Assignment 3

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Download all python codes from

https://github.com/Dontha-Aarthi/AI1103/tree/main/Assignment3/Codes

and latex-tikz codes from

https://github.com/Dontha-Aarthi/AI1103/blob/main/Assignment3/main.tex

1 Problem

(GATE 2019-XE Q.no 1 (Page Number:4)

Let X be the Poisson random variable with parameter $\lambda = 1$. Then, the probability $\Pr(2 \le X \le 4)$ equals .....

2 solution

Let

$$X \in \{0, 1, 2, 3, 4, 5...\} \tag{2.0.1}$$

We know that, for a poisson random variable X with a given parameter λ, probability of $X = k$ is:

$$\Pr(X = k) = \left(\frac{\lambda^k e^{-\lambda}}{k!}\right) \tag{2.0.2}$$

First, lets calculate the PMF of the distribution by plugging the values of k into 2.0.2,

k	0	1	2	3	4
$\Pr(X = k)$	1/e	1/e	1/2e	1/6e	1/24e

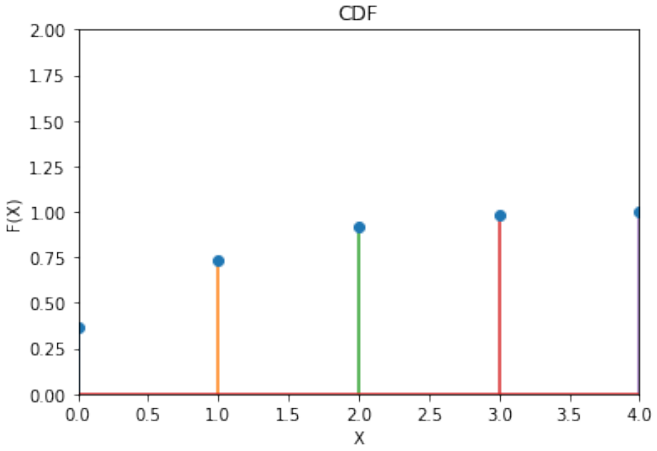
TABLE 0: PMF

The CDF is as follows:

x	0	1	2	3	4
$F(x)$	1/e	2/e	5/2e	8/3e	65/24e

TABLE 0: CDF

The graph of CDF is shown below



And also,

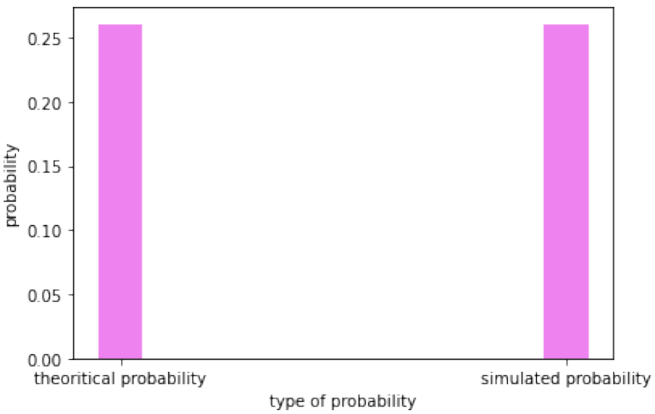
$$\Pr(x < X \le y) = F(y) - F(x) \tag{2.0.3}$$

So, now we can find the value of $\Pr(2 \le X \le 4)$ and also its given that λ=1.
We can represent the value of $\Pr(2 \le X \le 4)$ as $\Pr(1 \le X \le 4)$.

Now by using 2.0.3,

$$\Pr(2 \le X \le 4) = \Pr(1 < X \le 4) \tag{2.0.4}$$
$$= F(4) - F(1) \tag{2.0.5}$$
$$= \frac{65}{24e} - \frac{2}{e} \tag{2.0.6}$$
$$= \frac{17}{24e} \tag{2.0.7}$$

The graph for theoretical result vs simulation is given below


0.25
0.20
0.15
0.10
0.05
0.00
probability
theoritical probability
simulated probability
type of probability