MSPA 400 Session 9 Python Solutions

Module 1

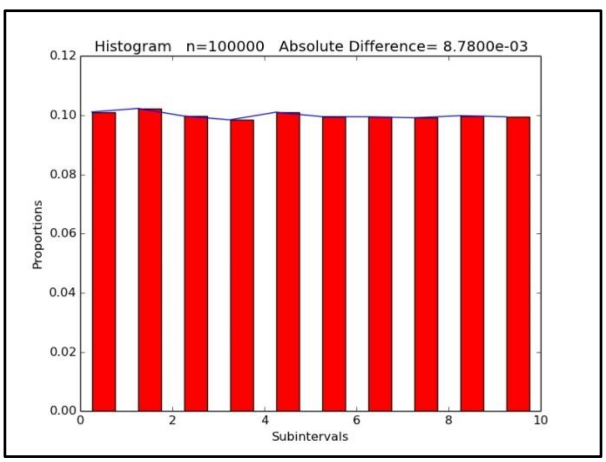
Exercise 1: Generate a series of plotted histograms using the code. Generate five plots using nsample values increasing by powers of ten: 100, 1000, 10000, 100000, 1000000. Calculate the sample mean value and absolute difference for each plot. Evaluate the changes in absolute difference and mean values as the sample size increases. When computing the sample mean value, use the dictionary histogram and the ind array. The ind array needs to be centered within each subinterval. (Hint: add 0.5)

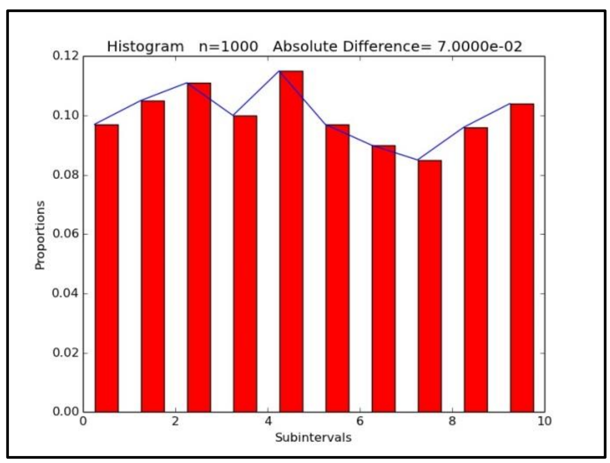
Exercise 2: Add code to estimate the sample variance for each random sample. For simplicity, calculate the sum of the following terms: histogram[k]*(ind[k]-mean)**2. In the limit as nsamples approaches infinity, for sample data grouped in subintervals centered at 0.5, 1.5, ..., 8.5, 9.5, the limiting value is 8.25. Do you see convergence?

Computed results for Exercise 2 are shown below along with two sample plots from Exercise 1. The shape of these plots will change as the sample size changes and the random numbers change.

```
ind=ind+0.5
mean=0.0
for k in range(0,len(h)):
        mean=mean+histogram[k]*ind[k]
print('n= %r and the mean value= %r') %(nsamples, round(mean,3))

variance=0.0
for k in range(0,len(h)):
        variance=variance+histogram[k]*(ind[k]-mean)**2
print('\nn= %r the sample variance equals %r') %(nsamples,round(variance,3))
```





Sum of Absolute Differences= '4.5600e-03'.
n= 100000 and the mean value= 4.994
n= 100000 the sample variance equals 8.258

Sum of Absolute Differences= '7.0000e-02'
n= 1000 and the mean value= 5.168
n= 1000 the sample variance equals 8.069

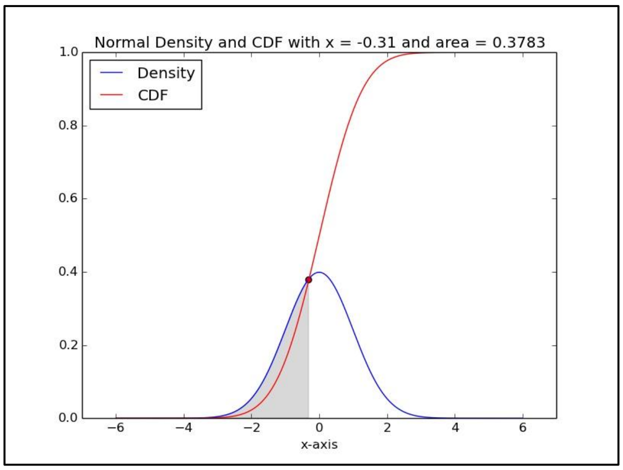
MSPA 400 Session 9 Python Solutions

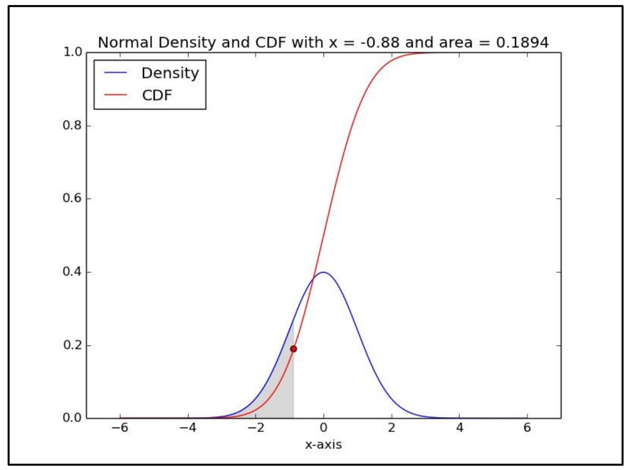
Module 2:

Exercise 1: Refer to Lial Chapter 18 Section 18.3. Reproduce the results shown in Example 3(c).

The solution requires running the existing code without modification.

Area with x= -0.31 equals 0.3783
Area with x= -0.88 equals 0.1894
Manually subtracting the two values gives 0.1889.





Exercise 2: Refer to Lial Chapter 18 Section 18.3. Reproduce the results in Example 4 part(a).

The solution requires running the existing code without modification.

Due to the symmetry of the normal density function, this problem is equivalent to finding the probability that Z <= -2.34.

Value of the variable x for integration= -2.34
Area with x= -2.34 equals 0.0096