cheg304 homework4 question2

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The poisson distribution is an appropriate model for this sampling. the sample size of 1000 is large, and the probability of each being defective is super super tiny. we need the formula that our expected value is np and remember that λ in our poisson is the expected value

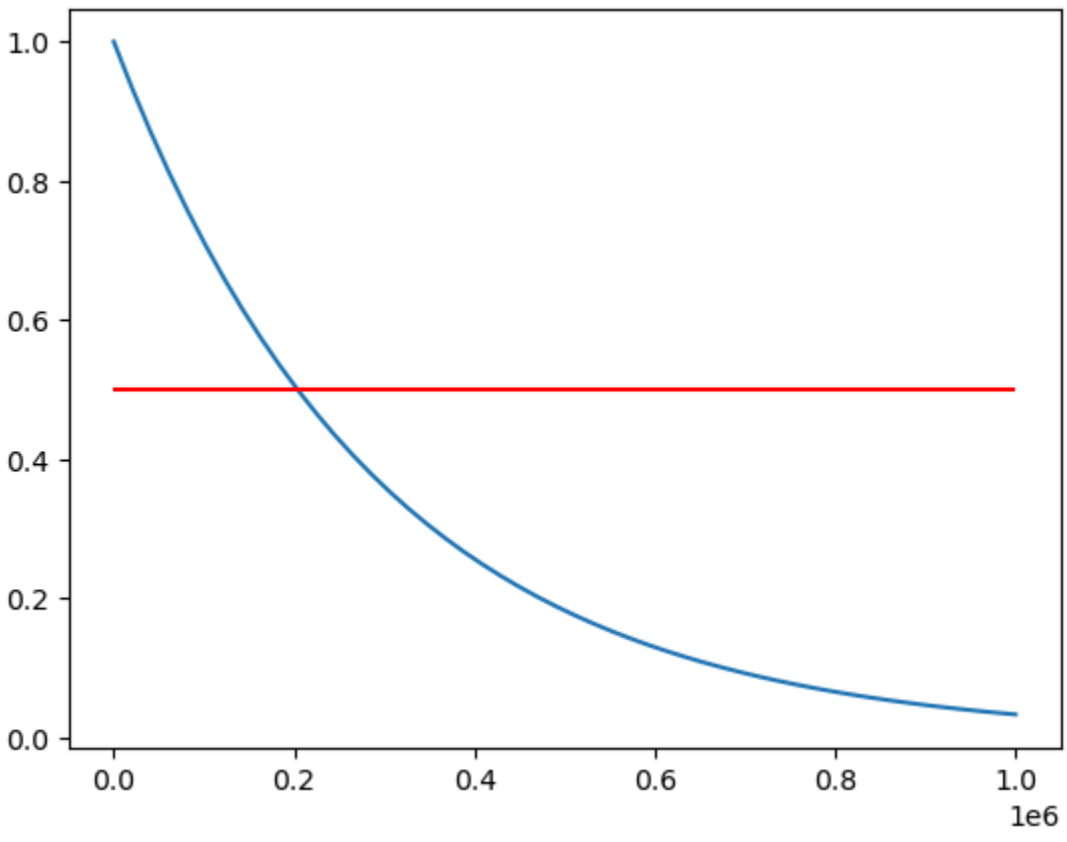
$$\lambda = np$$

```
from scipy.stats import poisson
import numpy as np
import matplotlib.pyplot as plt

n = 1000
p = 3.4e-6
prob_zero_defects = poisson.pmf(0,n*p)

(f"probability of finding 0 defects: {prob_zero_defects:.3f}")
```

```
'probability of finding 0 defects: 0.997'
```

to answer the next question this could either be done graphically (as directly follows this markdown cell), or with a nonlinear equation solver (below graphical method)

```
n = np.linspace(0,1e6)
prob_of_finding_0 = poisson.pmf(0,n*p)
plt.plot(n, prob_of_finding_0)
plt.hlines(0.5,n.min(), n.max(), color='red')
```



from visual inspection it will take about a sample size of 200,000 to have a 50/50 shot at finding a defect. now with solver

```
from scipy.optimize import fsolve

def prob(n):
    return poisson.pmf(0,n*p) - 0.5

sol = fsolve(prob, 0.2e6)[0]
print(f'number to have 50/50: {sol:.0f}')
```

```
number to have 50/50: 203867
```