## 1) About the Dataset

**Data Link:-** https://www.kaggle.com/datasets/nikhil7280/student-performance-multiple-linear-regression/code (https://www.kaggle.com/datasets/nikhil7280/student-performance-multiple-linear-regression/code)

```
We Having Dataset of student which have been avalible on kaggle
```

**Description:**

```
The Student Performance Dataset is a dataset designed to examine the factors influencing academic student performance. The dataset co
nsists of 10,000 student records, with each record containing information about various predictors and a performance index.
```

- **Variable:**
  - **Hour Studies:-** The Total Number of hours spent studying by each student.
  - **Pervious Score:** The Socre Obtained by student in previous score.
  - **Extracurrcular Activities:** Whether the student pariticipates activities (Yes or No).
  - **Sleep Hour:** The Average number of hours of sleep the student had per day.
  - **Sample Question Paper Praticed:** The Number of sample question papers the student practiced.
- **Target Variable:**
  - Performence metrics : A measure of the overall performance of each student. The performance index represents the student's academic performance and has been rounded to the nearest integer. The index ranges from 10 to 100, with higher values indicating better performance.

## 2) Importing the standard Libraries

In [1]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as sts
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```python
df = pd.read_csv('Student_Performance.csv')
df.head()
```

Out[2]:

|   | Hours Studied | Previous Scores | Extracurricular Activities | Sleep Hours | Sample Question Papers Practiced | Performance Index |
|---|---|---|---|---|---|---|
| **0** | 7 | 99 | Yes | 9 | 1 | 91.0 |
| **1** | 4 | 82 | No | 4 | 2 | 65.0 |
| **2** | 8 | 51 | Yes | 7 | 2 | 45.0 |
| **3** | 5 | 52 | Yes | 5 | 2 | 36.0 |
| **4** | 7 | 75 | No | 8 | 5 | 66.0 |

## 3) Get some information about the dataset

In [3]:

```python
df.shape
```

Out[3]:

```
(10000, 6)
```

#### Shape of the Dataset

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 6 columns):
 #   Column                            Non-Null Count  Dtype  
---  ------                            --------------  -----  
 0   Hours Studied                     10000 non-null  int64  
 1   Previous Scores                   10000 non-null  int64  
 2   Extracurricular Activities        10000 non-null  object 
 3   Sleep Hours                       10000 non-null  int64  
 4   Sample Question Papers Practiced  10000 non-null  int64  
 5   Performance Index                 10000 non-null  float64
dtypes: float64(1), int64(4), object(1)
memory usage: 468.9+ KB
```

**Observation :-** All the Feature are intiger and float type we no need to do type cast

In [5]:

```
df.isnull().sum()
```

Out[5]:

```
Hours Studied                       0
Previous Scores                     0
Extracurricular Activities          0
Sleep Hours                         0
Sample Question Papers Practiced    0
Performance Index                   0
dtype: int64
```

**Observation:-** We can see there no any missing value in our dataset

In [6]:

```
df.duplicated().sum()
```

Out[6]:

```
127
```

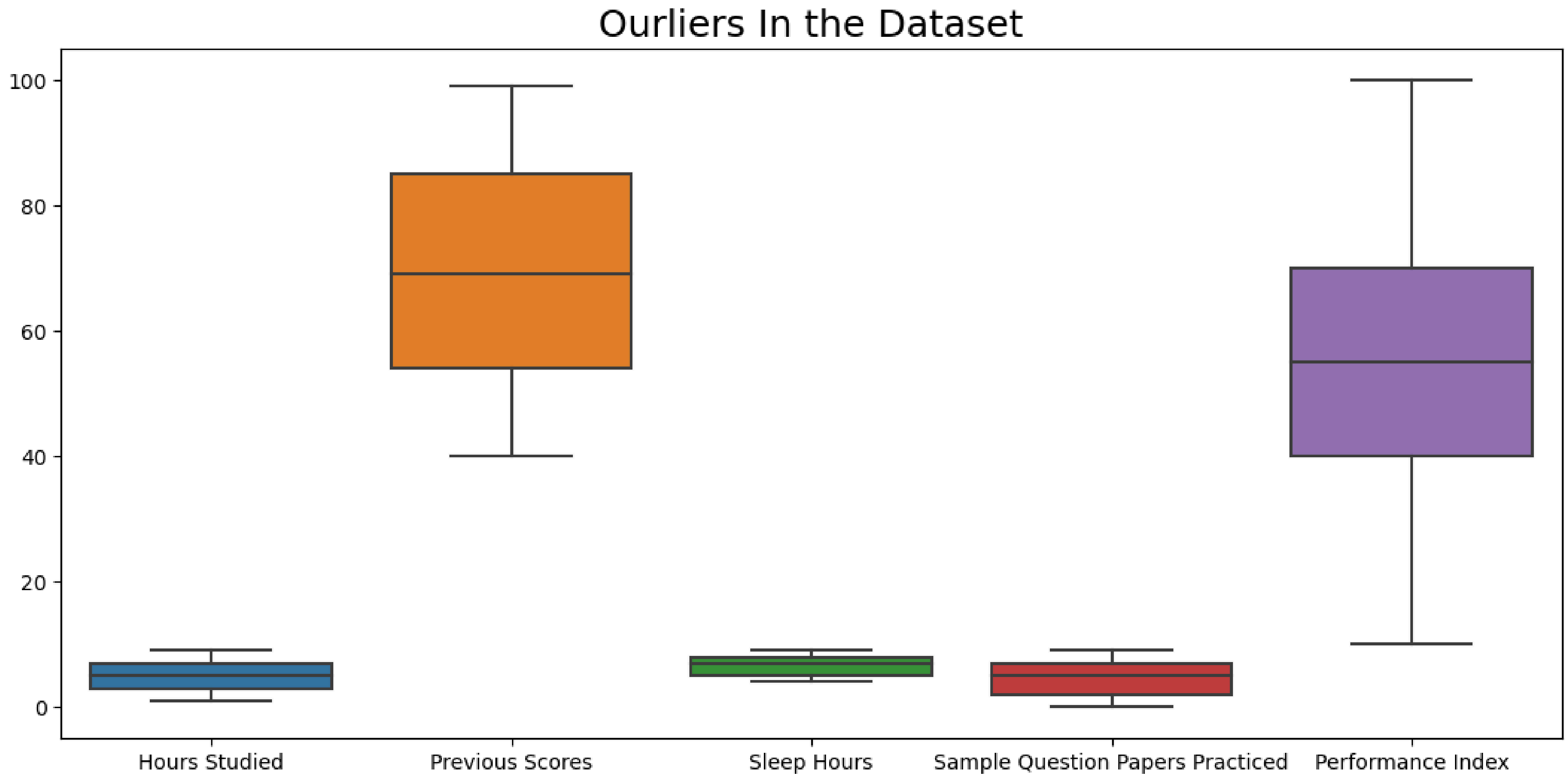
In [7]:

```
df.drop_duplicates(inplace = True)
```

