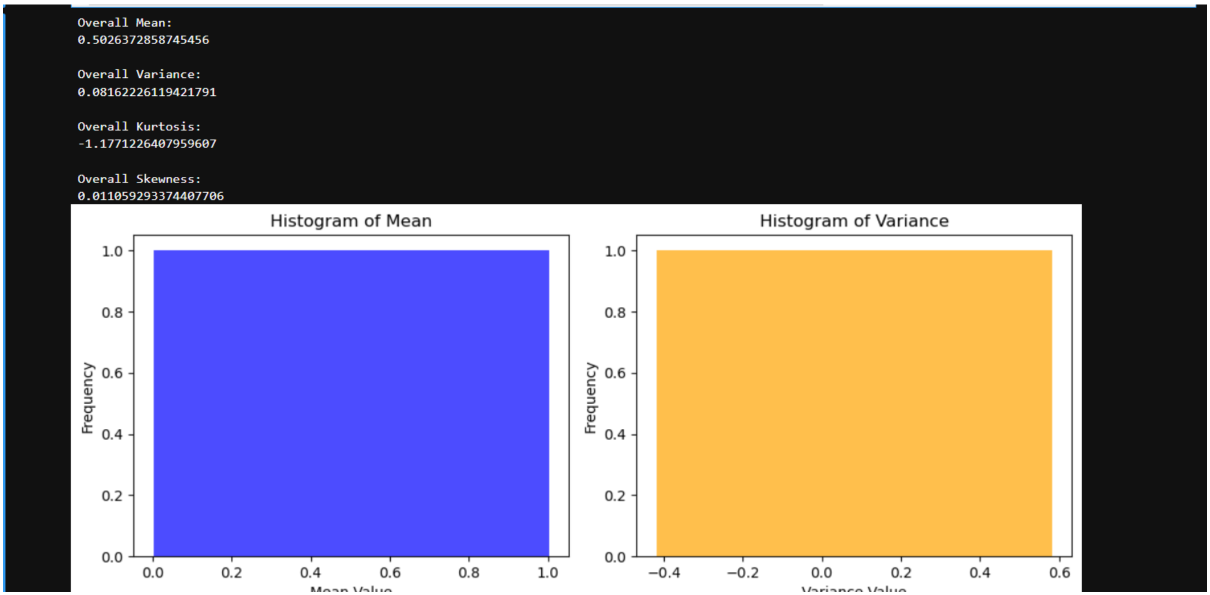
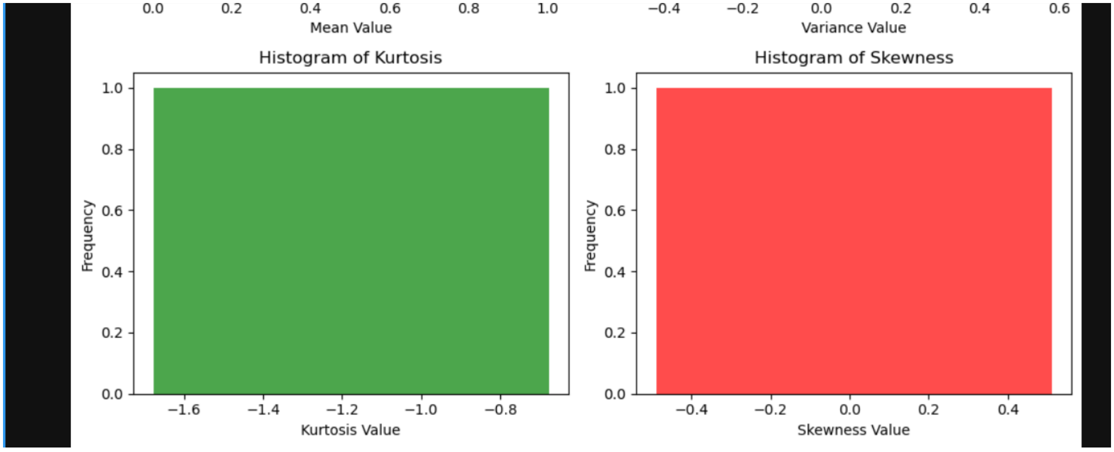
Q.2) Python program that generates a random 100×10 matrix ,calculates the mean,variance, kurtosis, and skewness,plot graphs & check statistical properties.

