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EE 380

Lab 3

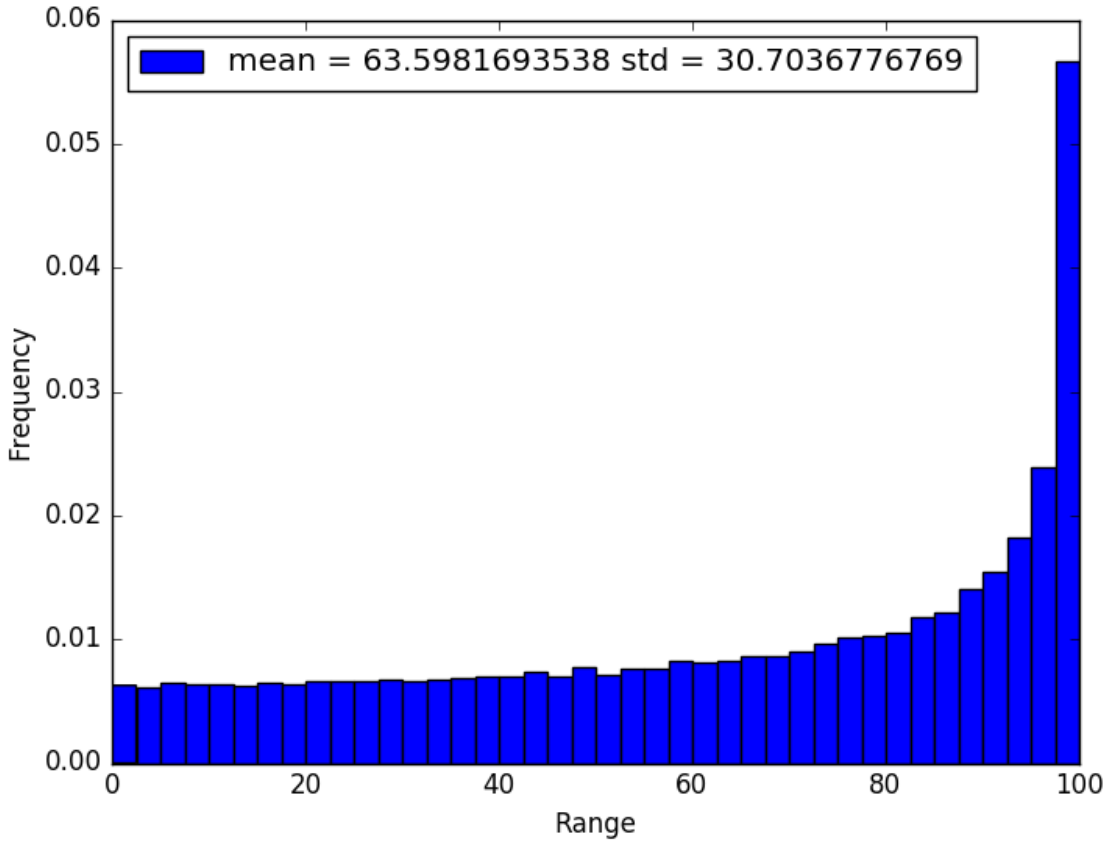
Problem 1:

Using Taylor Series:

$$E[y] = \frac{980 \sin 2\mu_x}{9.8} - 2\frac{980 \sin 2\mu_x}{9.8}\left(\frac{\left(-\frac{\pi}{2}\right)^2}{12}\right) = \frac{980 \sin \frac{2\pi}{4}}{9.8} - 2\frac{980 \sin \frac{2\pi}{4}}{9.8}\left(\frac{\left(-\frac{\pi}{2}\right)^2}{12}\right)$$

$$= 100 - 200\left(\frac{\pi^2}{48}\right) = 100 - 200 * .205617 = 100 - 41.1234 = 58.8766$$

By Simulation:



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

gravity = 9.8
rounds = 80000
velocity = np.sqrt(980)
f = np.zeros(rounds)
p = np.zeros(rounds)

for i in range(rounds):
    angle = np.random.random() * np.pi / 2
    f[i] =  velocity * velocity / gravity * np.sin(2 * angle)

mean = np.mean(f)
std = np.std(f)


