, noise in the dataset. The overfitting in the decision tree can be checked by monitoring validation set accuracy. The overfitting can be mitigated by pruning the decision tree to reduce the complexity. Also using Ensemble methods like random forest can be used for mitigation.

4. How does Random Forest differ from a single Decision Tree?

Random Forest is an ensemble method in machine learning that builds multiple decision trees and combines their predictions to improve accuracy and reduce overfitting.

Single decision tree is a single method that makes decisions based on traversal through the tree structure.

In Random forest, overfitting is not there but whereas single decision tree can be impacted by overfitting.

5. What is the main idea behind Boosting in ensemble methods?

Boosting is an ensemble learning technique where multiple weak learners are combined sequentially to create a strong learner. The models are built one after another. The core idea is to focus on the mistakes made by previous models.