Ex. No.: 10

A PYTHON PROGRAM TO IMPLEMENT DIMENSIONALITY REDUCTION USING PCA

Aim:

To implement Dimensionality Reduction using PCA in a python program.

Algorithm:

Step 1: Import Libraries

Import necessary libraries, including pandas, numpy, matplotlib.pyplot, and sklearn.decomposition.PCA.

Step 2: Load the Dataset (iris dataset)

Load your dataset into a pandas DataFrame.

Step 3: Standardize the Data

Standardize the features of the dataset using StandardScaler from sklearn.preprocessing.

Step 4: Apply PCA

● Create an instance of PCA with the desired number of components.

● Fit PCA to the standardized data.

● Transform the data to its principal components using transform. Step 5: Explained Variance Ratio

● Calculate the explained variance ratio for each principal component.

● Plot a scree plot to visualize the explained variance ratio. Step 6: Choose the Number of Components

Based on the scree plot, choose the number of principal components that explain a significant amount of variance.

Step 7: Apply PCA with Chosen Components

Apply PCA again with the chosen number of components.

Step 8: Visualize the Reduced Data

● Transform the original data to the reduced dimension using the fitted PCA.

● Visualize the reduced data using a scatter plot.

Step 9: Interpretation

Interpret the results, considering the trade-offs between dimensionality reduction and information loss.

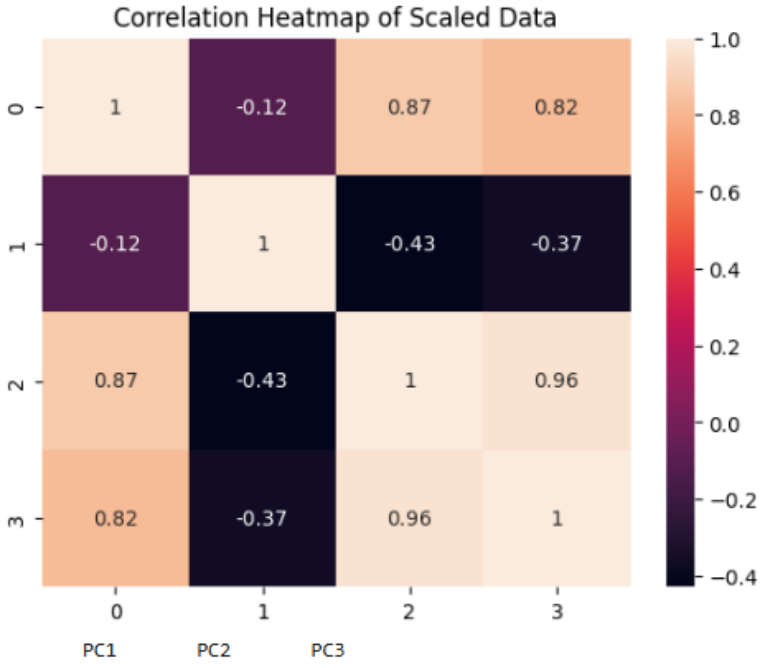
PROGRAM:

```
from sklearn import datasets
import pandas as pd
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
import seaborn as sns
import matplotlib.pyplot as plt

iris = datasets.load_iris()
df = pd.DataFrame(iris['data'], columns=iris['feature_names'])
print(df.head())

scalar = StandardScaler()
scaled_data = pd.DataFrame(scalar.fit_transform(df))
print(scaled_data.head())

sns.heatmap(scaled_data.corr(), annot=True)
plt.title('Correlation Heatmap of Scaled Data')
plt.show()

pca = PCA(n_components=3)
pca.fit(scaled_data)
data_pca = pca.transform(scaled_data)
data_pca = pd.DataFrame(data_pca, columns=['PC1', 'PC2', 'PC3'])
print(data_pca.head())

sns.heatmap(data_pca.corr(), annot=True)
plt.title('Correlation Heatmap of PCA Components')
plt.show()
```

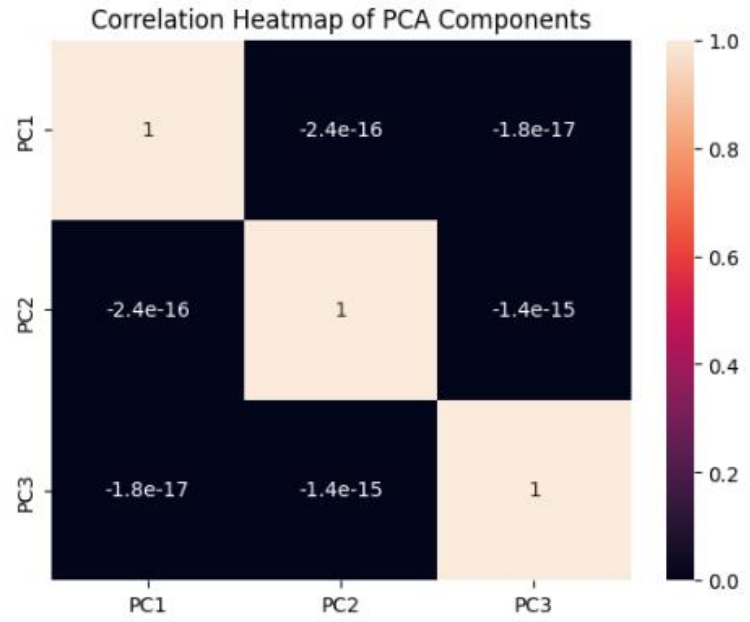
OUTPUT:

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)
0	5.1	3.5	1.4	0.2
1	4.9	3.0	1.4	0.2
2	4.7	3.2	1.3	0.2
3	4.6	3.1	1.5	0.2
4	5.0	3.6	1.4	0.2

	0	1	2	3
0	-0.900681	1.019004	-1.340227	-1.315444
1	-1.143017	-0.131979	-1.340227	-1.315444
2	-1.385353	0.328414	-1.397064	-1.315444
3	-1.506521	0.098217	-1.283389	-1.315444
4	-1.021849	1.249201	-1.340227	-1.315444



```
        PC1       PC2       PC3
0 -2.264703  0.480027  0.127706
1 -2.080961 -0.674134  0.234609
2 -2.364229 -0.341908 -0.044201
3 -2.299384 -0.597395 -0.091290
4 -2.389842  0.646835 -0.015738
```



RESULT:-

Thus Dimensionality Reduction has been implemented using PCA in a python program successfully and the results have been analyzed