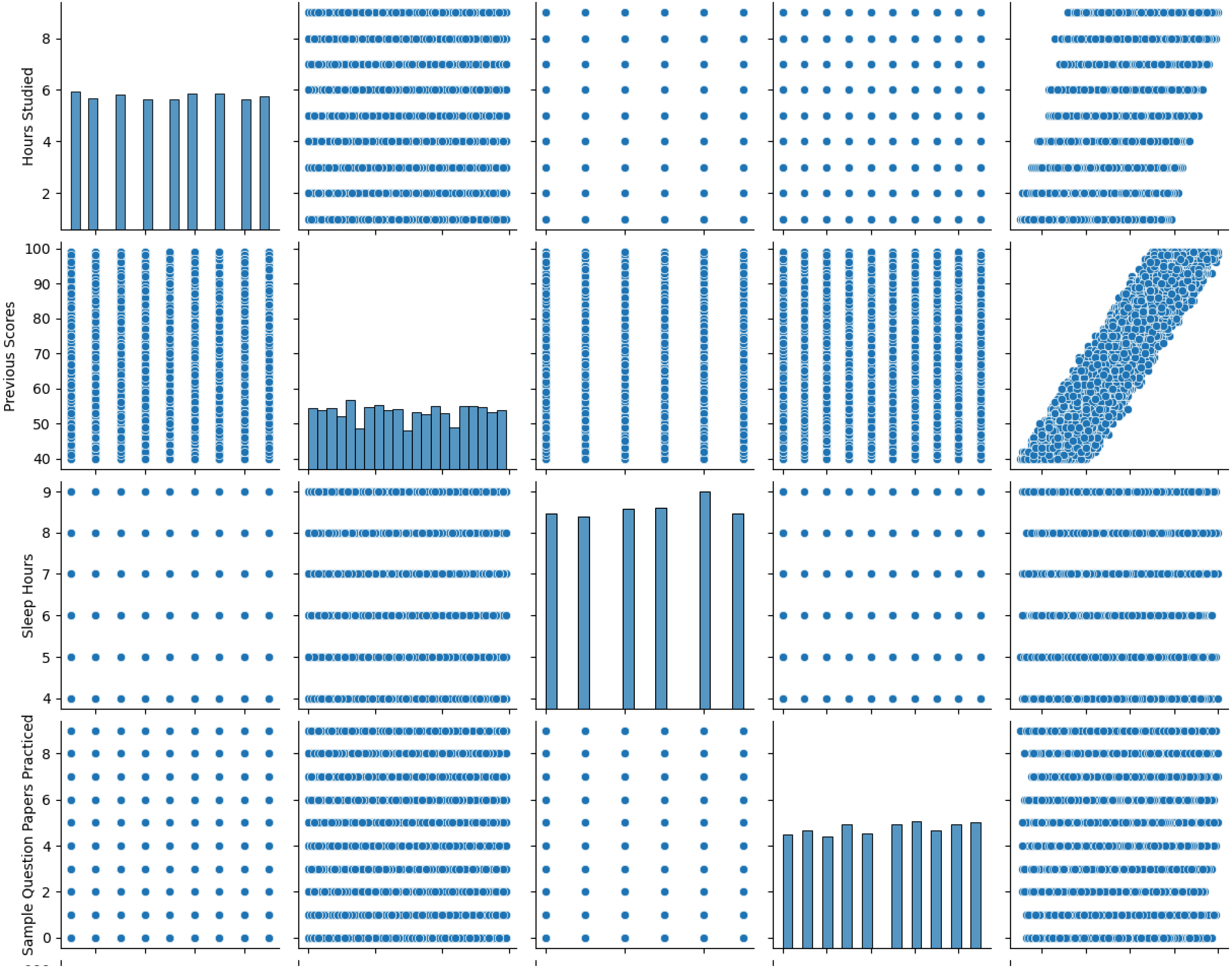
**Observation:-** As We can see there having 127 duplicates value and wo drop that value

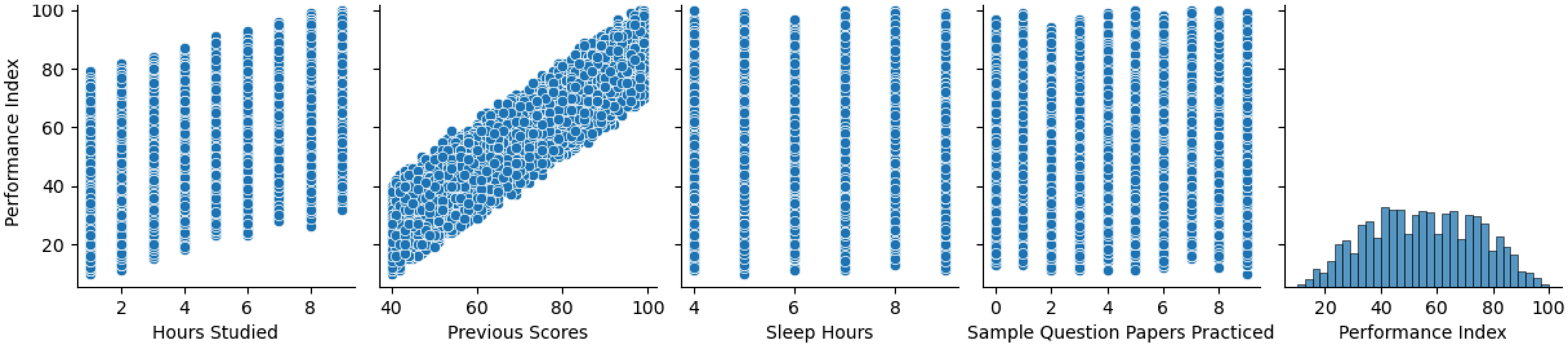
In [8]:

```
plt.figure(figsize = (13,6))
plt.title("Ourliers In the Dataset", fontsize = 18)
sns.boxplot(df)
plt.show()
```



**Observation:-** As we can see there having no outliers in the dataset

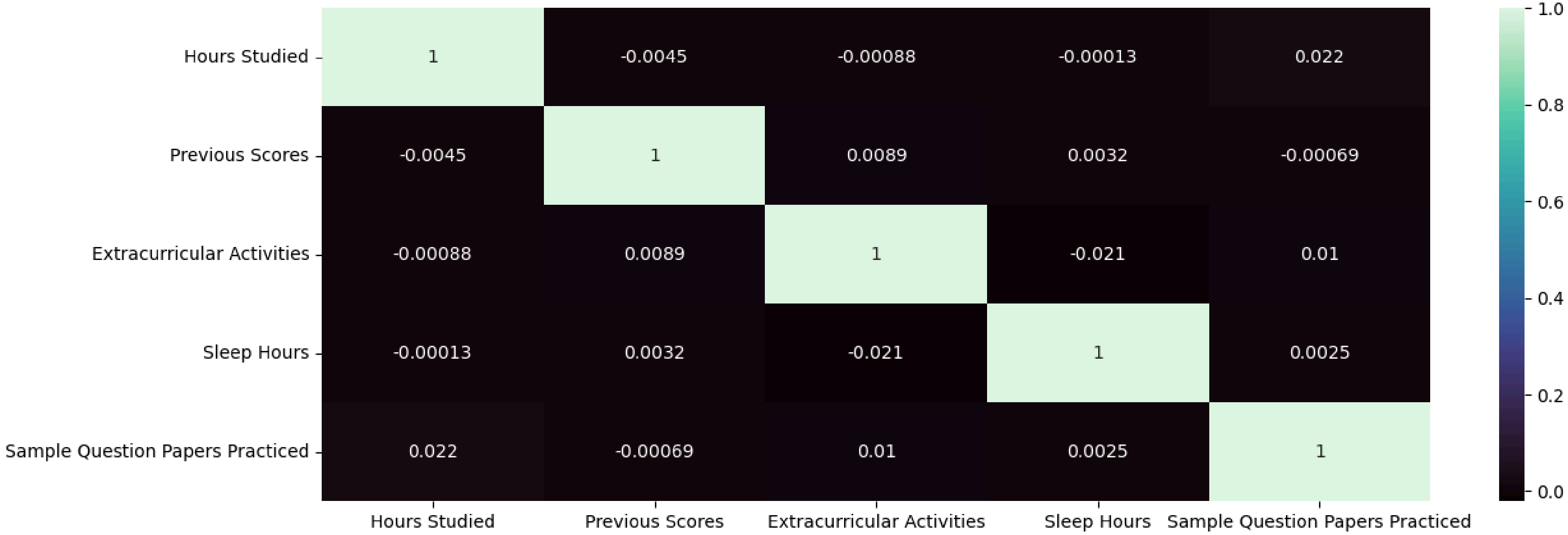

Hours Studied
8
6
4
2
Previous Scores
100
90
80
70
60
50
40
Sleep Hours
9
8
7
6
5
4
Sample Question Papers Practiced
8
6
4
2
0



**Pairplot of the dataset**

In [36]:

```
plt.figure(figsize = (14,5))
sns.heatmap(x_train.corr(), annot = True , cmap = 'mako')
plt.show()
```