labels= ["mean = " + str(mean)  + " std = " + str(std)]
plt.hist(f, 40, normed = True)
plt.xlabel("Range")
plt.ylabel("Frequency")
plt.legend(labels, loc = 0)
plt.show()
```

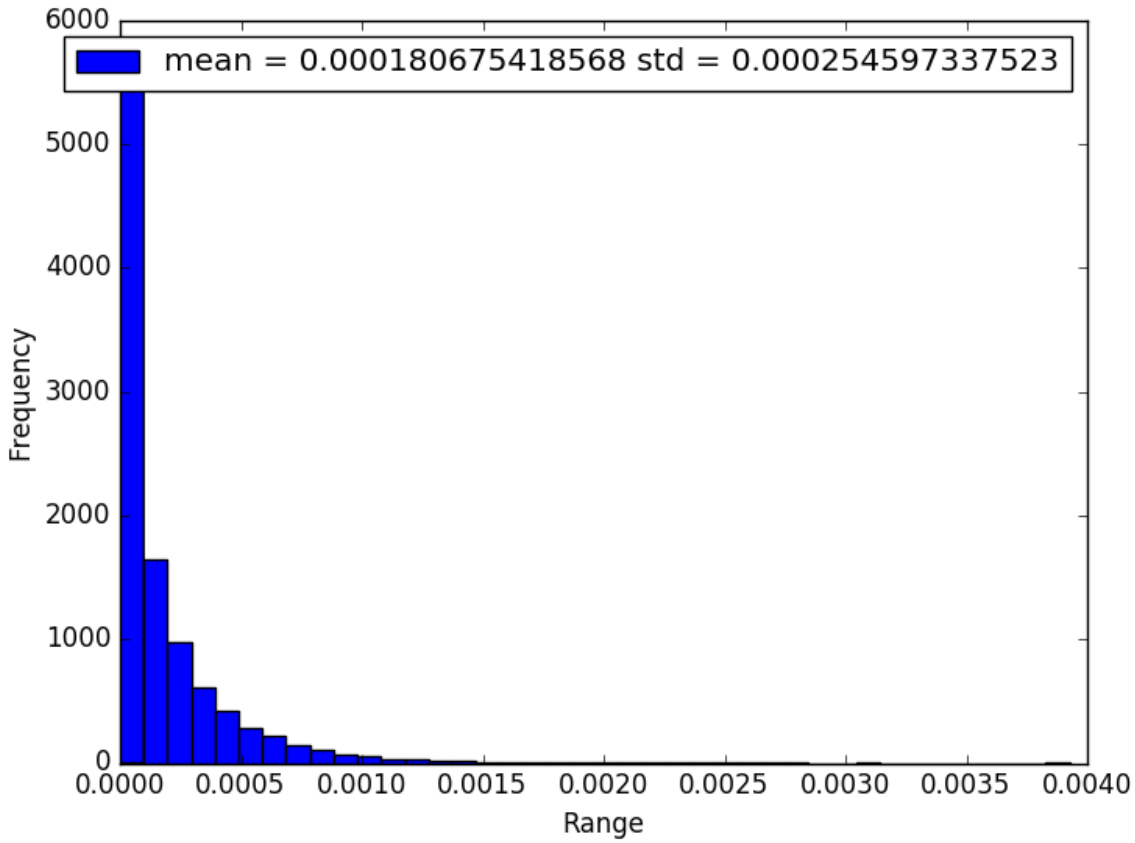
Problem 2:

Using Taylor Series:

$$E[y] = \mu_x{}^2 R + \frac{2R}{2} = 0 + R * (2 * 10^3)^2 = 5 * 4 * 10^6 = 2 * 10^5$$

$$V[y] = (2\mu_x R)^2(2 * 10^3) = (2 * 0 * 5)^2(2 * 10^3) = 0$$

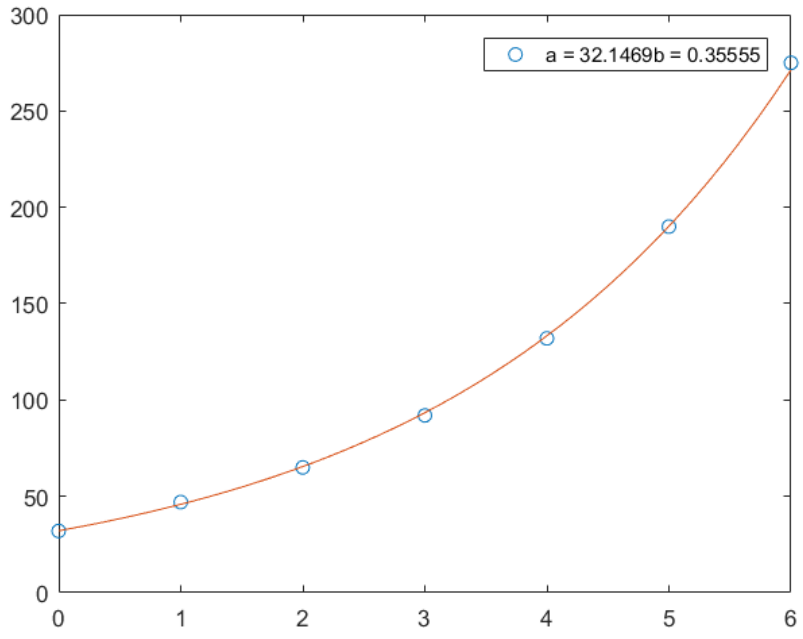
By Simulation:




```
import numpy as np

import matplotlib.pyplot as plt


rounds = 50000

R = 5

P = np.zeros(rounds)


for i in range(rounds):
```

```
        I = (np.random.randn() * 3 * .002)
        P[i] = I * I * R

mean = np.mean(P)
std = np.std(P)


labels= ["mean = " + str(mean)  + " std = " + str(std)]
plt.hist(P, 40, normed = True)
plt.xlabel("Range")
plt.ylabel("Frequency")
plt.legend(labels, loc = 0)
plt.show()
```

Problem 3:




```
clear;
clc;
```

```
A = [0,1,2,3,4,5,6];
B =[32,47,65,92,132,190,275];

plot(A,B,'o')

[P]=polyfit(A,log(B),1);

b=P(1);
a=exp(P(2));
func =@(x)(a*exp(b*x));

legend(['a = ',num2str(a),'b = ', num2str(b)])
hold on

fplot(func,[0,6])

hold off
```