

# EE670 - Wireless Communications



## Python Assignment #0

Done by-

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## **Question:**

1. Generate 10000000 i.i.d. instantiations of the Rayleigh fading channel in PYTHON. Plot separate histograms of the magnitude and phase as PDF and also superimpose the PDFs described in class lectures. Submit the relevant code and plots for the problem and also a brief description of your observations/ conclusions.

## **Solution:**

### **Code:**

```
import numpy as np
import matplotlib.pyplot as plt

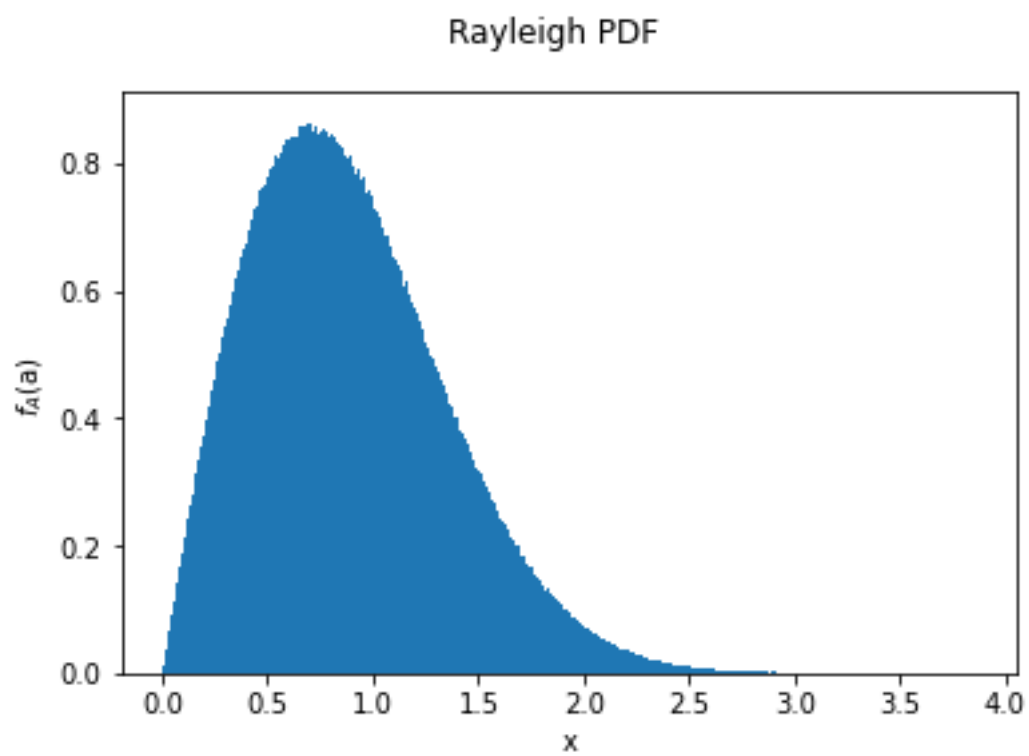
blockLength=10000000; #no. of iid instantiations
nbins=1000;
h=(np.random.normal(0.0,1.0,blockLength)+1j*np.random.normal(0.0, 1.0,
blockLength))/np.sqrt(2); #Definition of Rayleigh fading channel
amp=np.abs(h) #Takes the absolute value
phi=np.angle(h) #Takes the angle

plt.figure(1)
plt.hist(amp,bins=nbins,density=True);
plt.suptitle('Rayleigh PDF')
plt.xlabel('x')
plt.ylabel('$f_A(a)$')

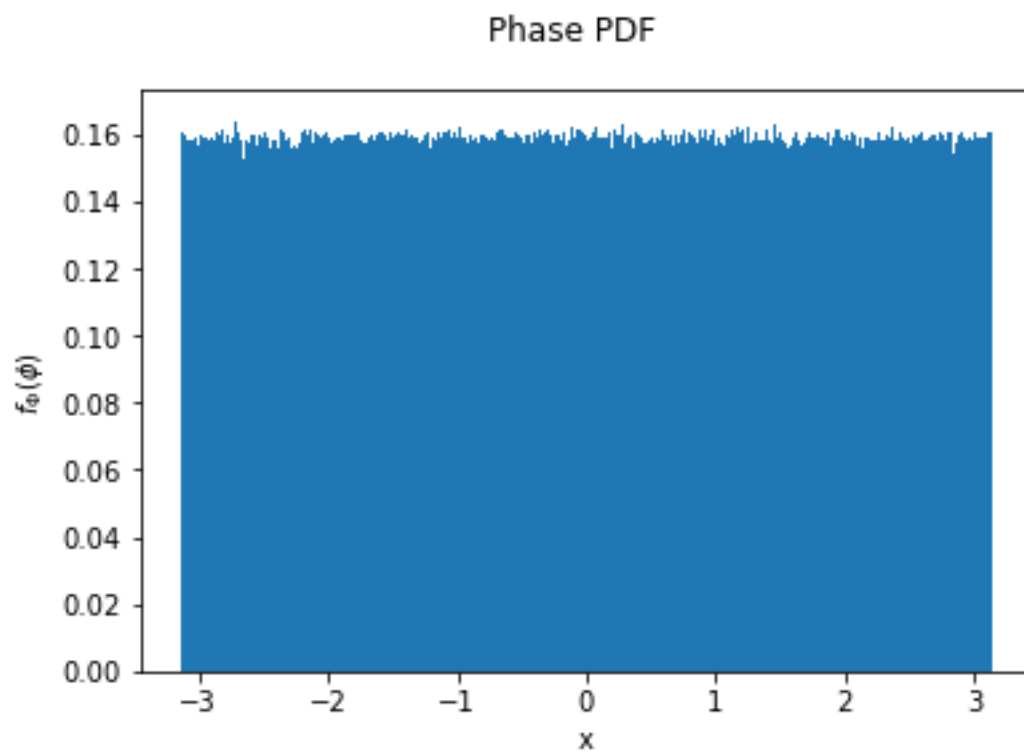
plt.figure(2)
plt.hist(phi,bins=nbins,density=True);
plt.suptitle('Phase PDF')
plt.xlabel('x')
plt.ylabel('$f_{\Phi}(\phi)$')
```

