IT 302

Assignment 3

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In [1]:

```
from scipy import stats
import numpy as np
import matplotlib.pyplot as plt
```

Poission Distribution

In [2]:

```
def poisson(lam, val, x):
    mean, variance = stats.poisson.stats(lam, moments='mv')
    print("Mean: ", mean)
    print("Variance: ", variance)
    print("CDF -> Probability(X <=", val, "): ", stats.poisson.cdf(val, lam))
    cdf_all = stats.poisson.cdf(x, lam)
    pmf_all = stats.poisson.pmf(x, lam)
    pmf_given = stats.poisson.pmf(x[val:], lam)
    plt.plot(x, pmf_all, color='y')
    plt.xlabel("x")
    plt.ylabel("P(x)")
    plt.title(
        "Probability Density function\nShaded area under the curve represents P
(X >= {})\n\n".format(val))
    plt.fill_between(x[val:], pmf_given, color='y')
    plt.show()
    plt.plot(x, cdf_all, color='y')
    plt.axvline(val, color='r')
    plt.axhline(stats.poisson.cdf(val, lam), color='r')
    plt.xlabel("x")
    plt.ylabel("Cumulative P(x)")
    plt.title("CDF\nIntersection point in the plot indicates P(X <= {}): {}".for
mat(
        val, stats.poisson.cdf(val, lam)))
    plt.show()
```

Uniform Distribution

In [3]:

```
def uniform(a, b, x, val):
    print("Mean: ", (a+b)/2)
    print("Variance: ", 1/12 * ((b-a) ** 2))
    p = 1/(b-a)
    pdf = []
    cdf = []
    for i in range(0, len(x)):
        if(x[i] >= a and x[i] <= b):
            pdf.append(p)
            cdf.append((x[i]-a)/(b-a))
        elif x[i] < a:
            pdf.append(0)
            cdf.append(0)
        elif x[i] > b:
            pdf.append(0)
            cdf.append(1)
    print("CDF -> Probability(X <=", val, "): ", (val-a)/(b-a))
    plt.plot(x, pdf, color='y')
    plt.fill_between(x, 0, pdf, where=x >= val, color='y')
    plt.xlabel("x")
    plt.ylabel("P(x)")
    plt.title(
        "Probability Density function\nShaded area under the curve represents P
(X >= {})\n\n".format(val))
    plt.show()
    plt.plot(x, cdf, color='y')
    plt.axvline(val, color='r')
    plt.axhline((val-a)/(b-a), color='r')
    plt.xlabel("x")
    plt.ylabel("Cumulative P(x)")
    plt.title("CDF\nIntersection point in the plot indicates P(X <= {}): {}".for
mat(
        val, (val-a)/(b-a)))
    plt.show()
```

Normal Distribution

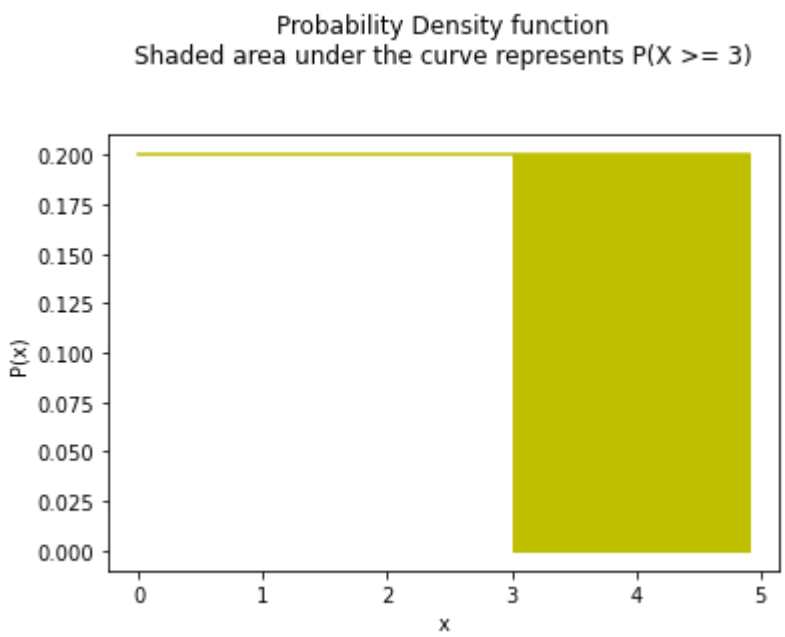
In [4]:

