cheg304 homework 1 question 3

AUTHOR
anon for grading??

PUBLISHED
February 5, 2025

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from scipy.special import factorial # import from special for delicious vectorized operations to
```

a.

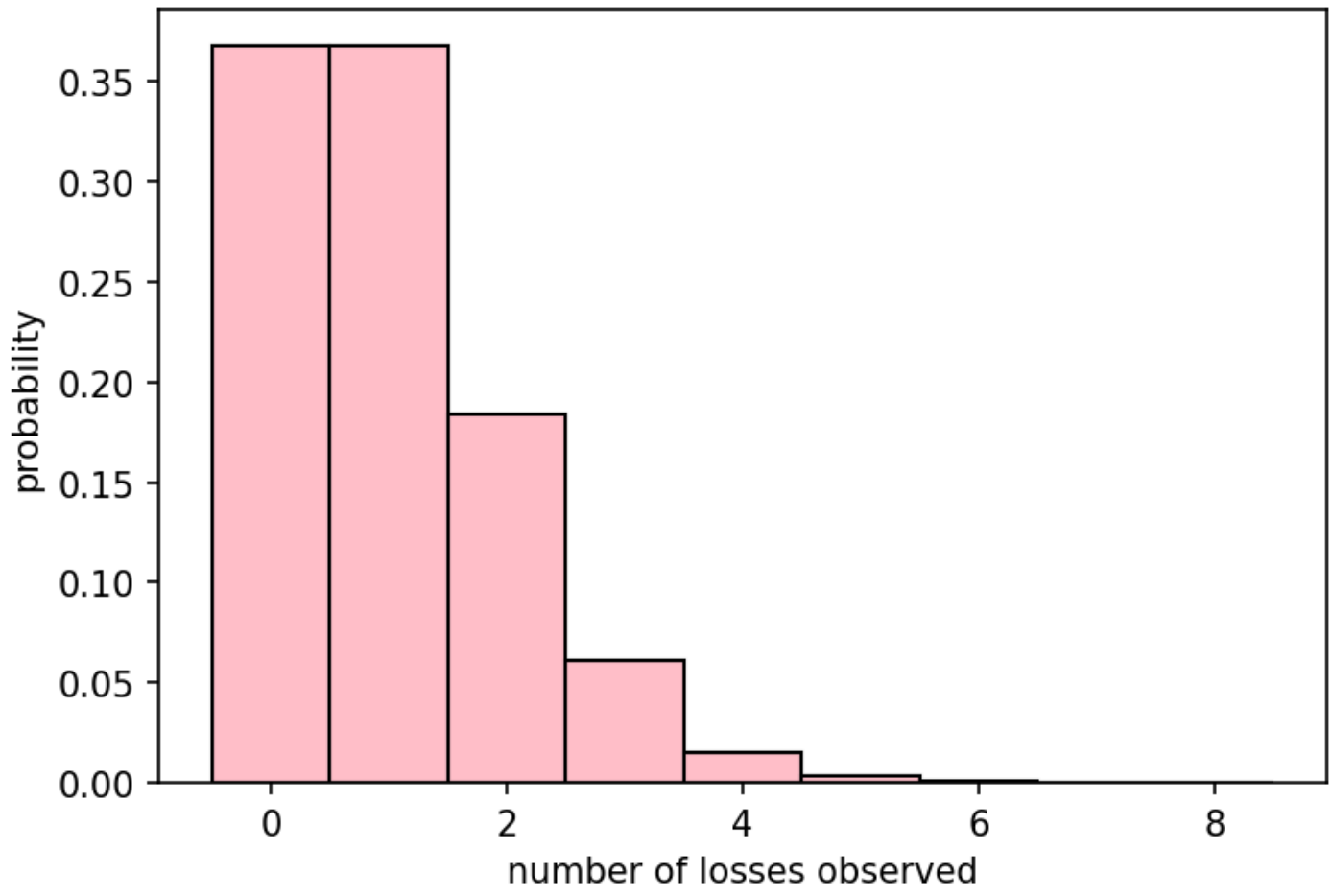
```
def poisson(n, lam):
    ''' poisson distribution where n is k and lam is lambda '''
    return (lam ** n) * np.exp(-lam) / factorial(n)

def poisson_plot(lam, highest):
    ''' plotter function to make tasty poisson plots '''
    xint = np.arange(0,highest + 1,1)
    yint = np.abs(  poisson(xint, lam)  )

    plt.bar(xint, yint, facecolor='pink', edgecolor='black', width=1)

fig, ax = plt.subplots(figsize=(6,4), subplot_kw={'xlabel':'number of losses observed', 'ylabel'

poisson_plot(1, 8)
```



to find the percentage or proprtion of time that we expect to observe 1 or fewer losses we would integrate the distribution... but the poisson is only defined for integers (if we pretend the gamma function doesn't exist) so we can just add the proportion that is 0 outages and 1 outages to get our proportion of 1 or fewer (no negative outages)

