08 Assignment

May 8, 2023

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Q1. What is the Probability density function?
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The probability density function defines the probability function representing␣
↪the density of a continuous random variable lying between
a specific range of values. In other words , the probability density function␣
↪produces likehood of values of the continuous random variable
sometime it is called a probability distribution function or just a probability␣
↪function.however this function is started in many other
sources as the function over a broad set of values.often it is referred to as␣
↪cumulative distribution function or sometimes as probability
mass function , however the actual truth is PDF is defined for continuous␣
↪random variable.
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Q2. What are the types of Probability distribution?
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Bernoulli Distribution :
                        A Bernoulli Distribution has only two bernoulli trails␣
↪or possible outcomes. namely 1 (success)
        and 0 (failure), and a single trail. so the random variable X with a␣
↪bernoulli distribution can take the value 1
        with the probability of success , say p, and value 0 with the␣
↪probability of failure , say q or 1-p.
         There are many example of bernoulli distribution such as whether it␣
↪will rain tomorrow or not .
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Uniform Distribution :
                      When you roll a fair die , the outcome are 1 to 6 . The␣
↪probability of getting these outcomes are equally likely.
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      which is the basis of a uniform distribution. unlike bernoulli␣
↪distribution , all the n number of possible outcomes of a uniform
      distribution are equally likely.
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Binomial Distribution :
                        In probability theory and statistics, the binomial␣
↪distribution with parameters n and p is the discrete probability
      distribution of the number of successes in a sequence of n independent␣
↪experiments, each asking a yes–no question, and each with its
      own Boolean-valued outcome: success (with probability p) or failure␣
↪(with probability q=1-p). A single success/failure experiment
      is also called a Bernoulli trial or Bernoulli experiment, and a␣
↪sequence of outcomes is called a Bernoulli process; for a single
      trial, i.e., n = 1, the binomial distribution is a Bernoulli␣
↪distribution.
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Normal Distribution or Gaussian Distribution :
                                              The normal distribution␣
↪represents the behavior of most of the situations in the universe
      (That is why it called a normal distribution.) The large sum of random␣
↪variable often turns out to be normally distributed contibuting
      to its widespread application. Any distribution is known as normal␣
↪distribution if it has the following :
          1. The mean , median , and mode of the distribution coincide.
          2. The curve of the distribution is bell-shaped and symmetrical␣
↪about the line x .
          3. The total area under the curve is 1.
          4. Exactly half of the values are to the left of the center, and␣
↪the other half to the right.
    A normal distribution is highly different from binomial distribution.␣
↪however if the number of trails approaches infinity,
    then the shapes will be quite similar.
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Poisson Distribution :

1. The number of emergency calls recorded at a hospital in a day.
2. The number of thefts reported in an area in a day.
3. The number of customer arriving at a salon in an hour.
4. The number of suicides reported in a particular city.
       Poisson distribution is applicable in situations where events occur at␣
↪random points of time and space wherein our interest lies only
    in the number of occurrences of the event.
      A distribution is called a poisson distribution when the following␣
↪assumption are valid:
          1. Any successful events should not influence the outcome of␣
↪another successful event.
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            2. The probability of success over a short interval must equal its␣
 ↪probability over a longer interval.
            3. The probability of success in an interval approaches zero as the␣
 ↪interval becomes smaller.
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Q3. Write a Python function to calculate the probability density function of a␣
 ↪normal distribution with
given mean and standard deviation at a given point.
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A normal distribution is a type of continuous probability distribution for a␣
 ↪real valued random variable.
it is based on mean and standard deviation. the probability distribution␣
 ↪fnction or pdf computes the likelihood
of a single point in the distribution. the genral formula to calculate pdf for␣
 ↪the normal distribution is
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Q4. What are the properties of Binomial distribution? Give two examples of␣
 ↪events where binomial
distribution can be applied.
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                        In probability theory and statistics, the binomial␣
 ↪distribution with parameters n and p is the discrete probability
       distribution of the number of successes in a sequence of n independent␣
 ↪experiments, each asking a yes-no question, and each with its
       own Boolean-valued outcome: success (with probability p) or failure␣
 ↪(with probability q=1-p). A single success/failure experiment
       is also called a Bernoulli trial or Bernoulli experiment, and a␣
 ↪sequence of outcomes is called a Bernoulli process; for a single
       trial, i.e., n = 1, the binomial distribution is a Bernoulli␣
 ↪distribution.

