Q1. **Approach**
Unpickling a file gives a dictionary. To visualise an image I have reshaped and reordered the array in such a way that a single image is represented by a single 3 dimensional array which has dimensions 32x32x3 the first two 32 are for the pixels and the 3 is for the RGB values of a single pixel. For LDA the data from all the batches is concatenated separately for RGB values and corresponding labels, on which the model is trained using fit() function of sklearn LDA library. And predict() function is used on test data and accuracy is calculated.

Accuracy:
Overall: 37.13%
Accuracy of class 0 = 46.3
Accuracy of class 1 = 41.5
Accuracy of class 2 = 25.5
Accuracy of class 3 = 24.5
Accuracy of class 4 = 27.1
Accuracy of class 5 = 32.9
Accuracy of class 6 = 41.3
Accuracy of class 7 = 40.4
Accuracy of class 8 = 49.4
Accuracy of class 9 = 42.4

Q2. **Approach**
idx2numpy library has been used to get the data from ubyte file in array form. After reshaping the data is fitted using PCA and then LDA is used. The n_components parameter is changed from 15 to 8 and to 3. The highest accuracy is reported when n_components = 15, which is expected because the eigen vectors corresponding to the largest 15 eigen values have been used and the loss while reducing the dimensions is the lowest.

Accuracy:
n_components = 15: 80.37%
n_components = 8: 76.04%
n_components = 3: 46.6%

Q3. **Approach**
First the data has been segregated classwise as we would be required to calculate classwise means, within-class scatter etc later. The within class scatters is calculated from which Sw is determined. The mean across classes is calculated for finding the between class scatter and Sb. The eigen vectors corresponding to largest 10 eigen values of the matrix $Sw^{-1}Sb$ are used for FDA and transformed data is fitted by LDA library.

Accuracy:
Overall Accuracy = 53.13
Accuracy of class 0 = 50.2
Accuracy of class 1 = 76.8
Accuracy of class 2 = 46.1
Accuracy of class 3 = 49.9
Accuracy of class 4 = 34.8
Accuracy of class 5 = 57.6
Accuracy of class 6 = 37.8
Accuracy of class 7 = 63.3
Accuracy of class 8 = 48.7
Accuracy of class 9 = 66.1

Q4. **Approach**
Identical to Q3 and Q4 combined

Accuracy:
Using eigen vector corresponding to largest eigen value of Sw-1*Sb for FDA
Overall: 22.02%
Accuracy of class 0 = 6.836734693877551
Accuracy of class 1 = 40.70484581497797
Accuracy of class 2 = 8.333333333333334
Accuracy of class 3 = 40.99009900990099
Accuracy of class 4 = 0.0
Accuracy of class 5 = 0.0
Accuracy of class 6 = 36.74321503131524
Accuracy of class 7 = 60.992217898832685
Accuracy of class 8 = 4.209445585215605
Accuracy of class 9 = 15.163528245787909