**LDA Assignment**

**Lab Exercise 1: Introduction to LDA for Dimensionality Reduction**

**Objective:** Understand the basic principles of LDA and apply it to reduce the dimensionality of a simple classification dataset.

**Instructions:**

1. **Load the Dataset:**
    - Use the Iris dataset (available in sklearn or seaborn). The dataset has 4 features and 3 classes.
2. **Data Standardization:**
    - Standardize the data so that it has a mean of 0 and a standard deviation of 1.
3. **Apply LDA:**
    - Implement LDA using sklearn's LinearDiscriminantAnalysis class. Reduce the dimensionality of the dataset to 2 components.
4. **Visualization:**
    - Create a 2D scatter plot of the transformed data, using different colors for each class.
5. **Compare LDA with PCA:**
    - Plot the first two components from PCA (from the previous lab if done) on the same dataset and compare the results with LDA.

**Lab Exercise 2: LDA for Classification**

**Objective:** Learn how LDA can be used as a classifier by applying it to a multi-class classification problem.

**Instructions:**

1. **Load the Dataset:**
    - Use the Wine dataset from sklearn, which contains 13 features and 3 classes.
2. **Split the Data:**
    - Split the data into training and testing sets (e.g., 70% training, 30% testing).
3. **Train an LDA Model:**
    - Use LDA as a classifier by training a LinearDiscriminantAnalysis model on the training data.
4. **Evaluate the Model:**
    - Predict the labels on the test set and compute the model's accuracy, precision, recall, and confusion matrix.
5. **Compare with Logistic Regression:**
    - Train a logistic regression model on the same dataset, and compare its performance with the LDA classifier.
6. **Visualize Decision Boundaries (Optional):**
    - For an intuitive understanding, visualize the decision boundaries for both the LDA and logistic regression models in a 2D space (you can reduce the dataset to 2 dimensions using LDA or PCA for visualization purposes).