1) What is Boosting in Machine Learning?

Boosting is an ensemble technique that combines multiple weak learners (often decision trees) sequentially to create a strong predictive model. Each new model corrects the errors made by the previous one.

2) How does Boosting differ from Bagging?

Boosting vs Bagging:

Boosting trains models sequentially, correcting previous errors.

Bagging trains models independently in parallel and averages their predictions.

3) What is the key idea behind AdaBoost?

It assigns higher weights to misclassified samples, forcing the next model to focus more on those difficult cases.

4) Explain the working of AdaBoost with an example?

AdaBoost Example:

-Start with equal weights for all data points.

-Train a weak learner (e.g., decision stump).

-Increase weights for misclassified points.

-Train another weak learner with updated weights.

-Repeat until achieving the desired performance.

5) What is Gradient Boosting, and how is it different from AdaBoost?

Gradient Boosting optimizes a loss function by fitting new models to the residual errors of previous models. Unlike AdaBoost, Gradient Boosting directly minimizes loss rather than adjusting weights

6) What is the loss function in Gradient Boosting?

Loss Function in Gradient Boosting: Common loss functions include Mean Squared Error (MSE) for regression and Log Loss for classification.

7) How does XGBoost improve over traditional Gradient Boosting?

XGBoost Improvements:

Faster training using parallel computing.

Handles missing values efficiently.

Includes regularization to reduce overfitting.

8)What is the difference between XGBoost and CatBoost?

XGBoost vs CatBoost:

-XGBoost requires manual encoding for categorical features.

-CatBoost handles categorical data directly and efficiently.

9) What are some real-world applications of Boosting techniques?

Real-World Applications:

-Fraud detection

-Customer churn prediction

-Credit scoring

-Sales forecasting

-Image recognition

10) How does regularization help in XGBoost?

Regularization in XGBoost: It controls model complexity using L1 (Lasso) and L2 (Ridge) penalties to reduce overfitting.

11) What are some hyperparameters to tune in Gradient Boosting models?

Key Hyperparameters for Tuning Gradient Boosting:

-Learning rate

-Number of estimators (trees)

-Maximum depth

-Subsample ratio

-Minimum child weight

12) What is the concept of Feature Importance in Boosting?

Feature Importance in Boosting: Measures how much each feature contributes to reducing the model's loss. Important features are used more in splits.

13) Why is CatBoost efficient for categorical data?

CatBoost Efficiency: It uses an efficient algorithm called Ordered Boosting that prevents data leakage when handling categorical data.