**As we can see from the corelation Performence Index with Hours Studies and Performence with previous score is highily correlated**

In [ ]:

```
### Copping the dataset in new frameword
clean_df = df.copy()
```

## 4) Seperating the Dependent & Independent Feature

In [13]:

```
x = df[df.columns[0:5]]
y = df['Performance Index']
```

**Observation:-** We have the Split the Dependent Feature and Independent Feature In Different-Different Variables

## 5) Now We'll Split the Dataset into Train_test_Split

In [14]:

```
from sklearn.model_selection import train_test_split
```

In [15]:

```
x_train , x_test , y_train , y_test = train_test_split(x,y,random_state = 42 , test_size = 0.30)
```

In [16]:

```
x_train.shape, x_test.shape, y_train.shape , y_test.shape
```

Out[16]:

```
((6911, 5), (2962, 5), (6911,), (2962,))
```

## 5) Now We'll Move Toword the Feature Engineering

In [17]:

```
df['Extracurricular Activities'].unique()
```

Out[17]:

```
array(['Yes', 'No'], dtype=object)
```

**Observation / Ingisights:-** As we can see the Extracurricular Activities contains only Yes or No value so we need to use Feature Engineering for Extracurricular Activities and the best suitable preprocessing technique for curricular Activities is Label Encoding.

#### Label Encoding for Extracurricular Activities

In [18]:

```
from sklearn.preprocessing import LabelEncoder
```

In [19]:

```
LE = LabelEncoder()
```

In [134]:

```
LE
```

Out[134]:

```
▾ LabelEncoder
LabelEncoder()
```

In [138]:

```
x_train['Extracurricular Activities'] = LE.fit_transform(x_train[['Extracurricular Activities']])
x_test['Extracurricular Activities'] = LE.transform(x_test['Extracurricular Activities'])
```

In [22]:

```
df.head(2)
```

Out[22]:

| | Hours Studied | Previous Scores | Extracurricular Activities | Sleep Hours | Sample Question Papers Practiced | Performance Index |
|---|---|---|---|---|---|---|
| **0** | 7 | 99 | Yes | 9 | 1 | 91.0 |
| **1** | 4 | 82 | No | 4 | 2 | 65.0 |

### MinMaxScaler for Hours Studied , Previous Scores , Extracurricular Activities , Sleep Hours , Performance Index

In [23]:

```
from sklearn.preprocessing import MinMaxScaler
```

In [24]:

```
MMS = MinMaxScaler()
MMS
```

Out[24]:

```
▾ MinMaxScaler
MinMaxScaler()
```

In [25]:

```
x_train[['Hours Studied','Previous Scores','Sleep Hours','Sample Question Papers Practiced'
       ]]= MMS.fit_transform(x_train[['Hours Studied','Previous Scores','Sleep Hours','Sample Question Papers Practiced']])
```

In [26]:

```
x_test[['Hours Studied','Previous Scores','Sleep Hours','Sample Question Papers Practiced'
       ]]= MMS.fit_transform(x_test[['Hours Studied','Previous Scores','Sleep Hours','Sample Question Papers Practiced']])
```

### 6) Creating the model

In [27]:

```python
from sklearn.linear_model import LinearRegression
```

In [28]:

```python
LR = LinearRegression()
LR
```

Out[28]:

```
▾ LinearRegression
LinearRegression()
```

In [29]:

```python
### Fitting the model
LR.fit(x_train , y_train)
```

Out[29]:

```
▾ LinearRegression
LinearRegression()
```

In [30]:

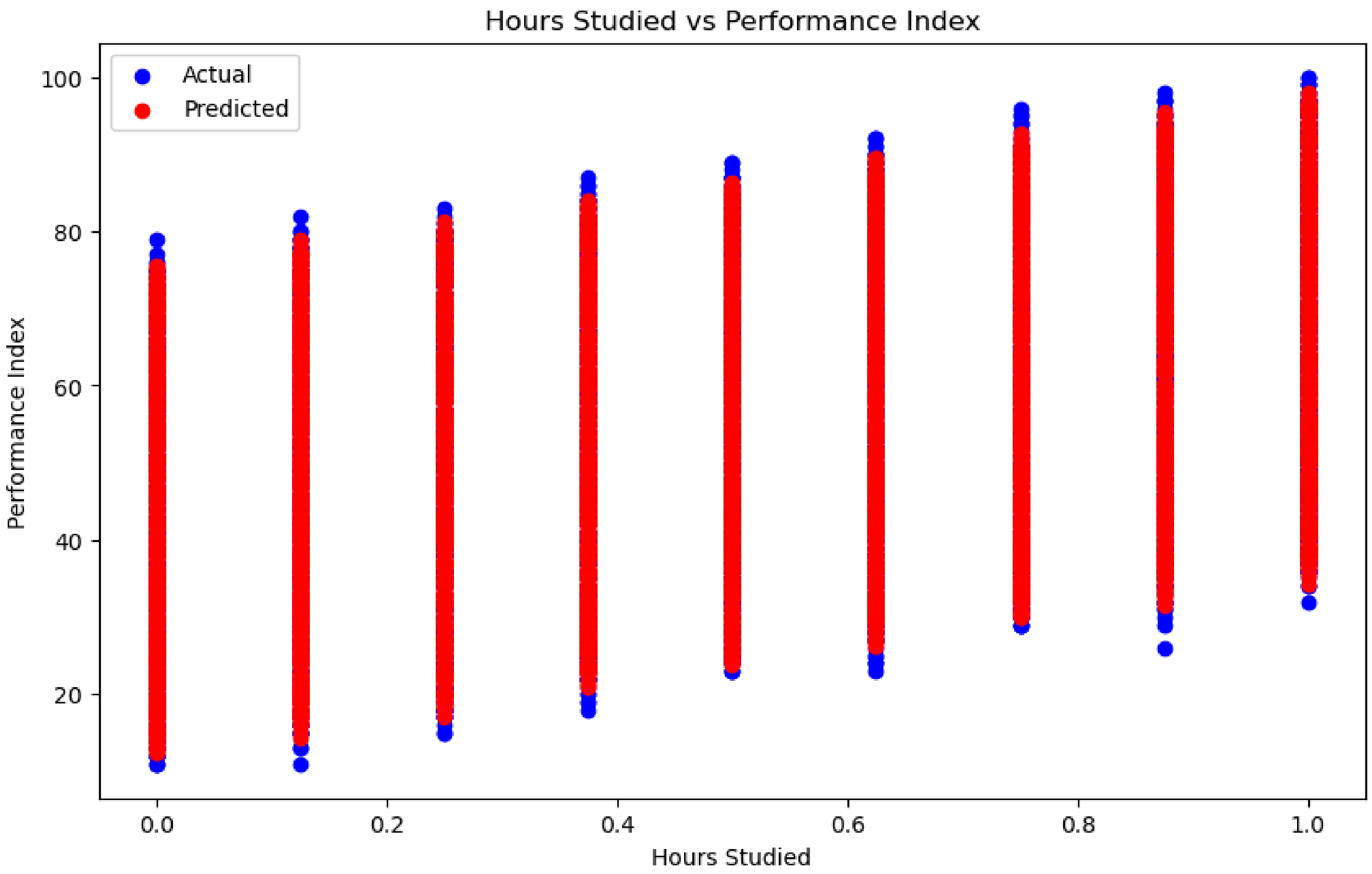
```python
print(f"My Intercept is for the Model is :{LR.intercept_}")
print(f"My Coeficiant is for the Model is :{LR.coef_}")
```