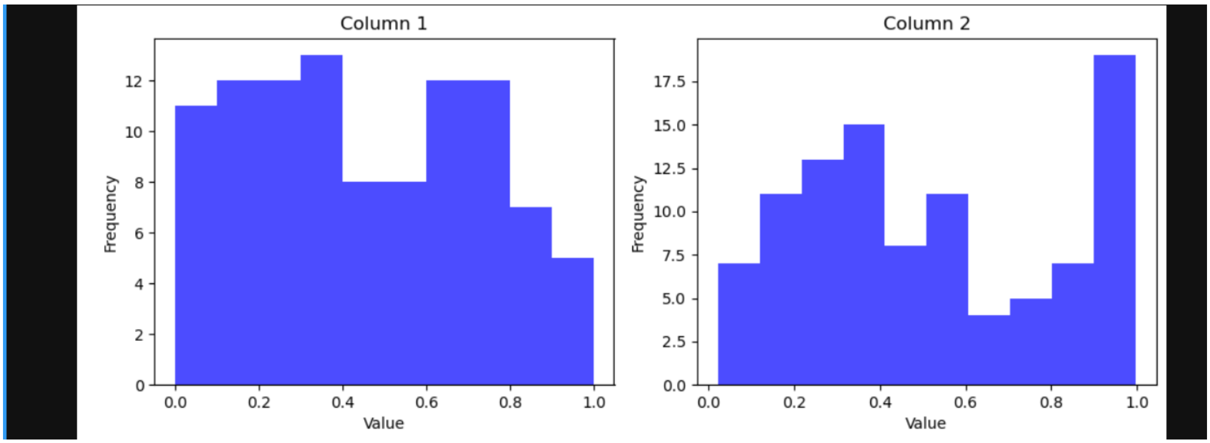
```
#Python program that generates a random 100×10 matrix ,calculates the mean,variance, kurtosis, and skewness,plot graphs & check statistical properties

import numpy as np
import scipy.stats as stats
import matplotlib.pyplot as plt

# Generate a random matrix of size 100x10
matrix = np.random.rand(100, 10)

# Flatten the matrix into a single array
flattened_matrix = matrix.flatten()

# Calculate mean, variance, kurtosis, and skewness for the entire dataset
mean = np.mean(flattened_matrix)
variance = np.var(flattened_matrix)
kurtosis = stats.kurtosis(flattened_matrix)
skewness = stats.skew(flattened_matrix)

# Print the results
print("Overall Mean:")
print(mean)
print("\nOverall Variance:")
print(variance)
print("\nOverall Kurtosis:")
print(kurtosis)
print("\nOverall Skewness:")
print(skewness)

# Plot histograms for the mean, variance, kurtosis, and skewness
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
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.
axs[0, 0].set_title('Histogram of Mean')
axs[0, 0].set_xlabel('Mean Value')
axs[0, 0].set_ylabel('Frequency')

# Histogram for variance
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
```

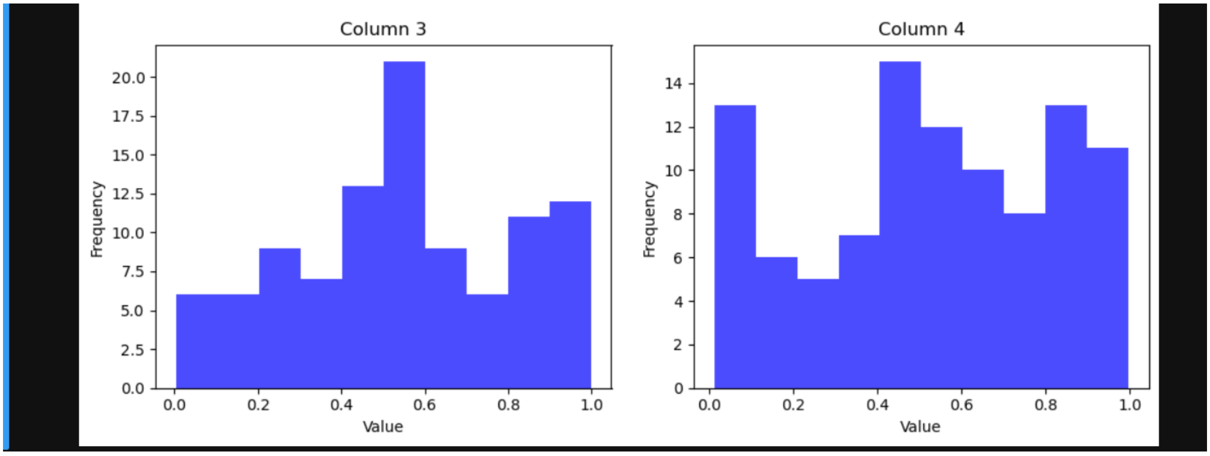
```
axs[1, 1].hist([skewness], bins=1, alpha=0.7, color='red') #bottom right
axs[1, 1].set_title('Histogram of Skewness')
axs[1, 1].set_xlabel('Skewness Value')
axs[1, 1].set_ylabel('Frequency')

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

# Plot histograms for the first 4 columns
fig, axs = plt.subplots(2, 2, figsize=(10, 8)) #Initializes a 2x2 grid of subplots within a figure of size 10x8 inches

columns = [0, 1, 2, 3]
titles = ["Column 1", "Column 2", "Column 3", "Column 4"]

for i, ax in enumerate(axs.flatten()):  #axs.flatten() flattens the 2x2 array of axes into a 1D array for easy iteration.

    ax.hist(matrix[:, columns[i]], bins=10, alpha=0.7, color='blue') #For each subplot (ax), a histogram is created for the specified column of the matrix (matrix[:, columns[i]]).
    ax.set_title(titles[i])
    ax.set_xlabel('Value')
    ax.set_ylabel('Frequency')

plt.tight_layout()
plt.show()
```



```
Overall Mean:
0.5026372858745456

Overall Variance:
0.08162226119421791

Overall Kurtosis:
-1.1771226407959607

Overall Skewness:
0.011059293374407706
```




Column 1
Frequency
0
2
4
6
8
10
12
0.0
0.2
0.4
0.6
0.8
1.0
Value
Column 2
Frequency
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
0.0
0.2
0.4
0.6
0.8
1.0
Value


Column 3
Frequency
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
0.0
0.2
0.4
0.6
0.8
1.0
Value
Column 4
Frequency
0
2
4
6
8
10
12
14
0.0
0.2
0.4
0.6
0.8
1.0
Value