EE18BTECH11026_A1

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1 Assignment 01

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1.2 EE18BTECH11026

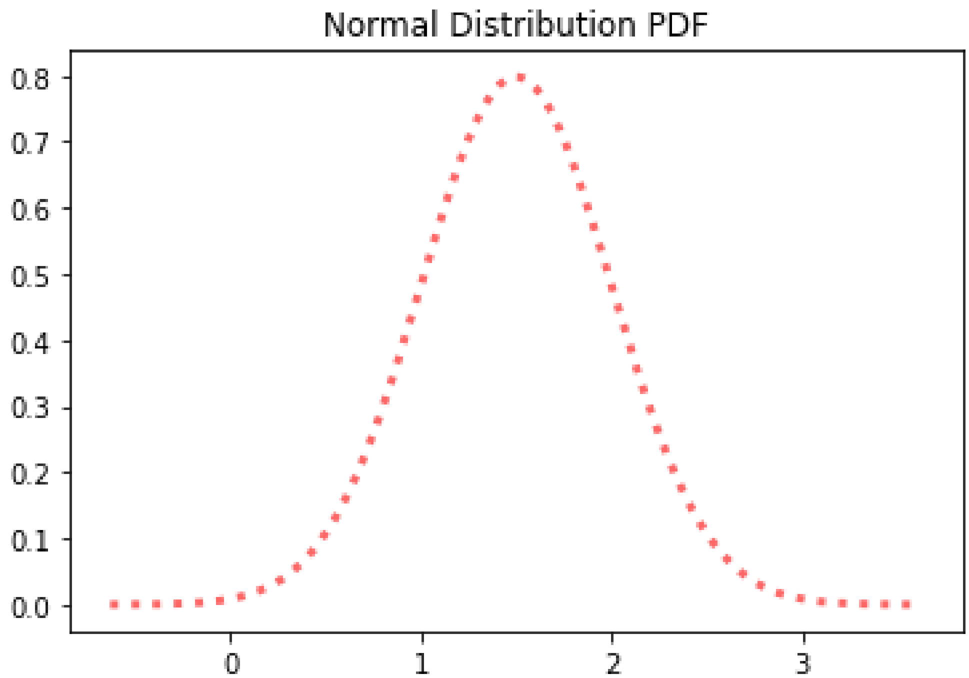
[8]:
```
## imports

import scipy.stats as sp
import numpy as np
import matplotlib.pyplot as plt
import math
from scipy.interpolate import interp1d
import pandas as pd
```

1.3 Q1

[8]:
```
dobj = sp.norm(loc= 1.5, scale = 0.5)  # normal distribution

samples = dobj.rvs(size= 1000) # draw samples from the distribution

print("Sample Mean = ", sp.tmean(samples))
print("Sample Variance = " ,sp.tvar(samples))
print("Skewness = ", sp.skew(samples))
print("Kurtosis = " , sp.kurtosis(samples))
print("Standard deviation using MAD = " , 1.4826*sp.
 ↪median_absolute_deviation(samples))
print("Standard deviation using sigma_{G} = " , np.log(sp.gstd(np.
 ↪exp(samples))))

### Plotting pdf
x1 = np.linspace(dobj.ppf(0.00001), dobj.ppf(0.99999), 1000)
plt.plot(x1, dobj.pdf(x1), linestyle = 'dotted', color = 'r', lw=3, alpha=0.6,␣
 ↪label='Normal Distribution pdf')
plt.title("Normal Distribution PDF")
```

```
Sample Mean =  1.494639046360198
Sample Variance =  0.24414119646662444
Skewness =  -0.007587025692646394
Kurtosis =  -0.10453605454597881
Standard deviation using MAD =  0.7382260870919113
Standard deviation using sigma_{G} =  0.4941064626845356
```