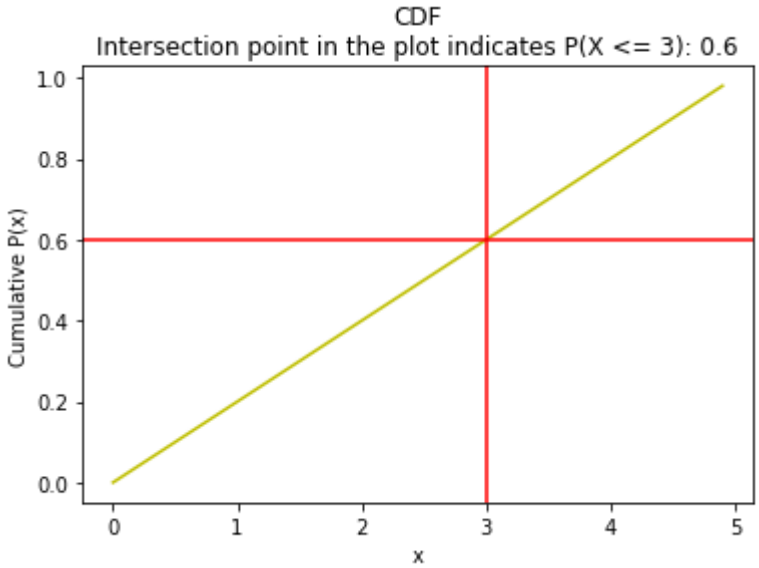
```
def normal(x, m, std, val):
    print("Mean: ", m)
    print("Variance: ", std**2)
    print("CDF -> Probability(X <=", val, "): ", stats.norm.cdf(val, m, std))
    pdf = stats.norm.pdf(x, m, std)
    cdf = stats.norm.cdf(x, m, std)
    plt.plot(x, pdf, color='y')
    plt.fill_between(x, 0, pdf, where=x >= val, color='y')
    plt.xlabel("x")
    plt.ylabel("P(x)")
    plt.title(
        "Probability Density function\nShaded area under the curve represents P
(X >= {})\n\n".format(val))
    plt.show()
    plt.plot(x, cdf, color='y')
    plt.axvline(val, color='r')
    plt.axhline(stats.norm.cdf(val, m, std), color='r')
    plt.xlabel("x")
    plt.ylabel("Cummulative P(x)")
    plt.title("CDF\nIntersection point in the plot indicates P(X <= {}): {}".for
mat(
        val, stats.norm.cdf(val, m, std)))
    plt.show()
```

In [5]:

```
condition = True
while condition:
    print("Select one of the following distributions: ")
    print("1) Uniform Distribution")
    print("2) Poisson Distribution")
    print("3) Normal Distribution")
    opt = int(input("Enter the option number: "))
    if opt == 1:
        print("Uniform Distribution")
        a = float(input("Enter left bound(a): "))
        b = float(input("Enter right bound(b): "))
        val = int(input("Enter x1 for P(X<=x1): "))
        x = np.arange(a, b, 0.1)
        uniform(a, b, x, val)
    elif opt == 2:
        print("Poisson Distribution")
        lam = float(input("Enter lambda: "))
        val = int(input("Enter x1 for P(X<=x1): "))
        x = np.arange(0, 20, 1)
        poisson(lam, val, x)
    elif opt == 3:
        print("Normal Distribution")
        val = int(input("Enter X for P(X<=x1): "))
        arr = np.arange(0, 20, 0.1)
        m = np.mean(arr)
        std = np.std(arr)
        normal(arr, m, std, val)
    else:
        print("Please enter a valid option")
    entered = input("Do you want to try again(Y/N)?: ")
    if entered == 'Y':
        condition = True
    else:
        condition = False
```

```
Select one of the following distributions:
1) Uniform Distribution
2) Poisson Distribution
3) Normal Distribution
Enter the option number: 1
Uniform Distribution
Enter left bound(a): 0
Enter right bound(b): 5
Enter x1 for P(X<=x1): 3
Mean:  2.5
Variance:  2.083333333333333
CDF -> Probability(X <= 3 ):  0.6
```






```
Do you want to try again(Y/N)?: N
```