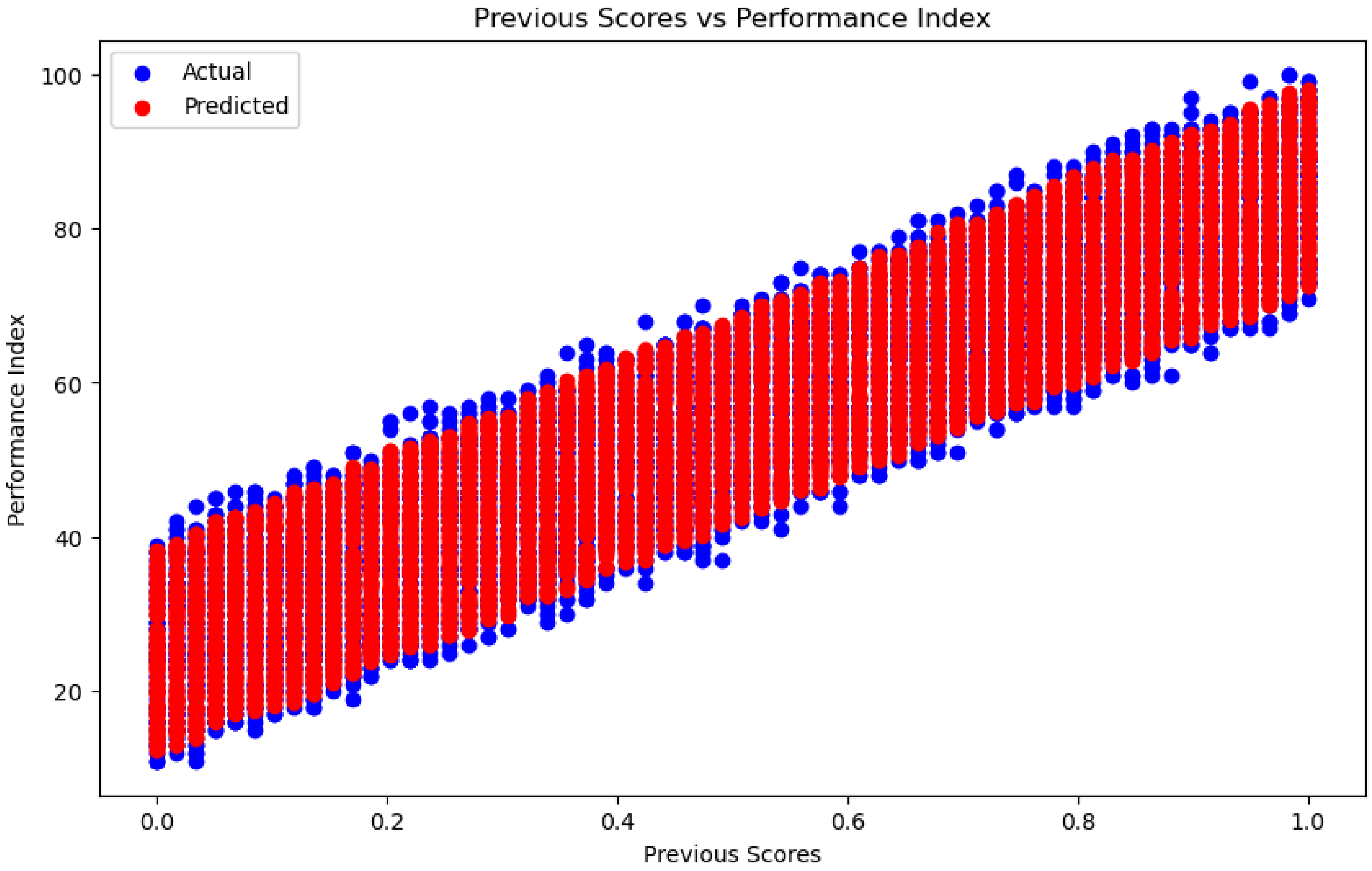
```
My Intercept is for the Model is :11.491703791242934
My Coeficiant is for the Model is :[22.79393076 60.07597174  0.55684553  2.35000699  1.74053014]
```

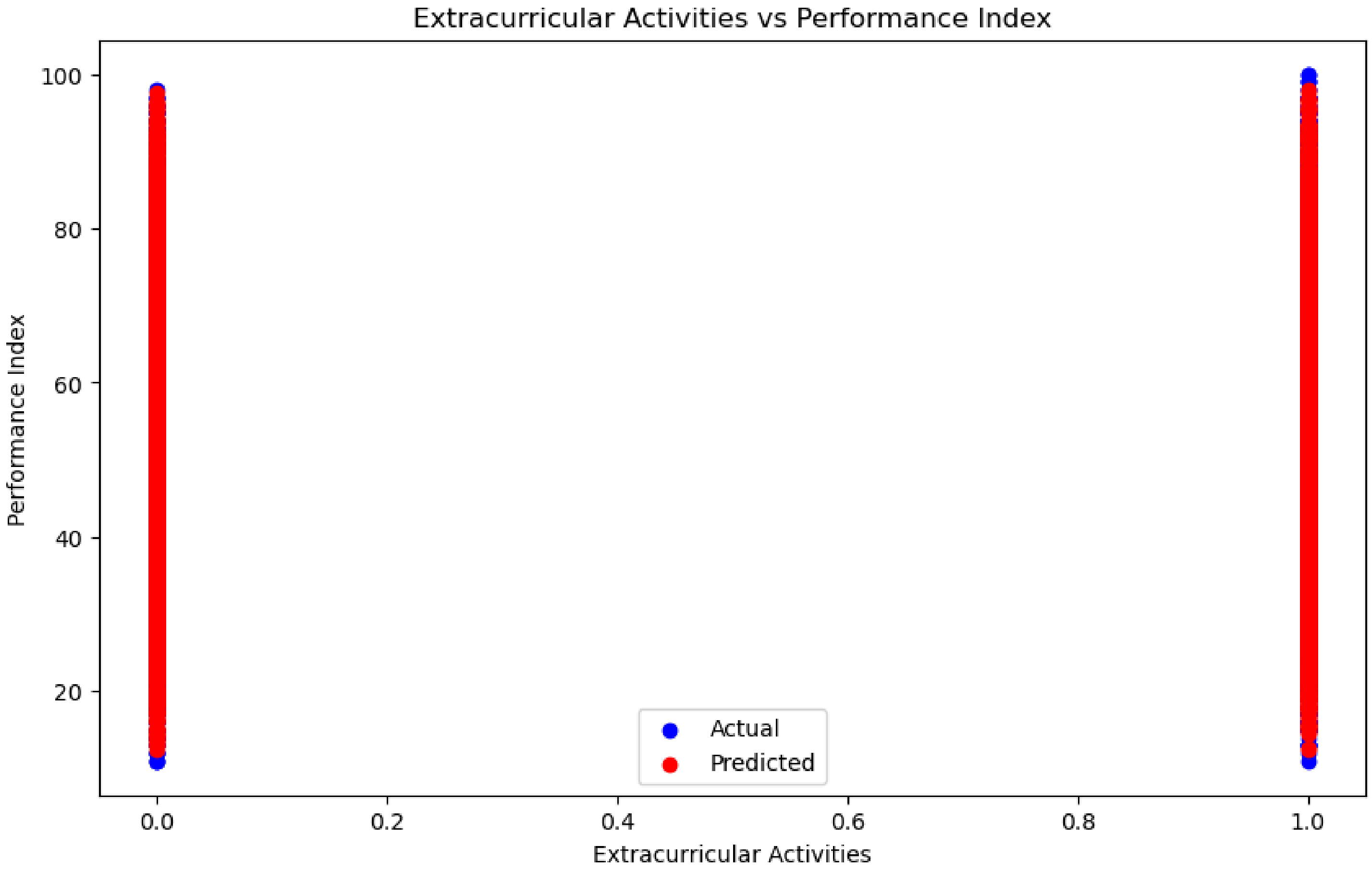
In [83]:

