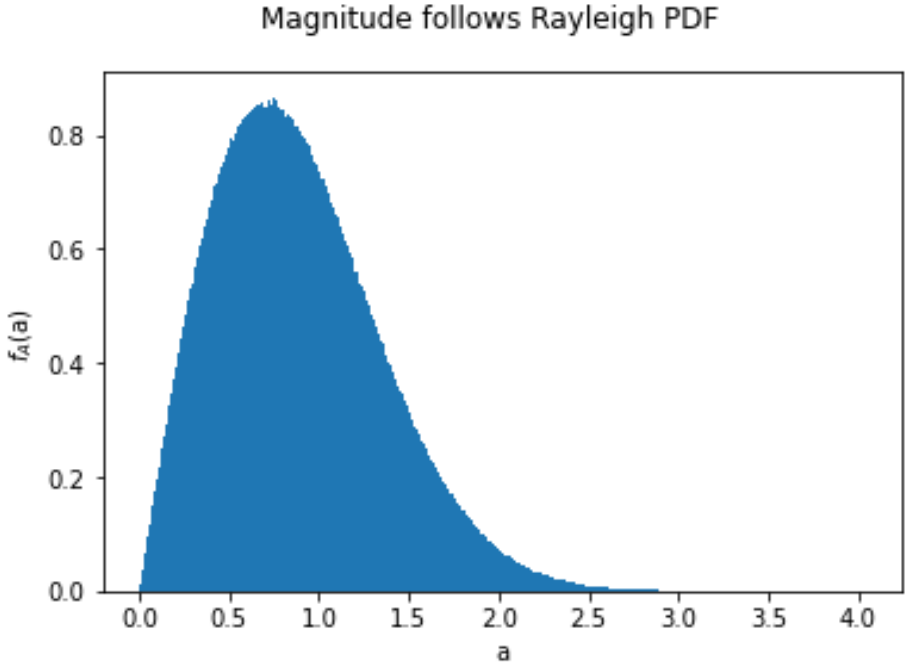
EE 670A Wireless Communications
PYTHON Assignment #0

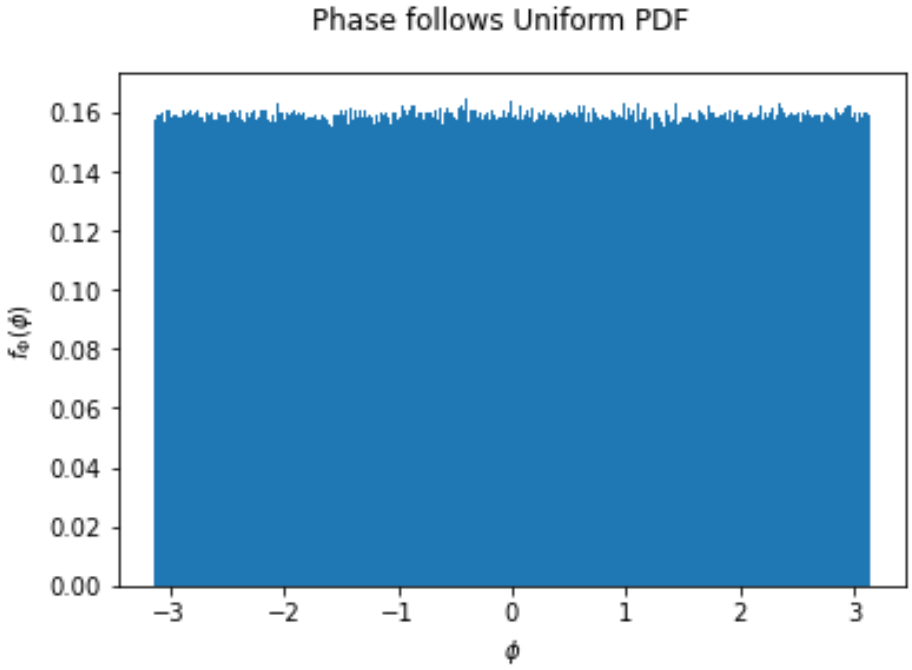
Name:S Srikanth Reddy
RollNo:22104092

```
# -*- coding: utf-8 -*-
"""
Created on Wed Aug 17 17:26:03 2022

@author: S Srikanth Reddy
"""

import numpy as np
import matplotlib.pyplot as plt

blockLength = 10000000;
nbins = 1000;
h = (np.random.normal(0.0, 1.0,
blockLength)+1j*np.random.normal(0.0,1.0,blockLength))/np.sqrt(2);
amp = np.abs(h)
phi = np.angle(h)

plt.figure(1)
plt.hist(amp, bins=nbins,density=True);
plt.suptitle('Magnitude follows Rayleigh PDF')
plt.xlabel('a')
plt.ylabel('$f_A$(a)')
plt.figure(2)
plt.hist(phi,bins=nbins,density=True);
plt.suptitle('Phase follows Uniform PDF')
plt.xlabel('$\phi$')
plt.ylabel('$f_\Phi(\phi)$')
```

python0.py*

```python
# -*- coding: utf-8 -*-
"""
Created on Wed Aug 17 17:26:03 2022

@author: S Srikanth Reddy
"""

import numpy as np
import matplotlib.pyplot as plt

blockLength = 10000000;
nbins = 1000;
h = (np.random.normal(0.0, 1.0, blockLength)+1j*np.random.normal(0.0,1.0,blockLength))/np.sqrt(2);
amp = np.abs(h)
phi = np.angle(h)

plt.figure(1)
plt.hist(amp, bins=nbins,density=True);
plt.suptitle('Magnitude follows Rayleigh PDF')
plt.xlabel('a')
plt.ylabel('$f_A$(a)')
plt.figure(2)
plt.hist(phi,bins=nbins,density=True);
plt.suptitle('Phase follows Uniform PDF')
plt.xlabel('$\phi$')
plt.ylabel('$f_\Phi(\phi)$')

```


Magnitude follows Rayleigh PDF
0.8
0.6
0.4
0.2
0.0
$f_A(a)$
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
a


Phase follows Uniform PDF
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
$f_\Phi(\phi)$
−3
−2
−1
0
1
2
3
ϕ

Observations:

Fading channel coefficient h is written as h = X + jY, where X and Y are independent Gaussian random variables with mean 0 and variance 0.5

Now, when we calculate magnitude(absolute)(a) and phase(angle)(ø) of h and plot the histograms, we get the respective probability density functions.

$F_A(a) = 2a.\exp(-a^2)$; $a \geq 0$

$F_{ø}(ø) = 1/2\pi$; $-\pi < ø \leq \pi$

We can see that magnitude(a) follows Rayleigh distribution and phase(ø) follows Uniform distribution. Hence the channel is called Rayleigh fading channel.