

IT302 Assignment 3

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TOPIC: PROBABILITY

DISTRIBUTIONS

Note:

- 1) The colab link has been attached below. After opening the link, if it opens in drive, click on “Open with Google Colaboratory” to view the complete code.
- 2) Only output screenshots have been attached. Code for the same can be found in the colab notebook.

Colab notebook link:

https://colab.research.google.com/drive/1wjXwBUVSGf5Ph8S7wojgHc_wsTetZMyu?usp=sharing

Q. Develop a code/web to analyze the probability distributions of the Poisson, Uniform and Normal.

- a) User need to select the any one of the distributions Poisson, Uniform and Normal. (1)
- b) The code should ask the relevant parameters to the user and the user will give it as input. The inputs should be validated (eg: if any negative numbers in the positive distributions) (2)
- c) The code should find out the CDF (given values) , Mean and Variance? Randomly vary the Lambda values and plot the distribution. (3+2)
- d) Show/Plot the visualization of the complete distribution and indicate the CDF in the highlighted. (2)

SOLUTION:

Taking choice of distribution as input:

```
Enter the type of distribution:
1-Poisson
2-Uniform
3-Normal
Enter your choice number:
1
```

The user can enter any of the values 1/2/3. Any other input will lead to the termination of the program with the corresponding error message.

POISSON DISTRIBUTION:

After the user enters his/her choice number as 1, the poisson() function will be called. The user will be then asked to give the value of lambda as input as shown below,

*****POISSON DISTRIBUTION*****

Enter lambda: 10

Mean: 10.0

Variance: 10.0

The mean and variance will be calculated and will be shown as output as given in the above screenshot. The mean and variance in poisson distribution is equal to the value of lambda.