1. Participating in a Lucky Draw.
2. Number of spam Emails Received.
3.Participating in an Election.
4.Supporting a particular sports team.
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Q5. Generate a random sample of size 1000 from a binomial distribution with␣
 ↪probability of success 0.4
and plot a histogram of the results using matplotlib.
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[9]:

```python
from numpy import random

x = random.binomial(n=10 , p=0.4 , size=1000)
print(x)
```

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[3 5 4 3 1 6 5 7 6 4 4 4 2 1 5 1 3 3 5 5 5 3 5 6 0 5 5 6 4 7 4 4 5 5 5 3 4
 3 7 1 4 4 2 4 5 4 3 4 3 7 3 4 4 4 7 6 3 2 4 5 4 4 5 7 4 1 5 4 1 4 5 4 5 6
 0 4 5 4 4 3 4 4 2 5 2 3 7 3 4 4 7 8 4 5 6 4 2 5 5 3 3 3 4 7 4 3 5 5 6 4 2
 2 3 3 2 4 3 5 5 3 4 4 4 3 4 6 1 3 2 2 6 1 3 2 2 3 3 6 4 4 6 2 5 2 6 3 2 3
 6 6 5 4 5 4 6 3 1 3 7 2 4 3 3 5 4 4 6 5 3 8 3 3 6 3 0 3 3 4 3 2 5 3 3 5 3
 7 2 5 3 2 2 5 5 2 4 4 6 5 6 5 4 4 4 3 2 4 5 3 4 3 5 3 6 2 6 4 4 2 6 5 2 5
 5 6 2 5 3 5 5 6 5 1 7 4 1 3 3 1 5 3 2 3 4 2 4 3 3 6 2 5 2 2 3 3 3 2 4 5 2
 6 4 2 4 4 5 1 5 6 3 3 4 4 7 6 7 4 5 2 3 5 4 4 7 4 4 7 5 5 5 6 2 3 6 4 3 2
 4 4 3 5 5 6 2 7 3 7 4 5 2 5 3 6 4 5 3 3 3 2 3 5 2 6 6 5 3 1 5 3 5 3 5 4 3
 3 4 3 4 6 3 2 5 2 3 4 6 6 4 6 2 5 3 5 4 3 4 6 4 6 4 6 2 5 4 3 3 8 6 2 4 2
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 2 6 5 4 4 3 3 2 4 6 3 3 5 5 2 5 4 5 6 3 4 4 5 4 4 3 3 5 1 4 5 4 4 0 4 2 4
 2 3 5 4 1 5 4 3 3 4 5 4 6 6 2 3 3 1 6 4 6 5 6 3 3 3 1 2 1 3 5 4 1 3 8 4 5
 1 6 4 4 5 5 2 3 5 3 2 3 3 5 4 2 4 2 3 4 2 7 6 2 3 4 3 2 3 4 3 4 4 3 4 3 3
 3 5 5 4 4 6 7 4 3 2 5 4 3 3 2 4 4 2 3 2 5 5 4 2 5 4 4 3 3 5 5 4 4 5 5 4 5
 5 5 3 3 6 4 3 2 4 3 3 3 5 1 2 3 2 4 4 6 1 6 4 5 6 2 3 3 5 1 5 5 5 3 2 6 7
 3 3 7 1 5 7 4 5 5 4 4 4 5 4 4 3 5 3 7 3 5 3 6 2 2 3 4 4 5 3 4 5 4 2 3 2 4
 3 4 2 5 3 5 3 2 2 8 5 5 6 9 4 6 5 3 5 2 8 5 3 4 5 6 2 5 2 3 3 5 6 4 3 5 1
 2 4 4 5 4 4 3 5 3 6 3 4 5 4 0 3 7 2 5 5 5 6 4 2 3 4 5 1 6 3 4 7 4 2 2 2 4
 0 3 0 5 4 3 3 3 8 5 4 4 3 4 2 5 1 4 5 4 5 3 5 3 6 3 3 3 3 3 3 2 4 4 3 4 2
 3 2 5 5 3 6 3 3 6 4 4 2 4 3 4 3 4 5 4 2 8 6 2 3 3 4 1 2 3 5 2 0 3 2 1 4 2
 5 2 4 3 3 6 5 1 5 6 3 3 4 2 6 4 5 4 3 3 5 5 3 2 7 4 4 4 5 5 5 5 5 5 5 5 3
 2 5 3 3 4 3 5 3 6 4 7 4 7 6 4 2 1 6 4 9 3 2 5 2 1 2 2 6 4 5 2 5 1 4 2 7 2
 2 4 4 6 4 5 5 4 4 6 5 5 1 4 7 8 5 1 4 3 2 6 2 4 4 6 7 4 2 6 4 4 4 2 4 6 5
 5 2 6 2 4 3 3 4 2 3 5 5 4 4 3 4 3 3 6 7 5 4 6 5 4 5 3 3 2 5 3 4 4 4 5 3 3
 2 3 3 3 6 2 5 5 5 5 3 2 7 2 5 2 4 4 4 4 2 3 3 4 6 4 5 1 2 4 2 3 6 3 4 1 3
 6 6 2 5 4 2 5 5 5 3 2 5 6 6 5 5 7 3 3 6 5 9 2 0 3 6 6 4 6 5 1 4 4 3 3 3 3
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[13]:

```python
from numpy import random
import matplotlib.pyplot as plt
import seaborn as sns
```

