Q.2) Python program that generates a random 100×10 matrix ,calculates the mean,variance, kurtosis, and skewness,plot graphs & check statistical properties.

#Python program that generates a random 100×10 matrix ,calculates the mean,variance, kurtosis, and skewness,plot graphs & check statistical properties

```python
import pandas as pd

import numpy as np

import scipy.stats as stats

import matplotlib.pyplot as plt


# Generate a random matrix of size 100x10

np.random.seed(42)  #to reproduce same random sequence across different executions of the code

matrix = np.random.rand(100, 10)



# # Flatten the matrix into a single array

# flattened_matrix = matrix.flatten()


# convert the matrix into dataframe

data=pd.DataFrame(matrix)



# Calculate mean, variance, kurtosis, and skewness for the entire dataset(colwise)

# mean = data.mean()

# variance = data.var()

mean=data.mean()  #colwise mean

variance=np.var(data)
```

```python
kurtosis = stats.kurtosis(data)

skewness = stats.skew(data)


#print the results for each col

print("Mean:")

print(mean)

print("\nVariance:")

print(variance)

print("\nKurtosis:")

print(kurtosis)

print("\nSkewness:")

print(skewness)


# Print the results

print("\nOverall Mean:")

print(np.mean(mean))

print("\nOverall Variance:")

print(np.var(variance))

print("\nOverall Kurtosis:")

print(stats.kurtosis(kurtosis))

print("\nOverall Skewness:")

print(stats.skew(skewness))


#plot results

plt.figure(figsize=(12, 8))

plt.plot(mean,label='mean', marker='o')

plt.plot(variance,label='variance', marker='o')
```

```python
plt.plot(kurtosis,label='kurtosis', marker='s')

plt.plot(skewness,label='skewness', marker='x')

plt.title('plotting of mean,variance,kurtosis,skewness')

plt.legend()

plt.grid(True)

plt.show()
```

Plot histograms for the mean, variance, kurtosis, and skewness

```python
fig, axs = plt.subplots(2, 2, figsize=(10, 8))  #sets up a 2x2 grid of subplots within a figure of size 10x8
```
inches, allowing us to plot multiple graphs or charts within a single figure

fig: The Figure object.

axs: A 2D array of Axes objects (subplots), where axs[i, j] accesses the subplot in the i-th row and j-th column.

Histogram for mean

```python
axs[0, 0].hist([mean], bins=1, alpha=0.7, color='blue') #This line of code creates a histogram in the
```
top-left subplot of a 2x2 grid, displaying a single bar for the mean value, with a blue color, 70% opacity, and labeled axes.

```python
axs[0, 0].set_title('Histogram of Mean')

axs[0, 0].set_xlabel('Mean Value')

axs[0, 0].set_ylabel('Frequency')
```

Histogram for variance

```python
axs[0, 1].hist([variance], bins=1, alpha=0.7, color='orange') #top right

axs[0, 1].set_title('Histogram of Variance')

axs[0, 1].set_xlabel('Variance Value')

axs[0, 1].set_ylabel('Frequency')
```

```
# Histogram for kurtosis

axs[1, 0].hist([kurtosis], bins=1, alpha=0.7, color='green') #bottom left

axs[1, 0].set_title('Histogram of Kurtosis')

axs[1, 0].set_xlabel('Kurtosis Value')

axs[1, 0].set_ylabel('Frequency')


# Histogram for skewness

axs[1, 1].hist([skewness], bins=1, alpha=0.7, color='red') #bottom right

axs[1, 1].set_title('Histogram of Skewness')

axs[1, 1].set_xlabel('Skewness Value')

axs[1, 1].set_ylabel('Frequency')


plt.tight_layout()  #automatically adjusts the subplot parameters to give specified padding and prevent overlap between subplots and their labels

plt.show()
```

```
Mean:
0     0.458303
1     0.559489
2     0.452279
3     0.510929
4     0.450673
5     0.525704
6     0.470577
7     0.508199
8     0.505500
9     0.460913
dtype: float64
```

```
Variance:
0     0.089418
1     0.084402
2     0.083768
3     0.068180
4     0.087816
5     0.086766
6     0.081302
7     0.080521
8     0.095091
9     0.083015
dtype: float64
```

```
Kurtosis:
[-1.30515265 -1.08273166 -1.15214819 -1.01476521 -1.24796822 -1.206287
 -1.1994045  -1.19017366 -1.28508739 -1.30001506]

Skewness:
[ 0.10068414 -0.27596554  0.22444134  0.04043766  0.21263727 -0.0178336
  0.10794732 -0.05880564 -0.07169176  0.17584718]
```

Overall Mean:
0.4902565533201336

Overall Variance:
4.454162814622872e-05

Overall Kurtosis:
-0.5359635547772896

Overall Skewness:
-0.696049325821991

plotting of mean,variance,kurtosis,skewness