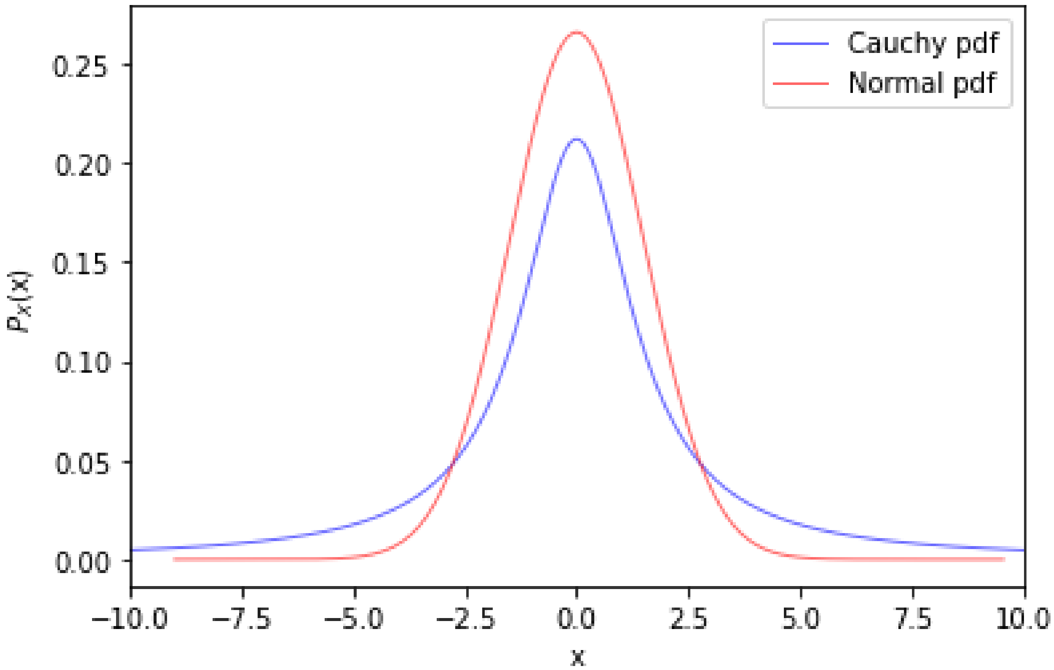
[8]:
```
Text(0.5, 1.0, 'Normal Distribution PDF')
```



2 Q2

[13]:
```
cauchy_dobj = sp.cauchy(0,1.5)
norm_dobj = sp.norm(0,1.5)

x1 = np.linspace(cauchy_dobj.ppf(0.01), cauchy_dobj.ppf(0.99), 1000)
x2 = np.linspace(norm_dobj.ppf(0.000000001), norm_dobj.ppf(0.9999999999), 1000)

plt.plot(x1, cauchy_dobj.pdf(x1),lw=1, color='b',alpha=0.6,label="Cauchy pdf" )
plt.plot(x2, norm_dobj.pdf(x2),lw=1, color='r',alpha=0.6,label="Normal pdf" )
plt.legend()
plt.xlim([-10, 10])
plt.xlabel('x')
plt.ylabel(r'$P_{X}$' + '(x)')
```

