A8Q11

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1 Mathematics and Statistics

1.1 Assignment 8 Question 11

Test for a central limit theorem, by taking sum of N random numbers. Is the sum normally distributed?

1.2 Method

Taken as input
N - Number of samples
n - sample size
LRange - Lower limit of range from which samples are drawn
URange - Upper limit of range from which samples are drawn
Range = set of all integers between LRange and URange

[1]:
```
import numpy as np
import plotly.graph_objects as go
from scipy.stats import kurtosis, skew
```

[2]:
```
N = int(input("Enter number of samples: "))#100000
n = int(input("Enter sample size: "))#100
LRange = int(input("Enter Lower Limit: "))#1
URange = int(input("Upper Limit: "))#100
X = np.random.randint(LRange, URange, (N, n));
X = X.sum(axis=1)
```

```
Enter number of samples: 100000
Enter sample size: 100
Enter Lower Limit: 1
Upper Limit: 100
```

1.3 Plotting histogram of new variable to get frequency distribution and normalising to get probability

[3]:
```
fig = go.Figure()
fig.add_trace(go.Histogram(
    x=X,
    histnorm='probability',
```

```
    marker_color='#330C73',
    opacity=0.75
))

fig.update_layout(
    title_text='Probability Distribution of X', # title of plot
    xaxis_title_text='X', # xaxis label
    yaxis_title_text='Probability', # yaxis label
)

fig.show()
```

1.4 Standardizing the new variable to make mean 0 and std deviation 1

1.5 Plotting histogram to get probability distribution of Z

[4]:
```
#Standardising value
Z = (X - np.mean(X))/np.std(X)

fig = go.Figure()
fig.add_trace(go.Histogram(
    x=X,
    histnorm='probability',
    marker_color='#330C73',
    opacity=0.75
))

fig.update_layout(
    title_text='Probability Distribution of Z', # title of plot
    xaxis_title_text='Z', # xaxis label
    yaxis_title_text='Probability', # yaxis label
)

fig.show()
```

1.6 The bell shaped graph leads us to believe that the probability distribution of the new random variable X and it's standardized equivalent Z is normal

1.7 Additionally computed moment coefficient of skewness and kurtosis. The value should ideally be 0 for a normal distribution

1.7.1 Skewness

- If the skewness is between -0.5 and 0.5, the data are fairly symmetrical
- If the skewness is between -1 and – 0.5 or between 0.5 and 1, the data are moderately skewed
- If the skewness is less than -1 or greater than 1, the data are highly skewed

[5]:
```
print("Moment coefficient of Skewness(ideally 0): ",skew(X))
print("Moment coefficient of Kurtosis(ideally 0)(after 3 subtracted):␣
 ↪",kurtosis(X))
```

```
Moment coefficient of Skewness(ideally 0):  -0.013068922344556672
Moment coefficient of Kurtosis(ideally 0)(after 3 subtracted):
0.007995022471792623
```

1.8 Clearly the values of moment coefficient of skewness and Kurtosis are small and hence this data is close to be normally distributed

[ ]:
```

```