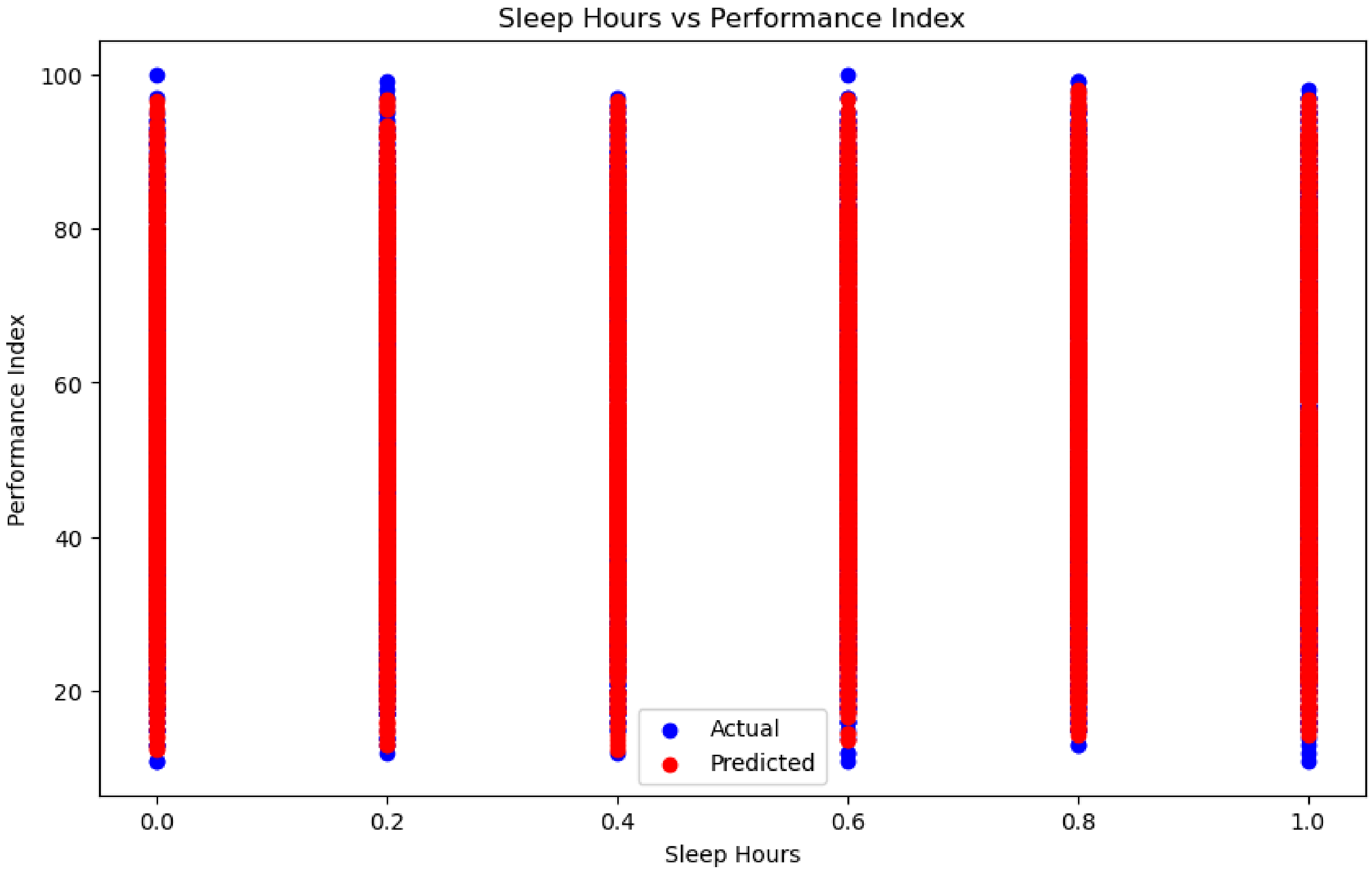
```python
def plot_partial_dependency(feature, feature_name):
    plt.figure(figsize=(10, 6))
    plt.scatter(x_train[feature_name], y_train, color='blue', label='Actual')
    plt.scatter(x_train[feature_name], LR.predict(x_train), color='red', label='Predicted')
    plt.xlabel(feature_name)
    plt.ylabel('Performance Index')
    plt.title(f'{feature_name} vs Performance Index')
    plt.legend()
    plt.show()
```

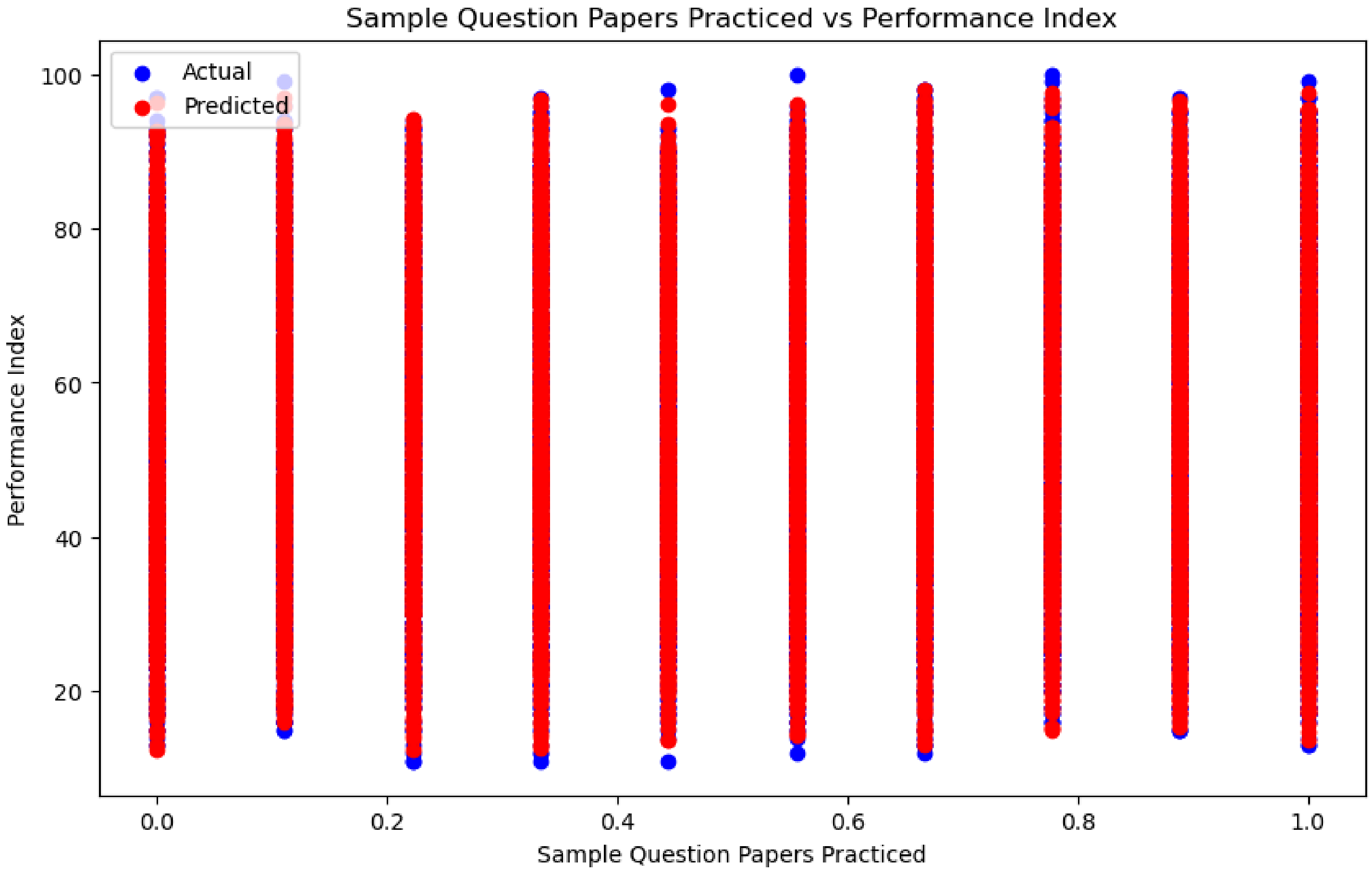
In [84]:
```
for i in x.columns:
    plot_partial_dependency(x_train[i],i )
```




Previous Scores vs Performance Index
● Actual
● Predicted
Performance Index
100
80
60
40
20
0.0
0.2
0.4
0.6
0.8
1.0
Previous Scores