```
y = poisson(np.arange(0,2), 1)
print(f'on average {100*(y[1] + y[0]):.1f}% of the time we would expect to observe 1 or less pov
```

```
on average 73.6% of the time we would expect to observe 1 or less power losses per year
```

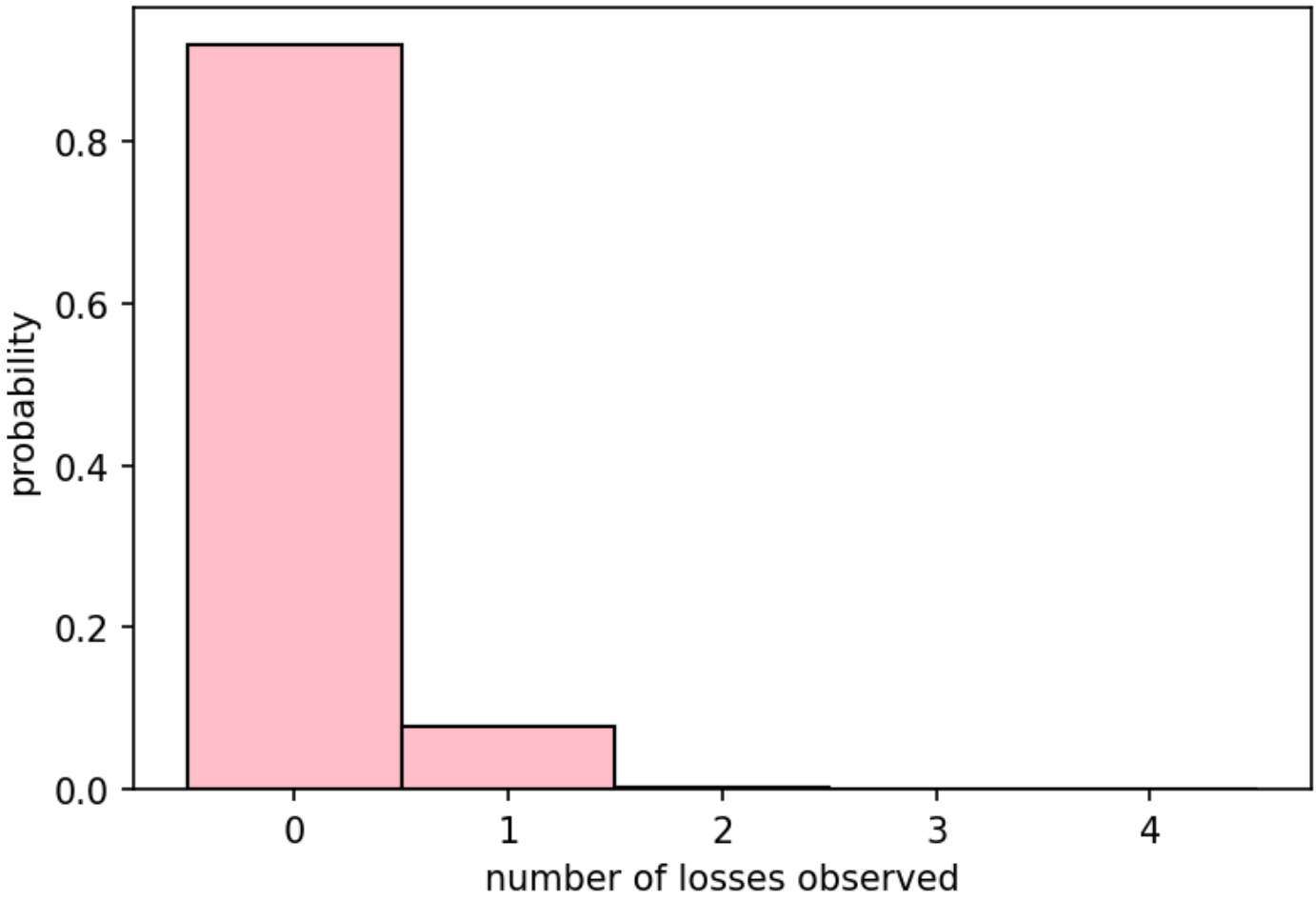
b. we can convert our once per year into once per month as follows

$$\lambda = \frac{1 \text{ loss}}{1 \text{ year}} \times \frac{1 \text{ year}}{12 \text{ months}} = \frac{1}{12} \frac{\text{loss}}{\text{month}}$$

```
fig, ax = plt.subplots(figsize=(6,4), subplot_kw={'xlabel':'number of losses observed', 'ylabel'

Lambda = 1/12
poisson_plot(Lambda, 4)
y = poisson(np.arange(0,9), Lambda)
print(f'on average {100*(y[1] + y[0]):.1f}% of the time we would expect to observe 1 or less pov
```

