Q1

The Probability Density Function(PDF) 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 the likelihood of values of the continuous random variable. Sometimes it is also called a probability distribution function or just a probability function. However, this function is stated 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(PMF). However, the actual truth is PDF (probability density function) is defined for continuous random variables, whereas PMF (probability mass function) is defined for discrete random variables.

Q2 Common probability distributions include the binomial distribution, Poisson distribution, and uniform distribution. Certain types of probability distributions are used in hypothesis testing, including the standard normal distribution, the F distribution, and Student's t distribution.

In [1]:
```
#Q3
from scipy.stats import norm
import numpy as np

data_start = -5
data_end = 5
data_points = 11
data = np.linspace(data_start, data_end, data_points)

mean = np.mean(data)
std = np.std(data)

probability_pdf = norm.pdf(3, loc=mean, scale=std)
print(probability_pdf)
```

```
0.0804410163156249
```

Q4 A binomial experiment is one that has the following properties: (1) The experiment consists of n identical trials. (2) Each trial results in one of the two outcomes, called a success S and failure F. (3) The probability of success on a single trial is equal to p and remains the same from trial to trial.

binomial distribution. In what cases would you use ... Number of trials are fixed Examples considered a binomial probability Example 1: Tossing a coin 10 times to see how many lands on head. Example 2 : To find probability that a person answered exactly 5 question correct oul- of 10 multiple choice question.

In [5]:
```
#Q5


from scipy.stats import binom
```

```
# setting the values
# of n and p
n = 6#1000
p = 0.4
# defining the list of r values
r_values = list(range(n + 1))
# obtaining the mean and variance
mean, var = binom.stats(n, p)
# list of pmf values
dist = [binom.pmf(r, n, p) for r in r_values ]
# printing the table
print("r\tp(r)")
for i in range(n + 1):
    print(str(r_values[i]) + "\t" + str(dist[i]))
# printing mean and variance
print("mean = "+str(mean))
print("variance = "+str(var))
```

```
r       p(r)
0       0.04665599999999999
1       0.1866240000000001
2       0.3110400000000002
3       0.2764800000000001
4       0.13824000000000009
5       0.03686400000000002
6       0.0040960000000000015
mean = 2.4000000000000004
variance = 1.4400000000000002
```

In [6]:
```
#Q6
# defining the libraries
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
%matplotlib inline

# No of Data points
N = 500

# initializing random values
data = np.random.randn(N)

# getting data of the histogram
count, bins_count = np.histogram(data, bins=10)

# finding the PDF of the histogram using count values
pdf = count / sum(count)

# using numpy np.cumsum to calculate the CDF
# We can also find using the PDF values by looping and adding
cdf = np.cumsum(pdf)
```

In [7]:
```
cdf
```

```
Out[7]: array([0.006, 0.03 , 0.078, 0.218, 0.442, 0.688, 0.876, 0.962, 0.988,
               1.   ])
```

Q7

Binomial distribution describes the distribution of binary data from a finite sample. Thus it gives the probability of getting r events out of n trials. Poisson distribution describes the distribution of binary data from an infinite sample. Thus it gives the probability of getting r events in a population.

Q8

Here we have, n = 1000, p = 0.002, λ = np = 2

X = Number of person suffer a bad reaction

Using Poisson's Distribution

P(X > 3) = 1 – {P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3)}

P(X = 0) = \frac{2^0e^{-2}}{0!}= 1/e2

P(X = 1) = \frac{2^1e^{-2}}{1!}= 2/e2

P(X = 2) = \frac{2^2e^{-2}}{2!}= 2/e2

P(X = 3) = \frac{2^3e^{-2}}{3!}= 4/3e2

P(X > 3) = 1 – [19/3e2] = 1 – 0.85712 = 0.1428

Q10 In a binomial distribution, there are only two possible outcomes, i.e. success or failure. Conversely, there are an unlimited number of possible outcomes in the case of poisson distribution. In binomial distribution Mean > Variance while in poisson distribution mean = variance.

Q11

A normal distribution is symmetric about the mean. So, half of the data will be less than the mean and half of the data will be greater than the mean. This means that most of the observed data is clustered near the mean, while the data become less frequent when farther away from the mean.