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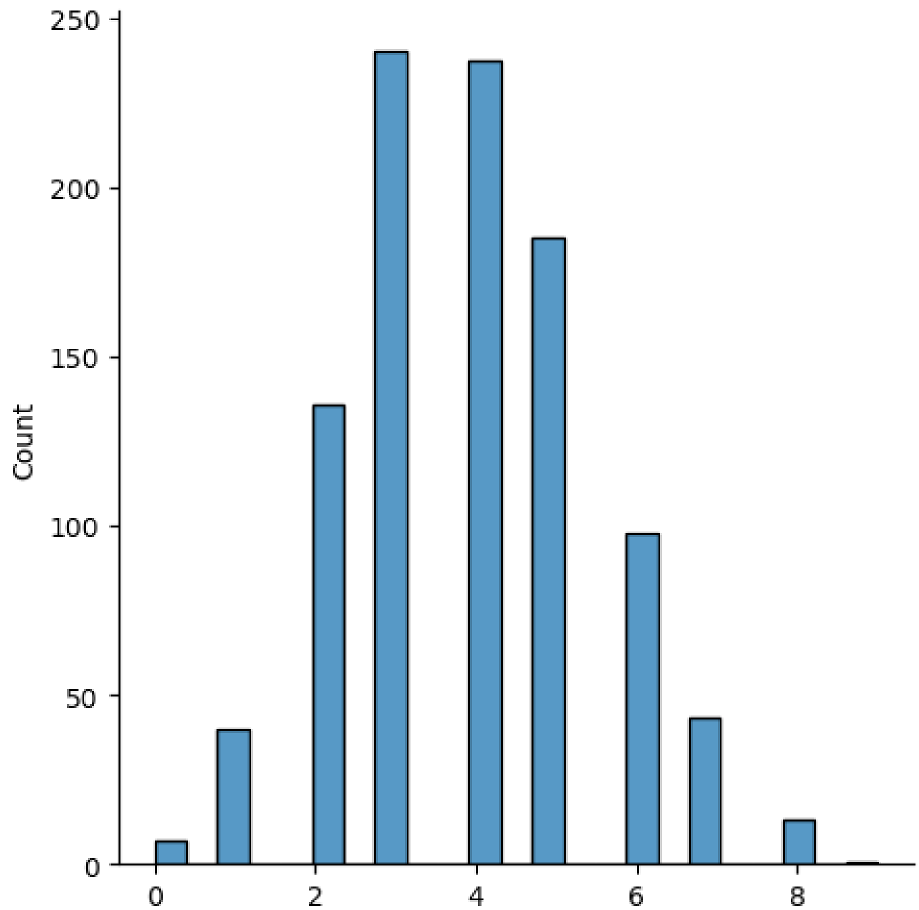
sns.displot(random.binomial(n=10 , p=0.4 , size=1000)  , kde=False)
plt.show()
```



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[ ]: Q6. Write a Python function to calculate the cumulative distribution function of a Poisson distribution
with given mean at a given point.

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import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import poisson
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k= np.arange (0, 15)
print(k)
```

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[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14]
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pmf=poisson.pmf(k , mu=7)
pmf=np.round(pmf ,5)
print(pmf)
```

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[0.00091 0.00638 0.02234 0.05213 0.09123 0.12772 0.149   0.149   0.13038
 0.1014  0.07098 0.04517 0.02635 0.01419 0.00709]
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Q7. How Binomial distribution different from Poisson distribution?
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Binomial distribution describes the distribution of ninary data from a finite␣
 ↪sample. Thus it gives the
probability of getting r events out of n trails.Binomial distribution is the␣
 ↪one in which the number of outcomes are only two ,
that is success or failure
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Poisson distribution describes the distribution of binary data from an infinite␣
 ↪sample.
Thus it gives the probability of getting r events in a population. poisson␣
 ↪distribution is the one in which the number of
possible outcomes has no limits
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Q9. How mean and variance are related in Binomial distribution and Poisson␣
 ↪distribution?
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The mean of the binomial distribution is np , and the variance of the binomial␣
 ↪distribution is np(1-p).
When p=0.5 , the distribution is symmetric around the mean such as when␣
 ↪flipping a coin because the chances of getting
heads or tails is 50% or 0.5 when p>0.5 , the distribution curve is skwewd to␣
 ↪the left.
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[ ]: When their is a positive number. Both the mean and variance of the poisson
      distribution are equal to ^ .
     The maximum likelihood estimate of feom a sample from the poisson distribution
      ^ is the sample mean.
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[ ]: Q10. In normal distribution with respect to mean position, where does the least
      frequent data appear?
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[ ]: Normal distribution , also known as  the Gaussian distribution , is a
      probability distribution that is symmetric
     about the mean showing that data near the mean are more frequent in occurrence
      than data far from the mean.
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