```
on average 99.7% of the time we would expect to observe 1 or less power losses per month
```



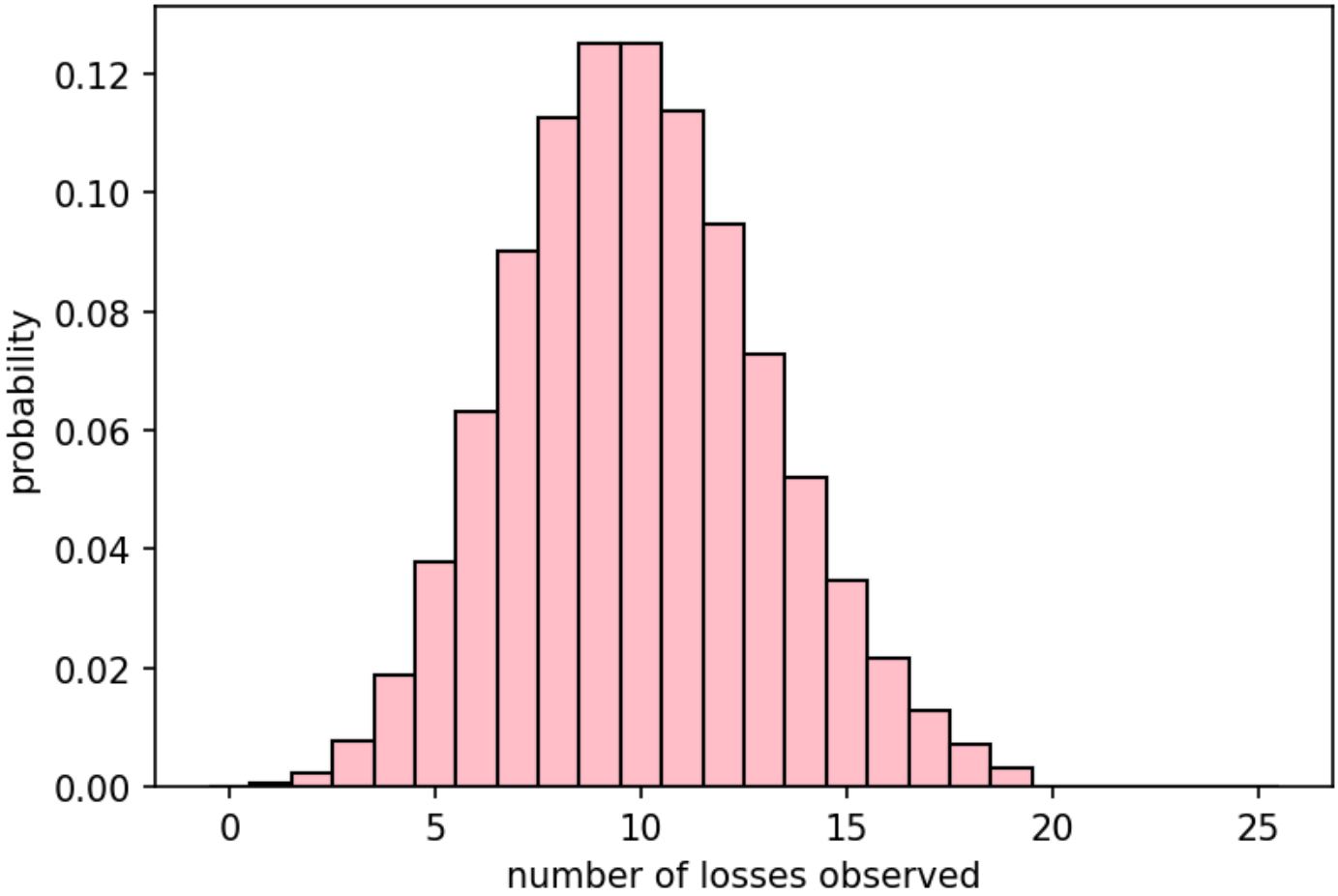
c.

$$\lambda = \frac{1 \text{ loss}}{1 \text{ year}} \times \frac{10 \text{ years}}{1 \text{ decade}} = 10 \frac{\text{loss}}{\text{decade}}$$

```
fig, ax = plt.subplots(figsize=(6,4), subplot_kw={'xlabel':'number of losses observed', 'ylabel'

Lambda = 10
poisson_plot(Lambda,25)
y = poisson(np.arange(0,2), Lambda)
print(f'on average {100*(y[1] + y[0]):.3f}% of the time we would expect to observe 1 or less pov
```

```
on average 0.050% of the time we would expect to observe 1 or less power losses per decade
```


0.12
0.10
0.08
0.06
0.04
0.02
0.00
probability
0
5
10
15
20
25
number of losses observed