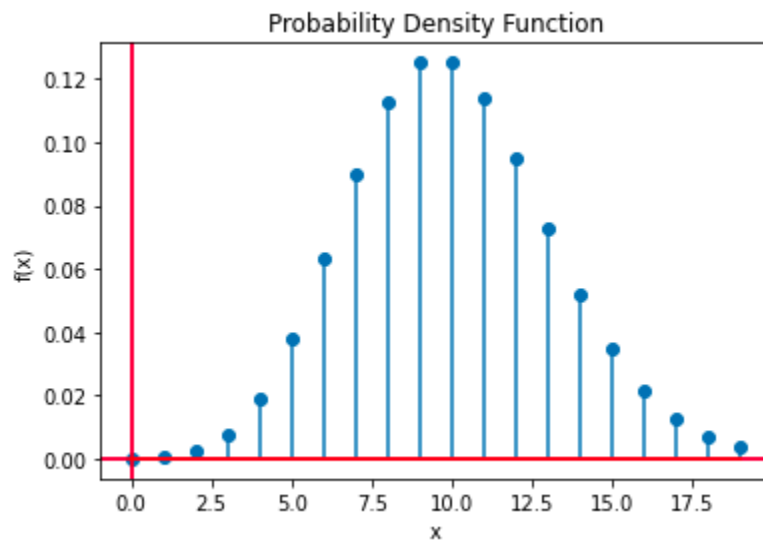
Hence,

$$\text{mean} = \lambda$$

$$\text{variance} = \lambda$$

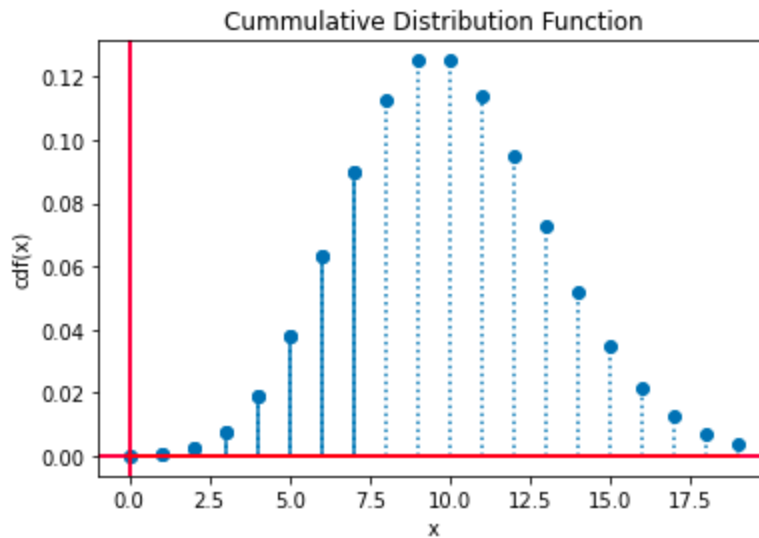
The plot for the probability density function of poisson will be shown.

$$f(x) = (e^{-\lambda} \lambda^x) / x!$$

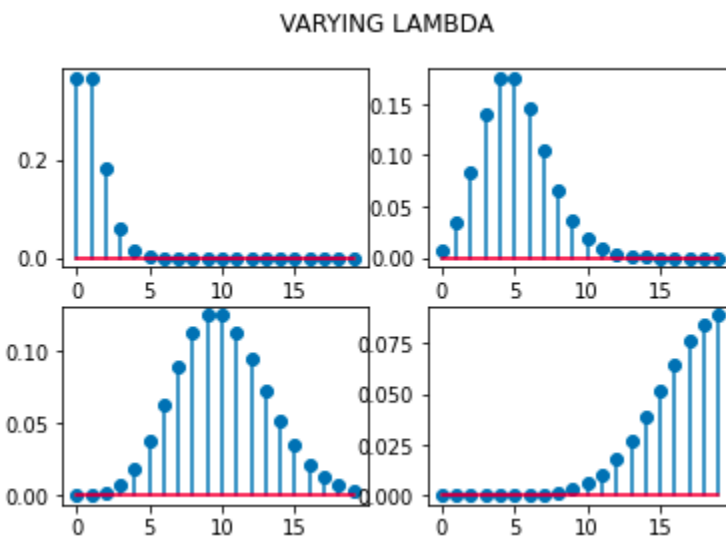


Now for calculating the CDF, the upper limit will be taken as input(lower limit will be 0) and will be validated as well.

Upper limit for CDF: 7
 CDF for the given values is: 0.22022064660169893



The value of CDF will be calculated and displayed. The shaded area in the plot of PDF will also be shown. In case of poisson distribution, the thick lines represent the values taken into consideration for calculating the CDF.



The next plot shows the poisson distribution when the input lamda is varied. The lambda values taken for each of these graphs is [1, lambda/2, lambda, 2*lambda]

UNIFORM DISTRIBUTION:

When the choice number is 2, uniform() is called. The 'a' and 'b' values are taken as input and the mean and variance are calculated and displayed.