Extracurricular Activities vs Performance Index
Performance Index
100
80
60
40
20
0.0
0.2
0.4
0.6
0.8
1.0
Extracurricular Activities
● Actual
● Predicted


Sleep Hours vs Performance Index
Performance Index
100
80
60
40
20
0.0
0.2
0.4
0.6
0.8
1.0
Sleep Hours
● Actual
● Predicted



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### Let's Apply Method on Test

In [39]:
```
y_pred = LR.predict(x_test)
```

In [69]:
```
temp_df = pd.DataFrame(y_pred, y_test).reset_index(drop = False)
```

In [77]:
```
temp_df.rename(columns = {temp_df.columns[1]:'Predictive Performance Index'},inplace = True)
```

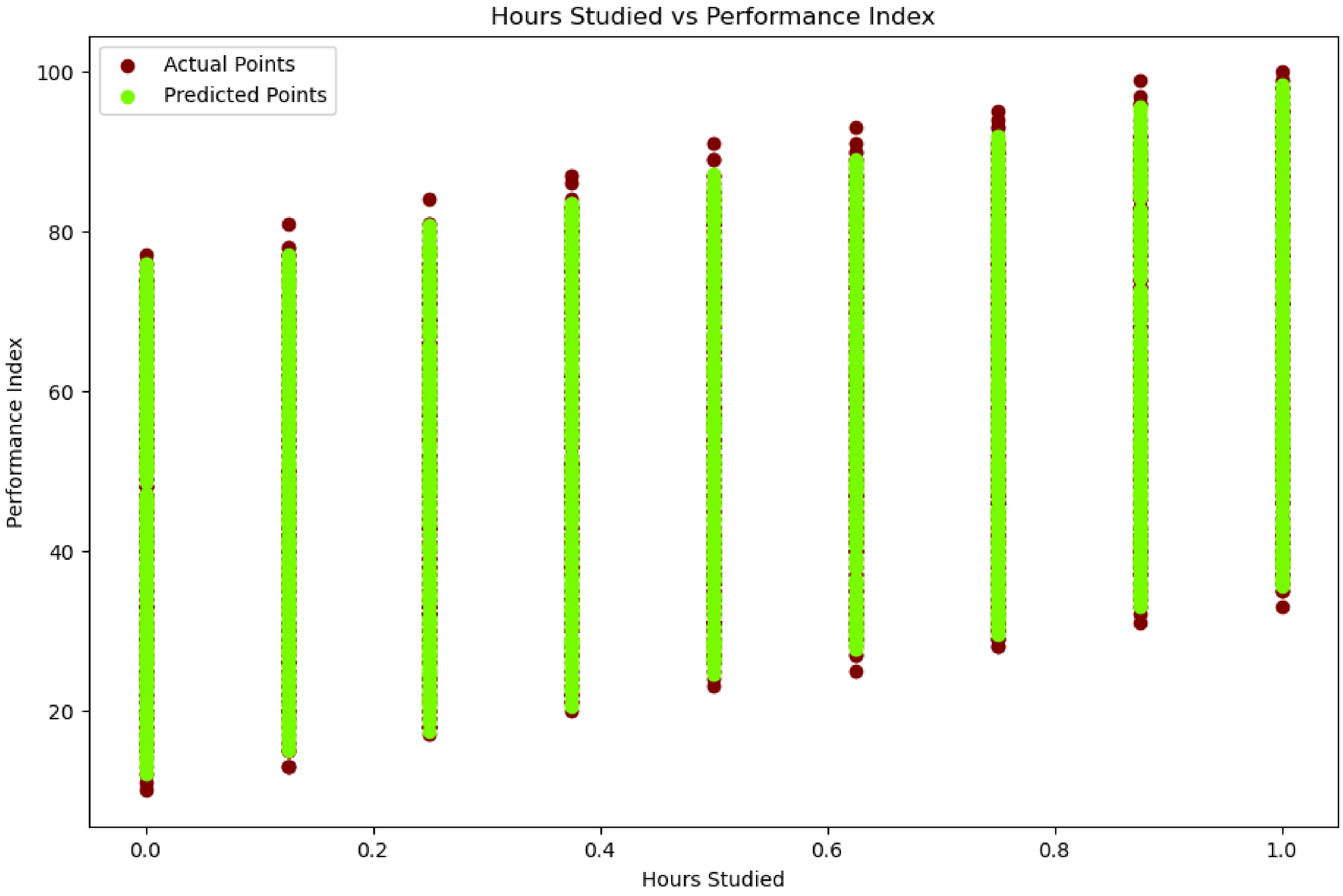
In [78]:
```
temp_df.head()
```

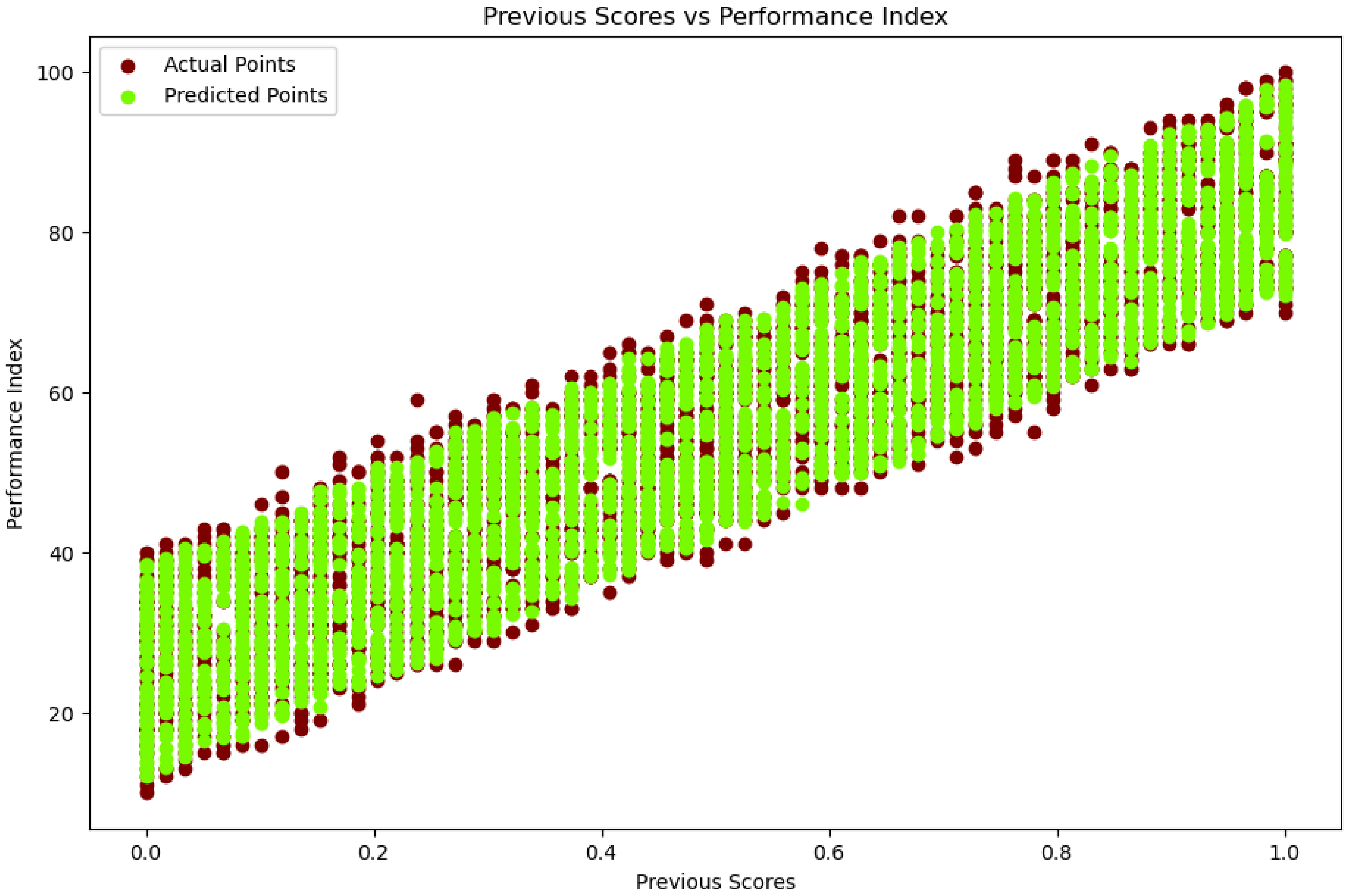
Out[78]:
```
   Performance Index  Predictive Performance Index
0               47.0                     46.470919
1               76.0                     80.249230
2               62.0                     61.029966
3               23.0                     22.732038
4               76.0                     74.839305
```

