Alireza Mohammadshafie Final Exam question

First Question

loading Data

```python
[1]: import numpy as np
     import matplotlib.pyplot as plt
     from sklearn import datasets
     from sklearn.decomposition import PCA

     iris = datasets.load_iris()
     X = iris.data
     y = iris.target
```

Fit PCA and output

```python
[2]: pca = PCA(n_components=2)
     X_pca = pca.fit_transform(X)

     print("Principal axes (eigenvectors):\n", pca.components_.T)
     print("\nExplained variance of each PC:\n", pca.explained_variance_)
     print("\nSingular values:\n", pca.singular_values_)
```

```
Principal axes (eigenvectors):
 [[ 0.36138659  0.65658877]
 [-0.08452251  0.73016143]
 [ 0.85667061 -0.17337266]
 [ 0.3582892  -0.07548102]]

Explained variance of each PC:
 [4.22824171 0.24267075]

Singular values:
 [25.09996044  6.01314738]
```

Plotting

```python
[3]: plt.figure(figsize=(8, 6))
     scatter = plt.scatter(X_pca[:, 0], X_pca[:, 1],
                           c=y, cmap='Set1',
                           edgecolor='k', s=70, marker='o')
     plt.xlabel('Principal Component 1')
     plt.ylabel('Principal Component 2')
     plt.title('PCA of Iris Dataset')
     plt.grid(True)

     handles = []
     for i, label in enumerate(iris.target_names):
         handles.append(plt.Line2D([], [], marker='o', color='b',
                                   markerfacecolor=plt.cm.Set1(i/3), markersize=10,
                                   markeredgecolor='k', label=label))
     plt.legend(handles=handles, title="Classes")
     plt.show()
```