Output:

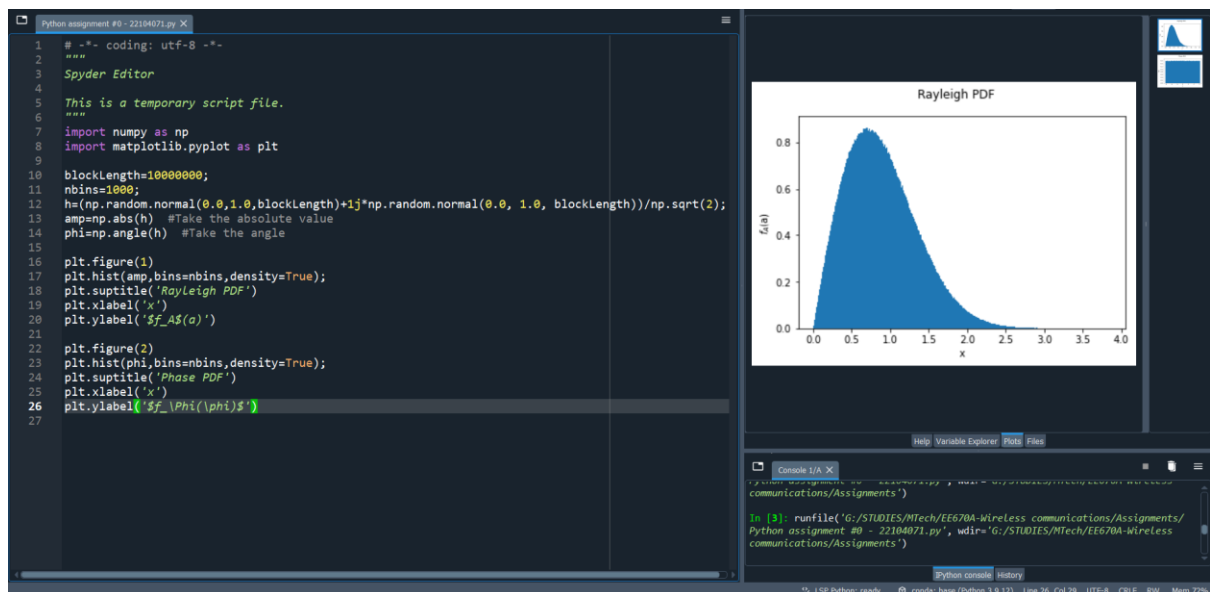
Rayleigh PDF



Phase PDF



## Output in spyder



## Observation:

In wireless communication channel the fading channel coefficient is modelled as complex gaussian random variable, the real part and imaginary part is distributed as independent gaussian random variable. This principle was used to generate Rayleigh PDF.

## Conclusion:

The Rayleigh fading channel with 10000000 i.i.d. instantiations was generated.