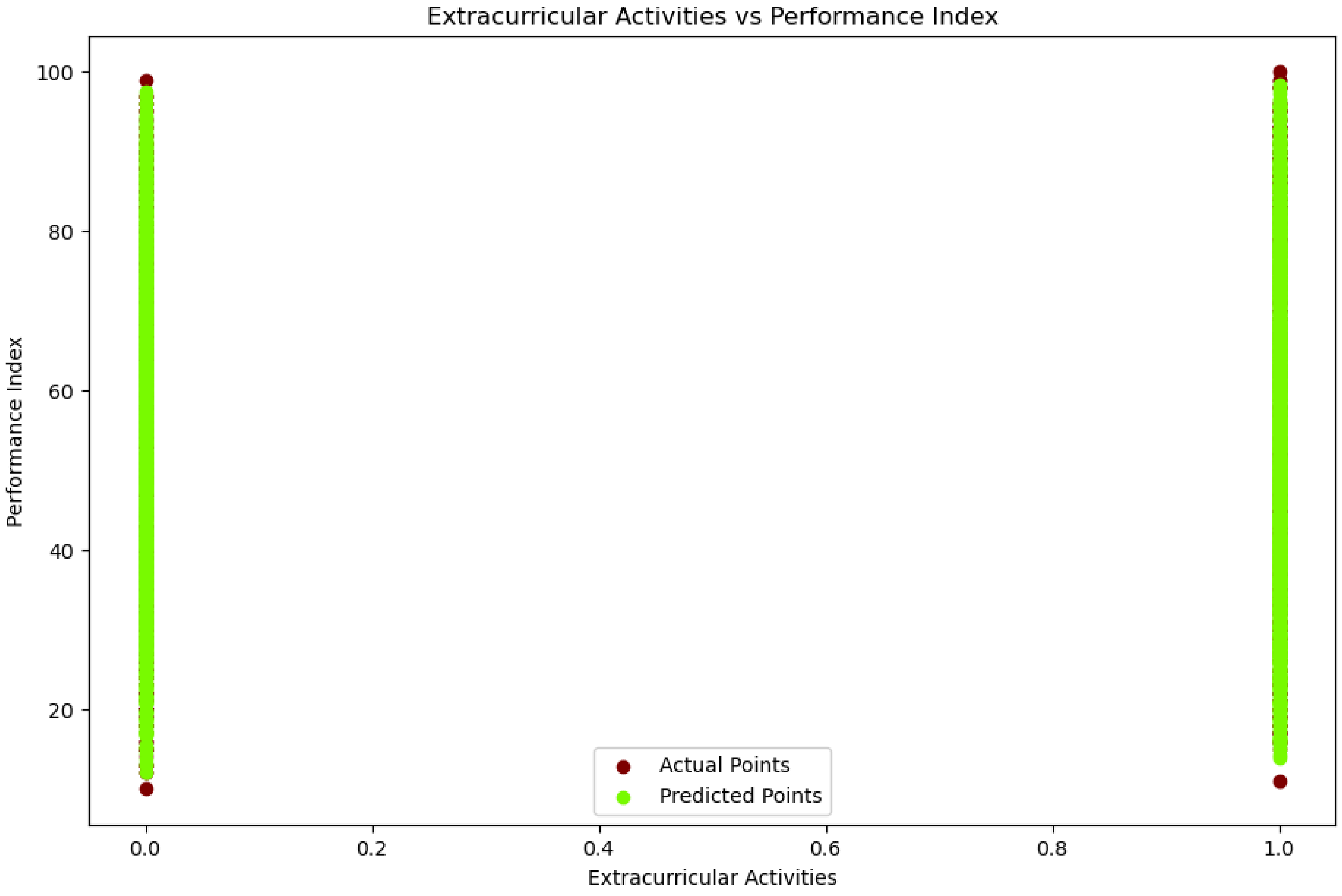
### Now We'll Apply the Model on Test Datset

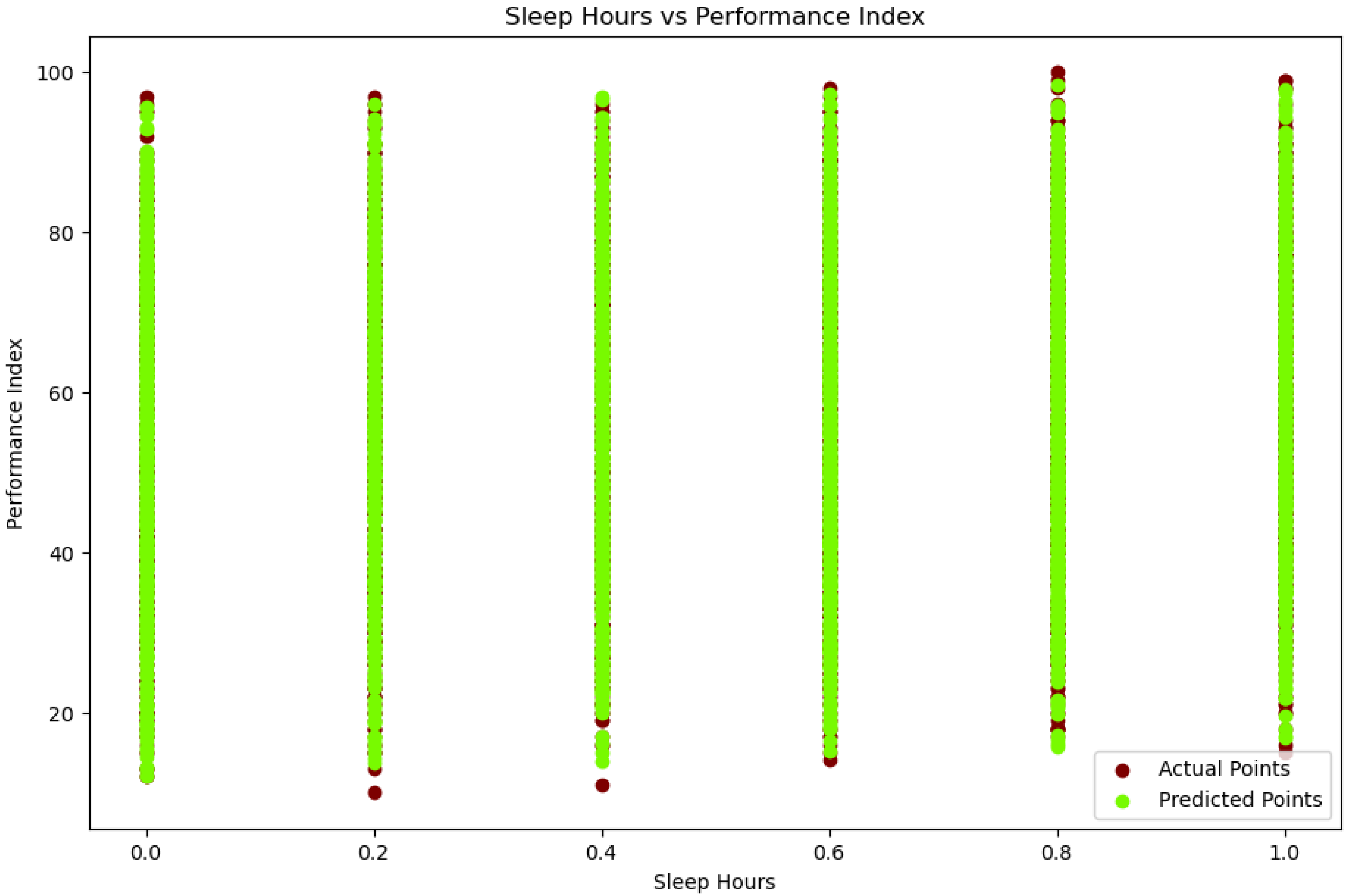
In [103]:

