

# Assignment 4

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Download all python codes from

<https://github.com/tanmaygoyal258/AI1103---Probability/blob/main/Assignment4/code.py>

and latex-tikz codes from

<https://github.com/tanmaygoyal258/AI1103---Probability/blob/main/Assignment4/main.tex>

Thus,

$$E(N_2) = \sum_{a=0}^{\infty} \sum_{i=0}^a (a-i) \times \frac{1}{a} \frac{e^{-\lambda} \lambda^a}{a!} \quad (2.0.5)$$

$$= \sum_{a=0}^{\infty} \frac{e^{-\lambda} \lambda^a}{a!} \sum_{i=0}^a \frac{a-i}{a} \quad (2.0.6)$$

$$= \sum_{a=0}^{\infty} \frac{e^{-\lambda} \lambda^a}{a!} \left( a - \frac{(a+1)}{2} \right) \quad (2.0.7)$$

$$= \sum_{a=0}^{\infty} \frac{e^{-\lambda} \lambda^a}{a!} \frac{a-1}{2} \quad (2.0.8)$$

$$= \frac{e^{-\lambda}}{2} \left[ \sum_{a=0}^{\infty} \frac{a \lambda^a}{a!} - \sum_{a=0}^{\infty} \frac{\lambda^a}{a!} \right] \quad (2.0.9)$$

$$= \frac{e^{-\lambda}}{2} \left[ \lambda \sum_{a=1}^{\infty} \frac{\lambda^{a-1}}{(a-1)!} - \sum_{a=0}^{\infty} \frac{\lambda^a}{a!} \right] \quad (2.0.10)$$

$$= \frac{e^{-\lambda}}{2} [\lambda e^{\lambda} - e^{\lambda}] \quad (2.0.11)$$

$$= \frac{\lambda - 1}{2} \quad (2.0.12)$$

## 1 PROBLEM

The number  $N$  of persons getting injured in a bomb blast at a busy market place is a random variable having a Poisson Distribution with parameter  $\lambda (\geq 1)$ . A person injured in the explosion may either suffer a minor injury requiring first aid or suffer a major injury requiring hospitalisation. Let the number of persons with minor injury be  $N_1$  and the conditional distribution of  $N_1$  given  $N$  is

$$\Pr(N_1 = i | N) = \frac{1}{N} \quad (1.0.1)$$

Find the expected number of persons requiring hospitalisation.

## 2 SOLUTION

Let  $N_2$  be the number of persons hospitalised.

Let  $N = a$ , and  $N_1 = i (i \leq a)$ , then,  $N_2 = a - i$

We know,

$$\Pr(A|B) = \frac{\Pr(A, B)}{\Pr(B)} \quad (2.0.1)$$

Then, from (1.0.1) :

$$\frac{\Pr(N_1 = i, N = a)}{\Pr(N = a)} = \frac{1}{a} \quad (2.0.2)$$

$$\Pr(N_1 = i, N = a) = \frac{1}{a} \frac{e^{-\lambda} \lambda^a}{a!} \quad (2.0.3)$$

$$\Pr(N_2 = a - i, N = a) = \frac{1}{a} \frac{e^{-\lambda} \lambda^a}{a!} \quad (2.0.4)$$