$$\text{mean} = (a+b)/2$$

$$\text{variance} = (b-a)^2/12$$

*****UNIFORM DISTRIBUTION*****

Enter a: 4

Enter b: 8

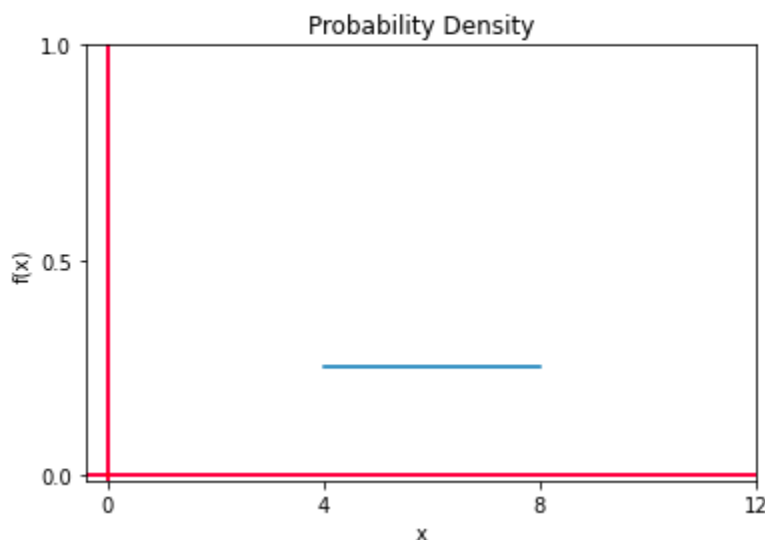
Mean: 6.0

Variance: 1.3333333333333333

Probability density function will be then generated and plotted

Probability Density Function:

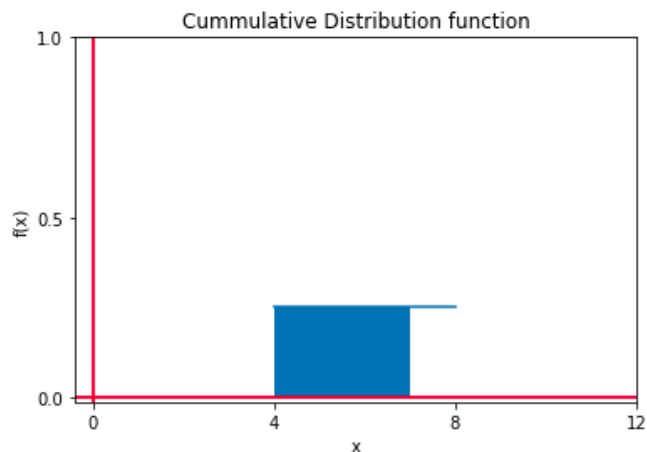
$f(x) = 0.25$ for $a \leq x \leq b$



Upper limit of CDF will be asked for input and CDF will be calculated and displayed in graph as shaded region

Upper limit for CDF: 7

CDF for the given values is: 0.75

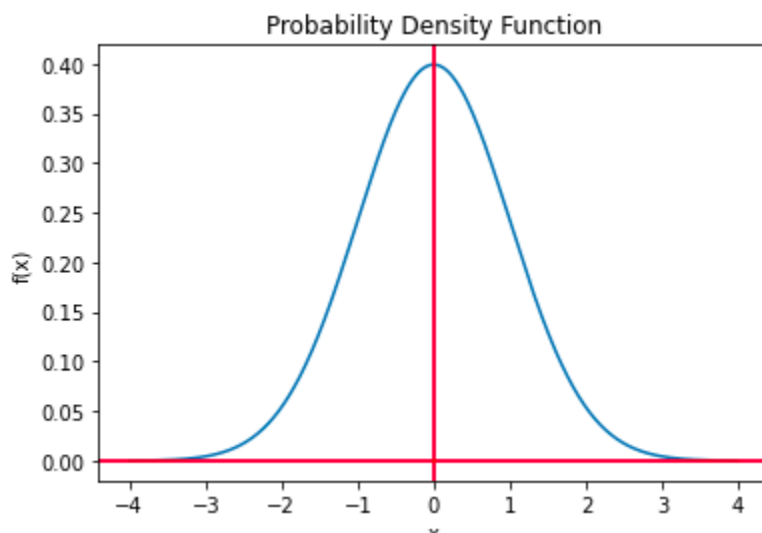


NORMAL DISTRIBUTION:

If the choice is 3, normal() will be called. The mean and standard deviation will be taken as input and the variance will be calculated as the square of standard deviation. The values will be displayed.

```
*****NORMAL DISTRIBUTION*****  
Enter the mean: 0  
Enter the standard deviation: 1  
  
Mean: 0.0  
Variance: 1.0
```

The PDF will be displayed as a graph



The upper limit of CDF will be asked to the user and CDF will be calculated

```
upper limit for CDF: 0  
CDF for the given values is: 0.5
```

