Q1. What is the Probability density function?

The Probability Density Function(PDF) defines the probability function representing the density of a continuous random variable lying between a specific range of values.

Q2. What are the types of Probability distribution?

Bernoulli Distribution

Binomial Distribution

Poisson Distribution

Normal Distribution

Uniform Distribution

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.

In [1]:

```
import math
def pdf(x,mean,std):
    exp = math.exp( -0.5 * (((x-mean) / (std))**2))
    coef = 1 / (std * math.sqrt(2 * math.pi))
    return coef * exp
pdf(1,0,1)
```

Out[1]:

```
0.24197072451914337
```

Q4. What are the properties of Binomial distribution? Give two examples of events where binomial distribution can be applied.

The binomial distribution is a discrete probability distribution that describes the number of successes in a fixed number of independent trials, where each trial has only two possible outcomes, such as success or failure.

The distribution is characterized by two parameters: n, the number of trials, and p, the probability of success in each trial.

The probability mass function of the binomial distribution is given by: P(X = k) = (n choose k) * p^k * (1-p)^(n-k), where X is the random variable representing the number of successes, k is the number of successes, (n choose k) is the binomial coefficient, and p and (1-p) are the probabilities of success and failure, respectively.

The mean of the binomial distribution is given by np, and the variance is np(1-p).

The binomial distribution is often used to model real-world phenomena where there are only two possible outcomes in each trial, such as flipping a coin, rolling a die, or testing the effectiveness of a drug.

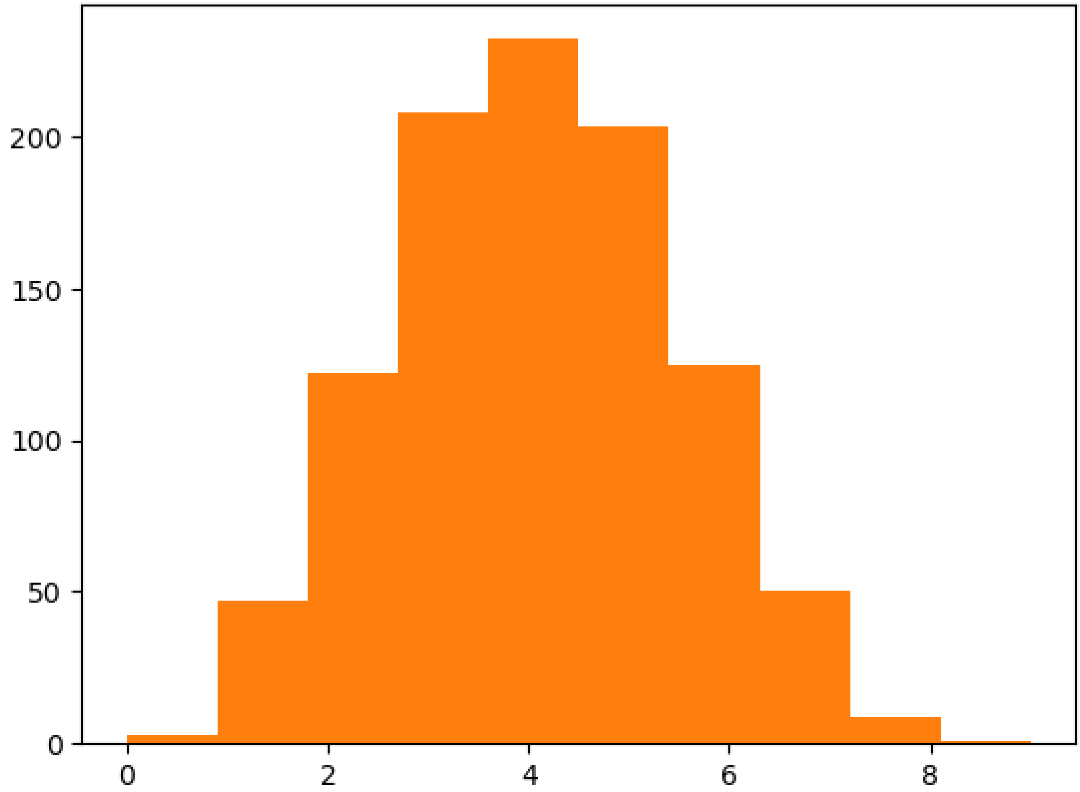
Q5. Generate a random sample of size 1000 from a binomial distribution with probability of success 0.4 and plot a histogram of the results using matplotlib.

In [3]:

```
import matplotlib.pyplot as plt
import numpy as np
n = 10
p = .4
d = np.random.binomial(n,p,size = 1000)
plt.hist(d)
plt.hist(d)
```

Out[3]:

```
(array([  3.,  47., 122., 208., 232., 203., 125.,  50.,   9.,   1.]),
 array([0. , 0.9, 1.8, 2.7, 3.6, 4.5, 5.4, 6.3, 7.2, 8.1, 9. ]),
 <BarContainer object of 10 artists>)
```



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

In [4]:

```
import math

def cdf(x,mean):
    cdf = 0
    for i in range(x+1):
        cdf += math.exp(-mean) * (mean ** i) / math.factorial(i)
    return cdf
cdf(2,2.5)
```

Out[4]:

```
0.5438131158833295
```

Q7. How Binomial distribution different from Poisson distribution?

Binomial distribution is one in which the probability of repeated number of trials are studied.

Poisson Distribution gives the count of independent events occur randomly with a given period of time.

Binomial distribution is the one in which the number of outcomes are only 2 and whereas Poisson distribution is the one in which the number of outcomes are unlimited.

Q8. Generate a random sample of size 1000 from a Poisson distribution with mean 5 and calculate the sample mean and variance.

In [7]:

```
import numpy as np
lam = 5

sample = np.random.poisson(lam,size = 1000)
x = np.mean(sample)
y = np.var(sample)

print('Mean of Sample is ',x)
print('Variance of Sample is ',y)
```

```
Mean of Sample is  5.004
Variance of Sample is  4.935984
```

Q9. How mean and variance are related in Binomial distribution and Poisson distribution?

In a binomial distribution, the mean and variance are both calculated as np, where n is the number of trials and p is the probability of success. Specifically, the mean of a binomial distribution is given by: mean = n p

and the variance is given by: variance = n * p * (1 - p)

In a Poisson distribution, both the mean and variance are equal to λ, where λ is the average number of events per interval. Specifically, the mean and variance of a Poisson distribution are given by: mean = variance = λ

So in both cases, the mean and variance are directly proportional to each other. This means that if the mean

Q10. In normal distribution with respect to mean position, where does the least frequent data appear?

In a normal distribution, the least frequent data appear at the tails of the distribution, furthest away from the mean. Specifically, data that falls more than 2 or 3 standard deviations away from the mean are considered outliers or extreme values, and are relatively rare in a normal distribution.

The normal distribution is symmetric around its mean, so the least frequent data will appear at both ends of the distribution, with the same probability of occurrence on either side. This is because the probability density function of the normal distribution approaches zero as the distance from the mean increases, indicating that data that is far from the mean is increasingly unlikely to occur.