EXPERIMENT: 29

Write a py thon pr ogram to implement Bay e‟s theorem. Example: When there are 2 box es A and B containing balls of 3 color s. Number of balls with each color in both the boxes are giv en. When a random ball is picked and its color is g iv en, the pr ogram sh ould be able to find the pr obabilities of the ball being taken fr om box A and box B. W

Program:

```
from math import sqrt
from math import pi
from math import exp

# Split the dataset by class values, returns a dictionary
def separate_by_class(dataset):
    separated = dict()
    for i in range(len(dataset)):
        vector = dataset[i]
        class_value = vector[-1]
        if (class_value not in separated):
            separated[class_value] = list()
        separated[class_value].append(vector)
    return separated

# Calculate the mean of a list of numbers
def mean(numbers):
    return sum(numbers)/float(len(numbers))

# Calculate the standard deviation of a list of numbers
def stdev(numbers):
    avg = mean(numbers)
    variance = sum([(x-avg)**2 for x in numbers]) / float(len(numbers)-1)
    return sqrt(variance)

# Calculate the mean, stdev and count for each column in a dataset
def summarize_dataset(dataset):
    summaries = [(mean(column), stdev(column), len(column)) for column
in zip(*dataset)]
    del(summaries[-1])
    return summaries
```

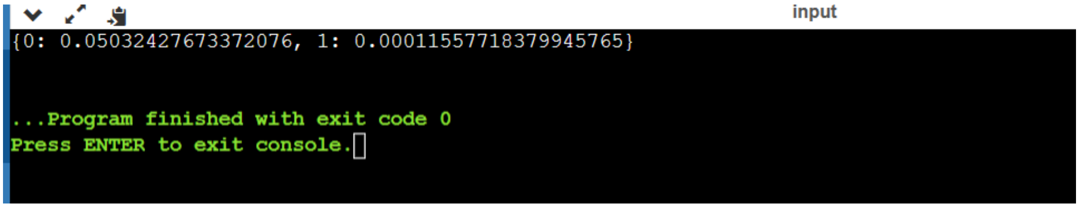
```
# Split dataset by class then calculate statistics for each row
def summarize_by_class(dataset):
    separated = separate_by_class(dataset)
    summaries = dict()
    for class_value, rows in separated.items():
        summaries[class_value] = summarize_dataset(rows)
    return summaries

# Calculate the Gaussian probability distribution function for x
def calculate_probability(x, mean, stdev):
    exponent = exp(-((x-mean)**2 / (2 * stdev**2 )))
    return (1 / (sqrt(2 * pi) * stdev)) * exponent

# Calculate the probabilities of predicting each class for a given row
def calculate_class_probabilities(summaries, row):
    total_rows = sum([summaries[label][0][2] for label in summaries])
    probabilities = dict()
    for class_value, class_summaries in summaries.items():
        probabilities[class_value] =
summaries[class_value][0][2]/float(total_rows)
        for i in range(len(class_summaries)):
            mean, stdev, _ = class_summaries[i]
            probabilities[class_value] *= calculate_probability(row[i],
mean, stdev)
    return probabilities

# Test calculating class probabilities
dataset = [[3.393533211,2.331273381,0],
    [3.110073483,1.781539638,0],
    [1.343808831,3.368360954,0],
    [3.582294042,4.67917911,0],
    [2.280362439,2.866990263,0],
    [7.423436942,4.696522875,1],
    [5.745051997,3.533989803,1],
    [9.172168622,2.511101045,1],
    [7.792783481,3.424088941,1],
    [7.939820817,0.791637231,1]]
summaries = summarize_by_class(dataset)
probabilities = calculate_class_probabilities(summaries, dataset[0])
print(probabilities)
```

OUTPUT:



```
{0: 0.05032427673372076, 1: 0.00011557718379945765}


...Program finished with exit code 0
Press ENTER to exit console.
```