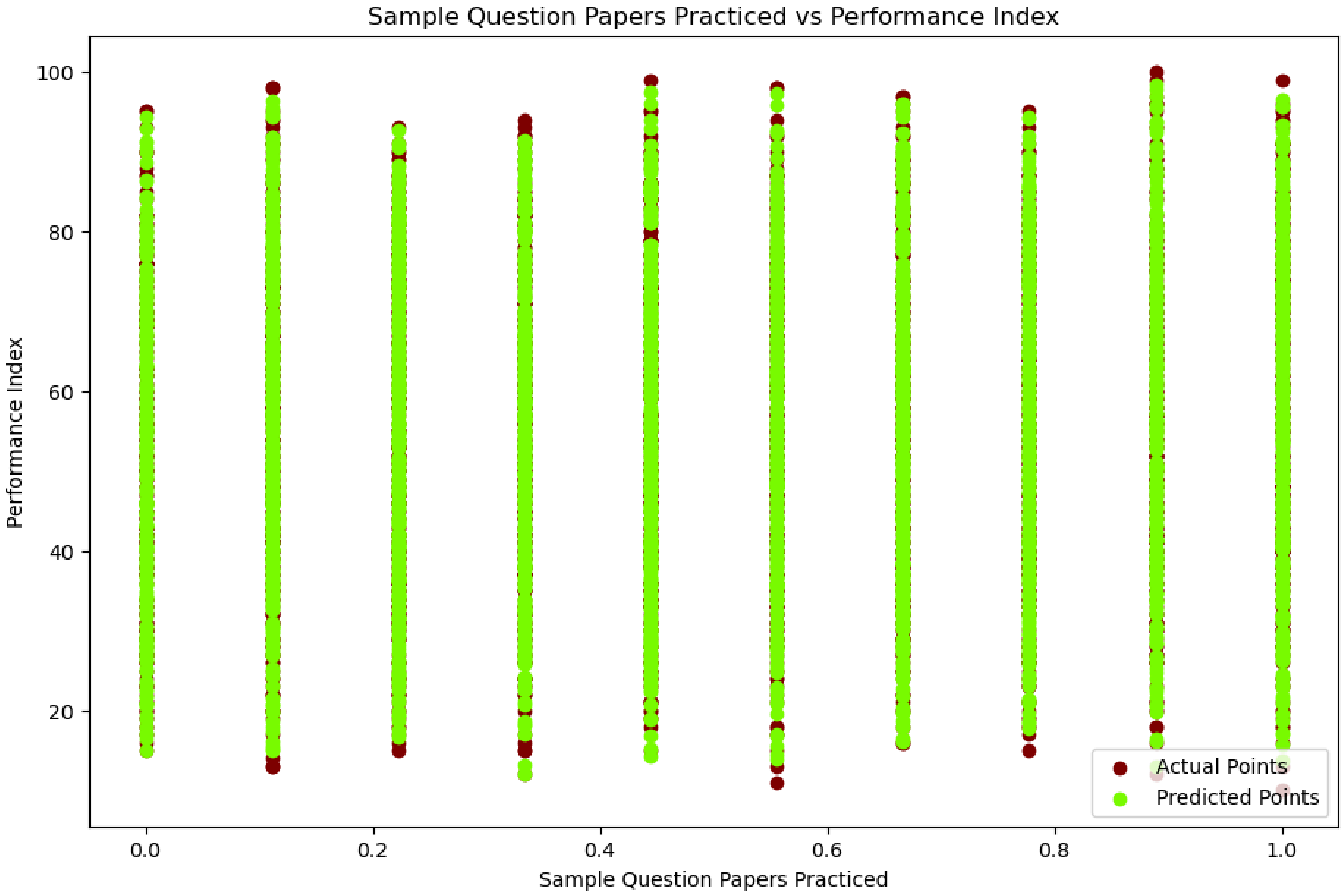
```
for i in x_test.columns:
    plt.figure(figsize = (11,7))
    plt.scatter(x_test[i], y_test, color = 'maroon', label = 'Actual Points')
    plt.scatter(x_test[i], LR.predict(x_test) , color = 'lawngreen' , label = 'Predicted Points')
    plt.xlabel(i)
    plt.ylabel('Performance Index')
    plt.title(f'{i} vs Performance Index')
    plt.legend()
    plt.plot()
```


Hours Studied vs Performance Index
● Actual Points
● Predicted Points
100
80
60
40
20
Performance Index
0.0
0.2
0.4
0.6
0.8
1.0
Hours Studied


Previous Scores vs Performance Index
Actual Points
Predicted Points
100
80
60
40
20
Performance Index
0.0
0.2
0.4
0.6
0.8
1.0
Previous Scores


Extracurricular Activities vs Performance Index
Performance Index
100
80
60
40
20
0.0
0.2
0.4
0.6
0.8
1.0
Extracurricular Activities
● Actual Points
● Predicted Points


Sleep Hours vs Performance Index
Performance Index
Sleep Hours
100
80
60
40
20
0.0
0.2
0.4
0.6
0.8
1.0
● Actual Points
● Predicted Points



## Let's Calculate the squared error

In [104]:
```
from sklearn.metrics import mean_squared_error , mean_absolute_error
```

In [106]:

```
mse = mean_squared_error(y_test , y_pred)
mae = mean_absolute_error(y_test , y_pred)
rmse = np.sqrt(mse)
print(f"My Mean Square Error is : {mse}")
print(f"My Mean Absolute Error is : {mae} ")
print(f"My Root Mean Square Error is :{rmse}")
```

```
My Mean Square Error is : 4.326180232071973
My Mean Absolute Error is : 1.6461997455341872
My Root Mean Square Error is :2.0799471705002444
```

### Now We'll me Calulating the How Good is Our Model is

In [107]:

```
from sklearn.metrics import r2_score
```

In [108]:

```
score = r2_score(y_test , y_pred)
```

In [109]:

```
score
```

Out[109]:

```
0.9881593003934889
```

In [111]:

```
df
```

Out[111]:

| | Hours Studied | Previous Scores | Extracurricular Activities | Sleep Hours | Sample Question Papers Practiced | Performance Index |
|---|---|---|---|---|---|---|
| **0** | 7 | 99 | Yes | 9 | 1 | 91.0 |
| **1** | 4 | 82 | No | 4 | 2 | 65.0 |
| **2** | 8 | 51 | Yes | 7 | 2 | 45.0 |
| **3** | 5 | 52 | Yes | 5 | 2 | 36.0 |
| **4** | 7 | 75 | No | 8 | 5 | 66.0 |
| **...** | ... | ... | ... | ... | ... | ... |
| **9995** | 1 | 49 | Yes | 4 | 2 | 23.0 |
| **9996** | 7 | 64 | Yes | 8 | 5 | 58.0 |
| **9997** | 6 | 83 | Yes | 8 | 5 | 74.0 |
| **9998** | 9 | 97 | Yes | 7 | 0 | 95.0 |
| **9999** | 7 | 74 | No | 8 | 1 | 64.0 |

9873 rows × 6 columns

In [126]:

```
new_input = MMS.transform([[7,87,10,1]])
```

In [147]:

```
input_ = np.insert(new_input,2,1)
print(input_)
```

```
[0.75       0.79661017 1.         1.2        0.11111111]
```

In [152]:

```
print(f"The Performence Index is based on given data is :{LR.predict([input_])}")
```

```
The Performence Index is based on given data is :[80.01452805]
```

THANKS!
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