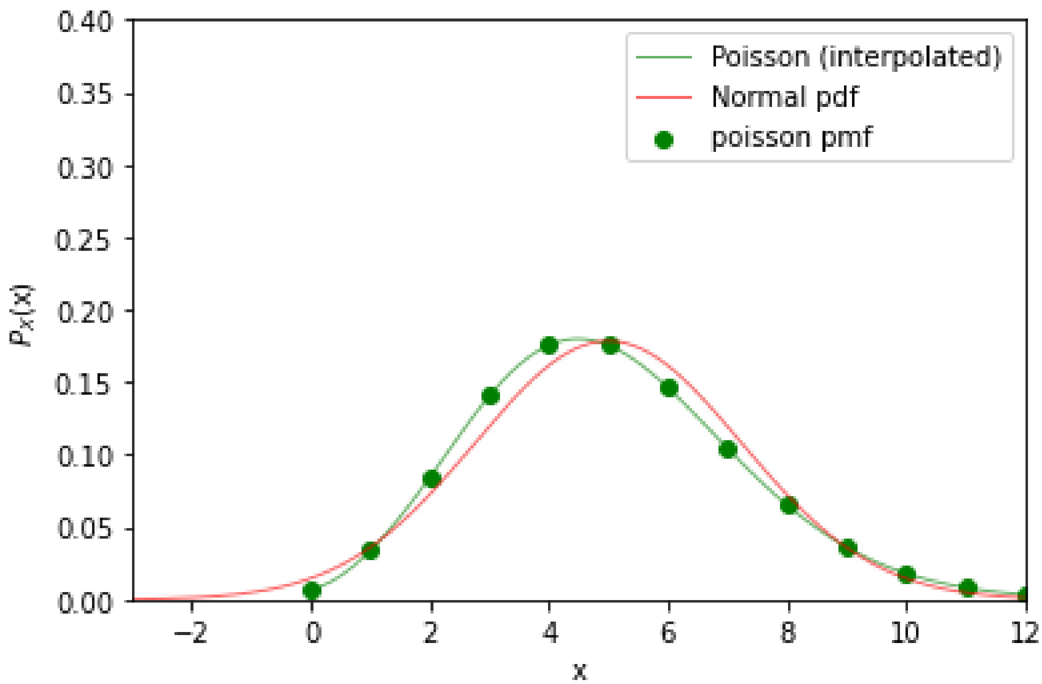
```
plt.show()
```



3 Q3

[39]:
```
poisson_dobj = sp.poisson


x1 = np.arange(poisson_dobj.ppf(0.0001, 5), poisson_dobj.ppf(0.99998, 5))
plt.scatter(x1, poisson_dobj.pmf(x1,5),lw=1, color='g',label="poisson pmf" )
interpolate_func = interp1d(x1, poisson_dobj.pmf(x1,5), kind='cubic')
x1_cont = np.linspace(poisson_dobj.ppf(0.001, 5), poisson_dobj.ppf(0.9999, 5),␣
↪1000)
plt.plot(x1_cont, interpolate_func(x1_cont), lw=1, color='g',alpha=0.
↪6,label="Poisson (interpolated)" )


norm_dobj = sp.norm(5,np.sqrt(5))
x2 = np.linspace(norm_dobj.ppf(0.000000001), norm_dobj.ppf(0.9999999999), 1000)
plt.plot(x2, norm_dobj.pdf(x2),lw=1, color='r',alpha=0.6,label="Normal pdf" )

plt.legend()
plt.xlim([-3, 12])
```

```
plt.ylim([0, 0.4])
plt.xlabel('x')
plt.ylabel(r'$P_{X}$' + '(x)')
plt.show()
```



4 Q4

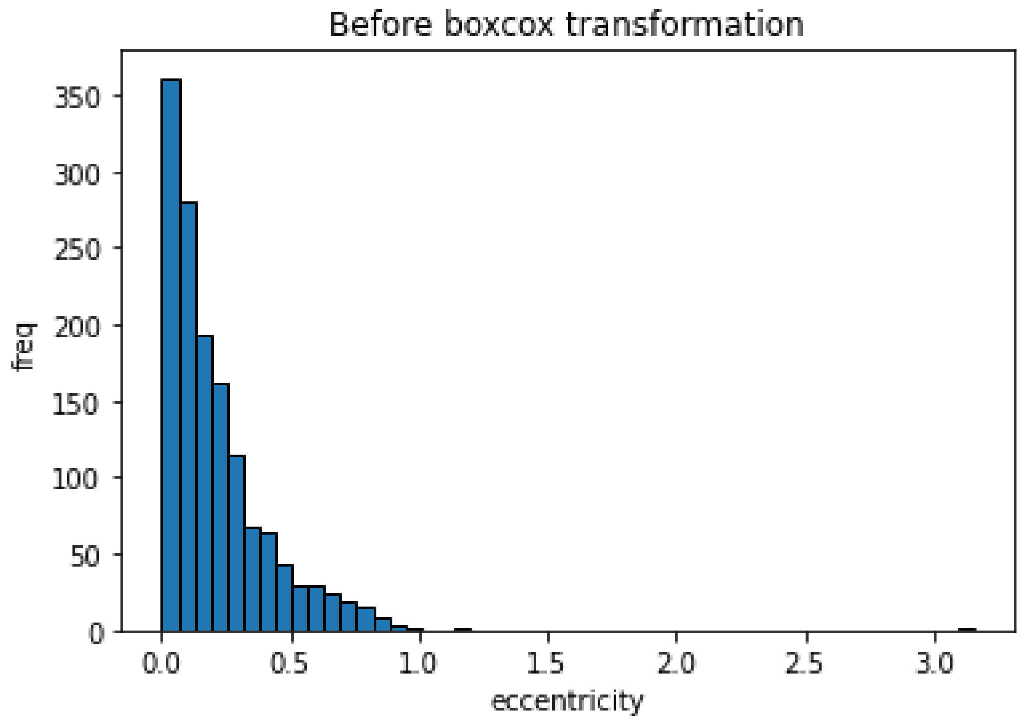
[5]:
```
data = [0.8920, 0.881, 0.8913, 0.9837, 0.8958]
delta = [0.00044, 0.009, 0.00032, 0.00048, 0.00045]

wm = 0
inv_unc = 0

for x, e in zip(data, delta):
        wm += x/(e**2)
        inv_unc += 1/(e**2)


wm = wm/inv_unc
unc = math.sqrt(1/inv_unc)

print("Weighted Mean Lifetime : {} (in units of 10^(-10)s) ".format( wm))
```

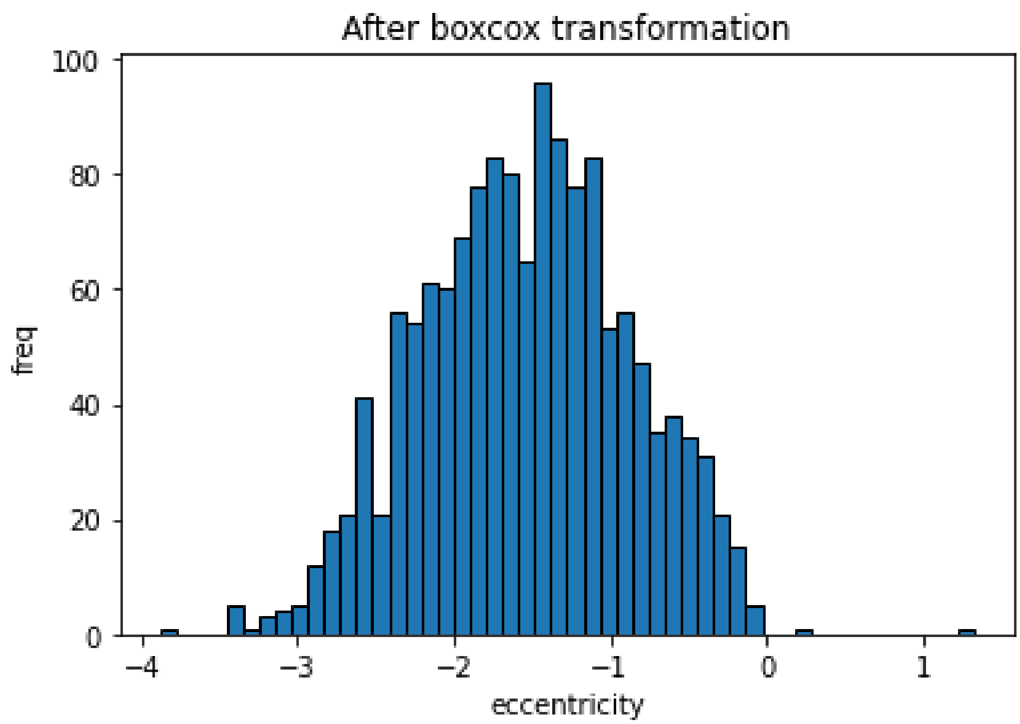
```
print("Uncertainity : {} (in units of 10^(-10)s) ".format(unc) )
```

```
Weighted Mean Lifetime : 0.9089185199574897 (in units of 10^(-10)s)
Uncertainity : 0.00020318737026848627 (in units of 10^(-10)s)
```

5 Q5

[27]:
```
ecc = []
df = pd.read_csv('Data_Q5.csv')
df = df.dropna(subset=['eccentricity'])
ecc = df['eccentricity'].to_list()
new_ecc = []
for e in ecc:
    if(e!=0):
        new_ecc.append(e)

ecc = new_ecc
plt.hist(ecc, bins=50, edgecolor='black')
plt.title('Before boxcox transformation')
plt.xlabel('eccentricity')
plt.ylabel('freq')
plt.show()


boxcox, _ = sp.boxcox(ecc)
plt.hist(boxcox, bins=50, edgecolor='black')
plt.title('After boxcox transformation')
plt.xlabel('eccentricity')
plt.ylabel('freq')
plt.show()
```


Before boxcox transformation
freq
0
50
100
150
200
250
300
350
0.0
0.5
1.0
1.5
2.0
2.5
3.0
eccentricity


After boxcox transformation
freq
0
20
40
60
80
100
−4
−3
−2
−1
0
1
eccentricity

6 The End

```
[ ]:
```