**Assignment-4**

PythonProgramming

| | |
|---|---|
| Student Name | Siva prabin.R |
| Maximum Marks | 2 Marks |

**Question-1:**

Download the dataset: Dataset

**Solution:**

https://drive.google.com/file/d/1Z21e5HOZZR81sC_dnfCDPDMEzs-w8ysr/view

**Question-2:**

Load the dataset.

**Solution:**

```
data = pd.read_csv('/content/Mall_Customers.csv')
data.head()
```

| | CustomerID | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|---|
| 0 | 1 | Male | 19 | 15 | 39 |
| 1 | 2 | Male | 21 | 15 | 81 |
| 2 | 3 | Female | 20 | 16 | 6 |
| 3 | 4 | Female | 23 | 16 | 77 |
| 4 | 5 | Female | 31 | 17 | 40 |

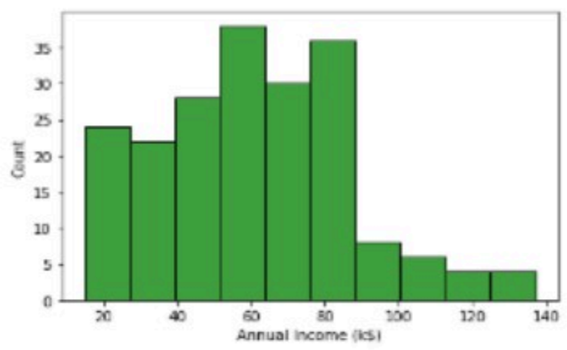
**Question-3:**

Perform Below Visualizations.

- Univariate  Analysis

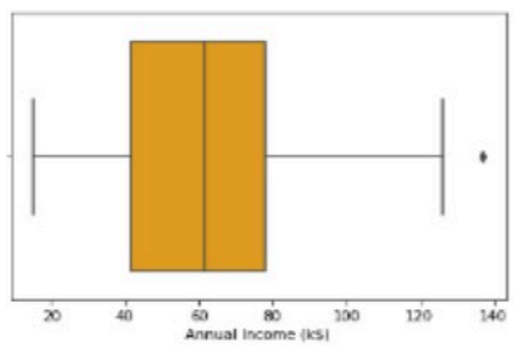
### Histplot

```
sns.histplot(data['Annual Income (k$)'], color="green")
```



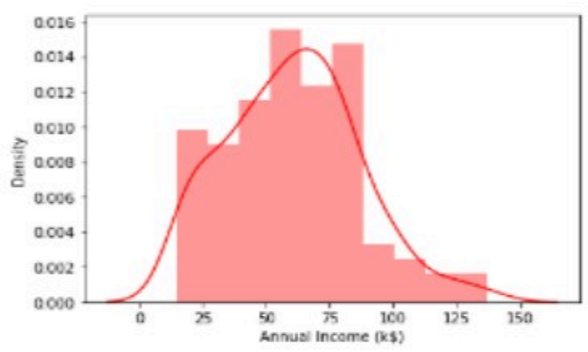

### Box Plot

```
sns.boxplot(data['Annual Income (k$)'], color="orange")
```




### Dist Plot

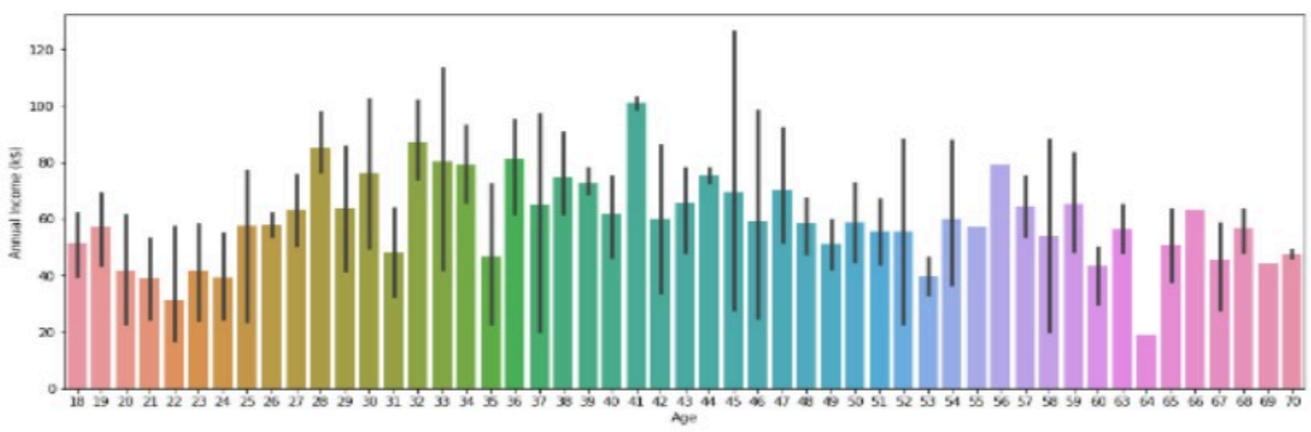
```
sns.distplot(data['Annual Income (k$)'], color="red")
```




## ● Bi – Variate Analysis

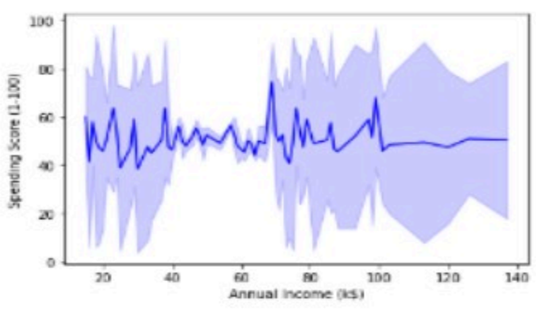
### Barplot

```
plt.figure(figsize=(16,6))
sns.barplot(data['Age'],data['Annual Income (k$)'])
```



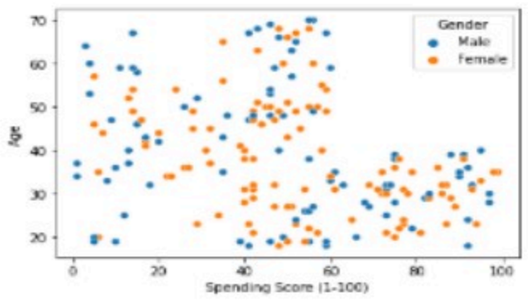

### Lineplot

```
sns.lineplot(data['Annual Income (k$)'], data['Spending Score (1-100)'], color="blue")
```



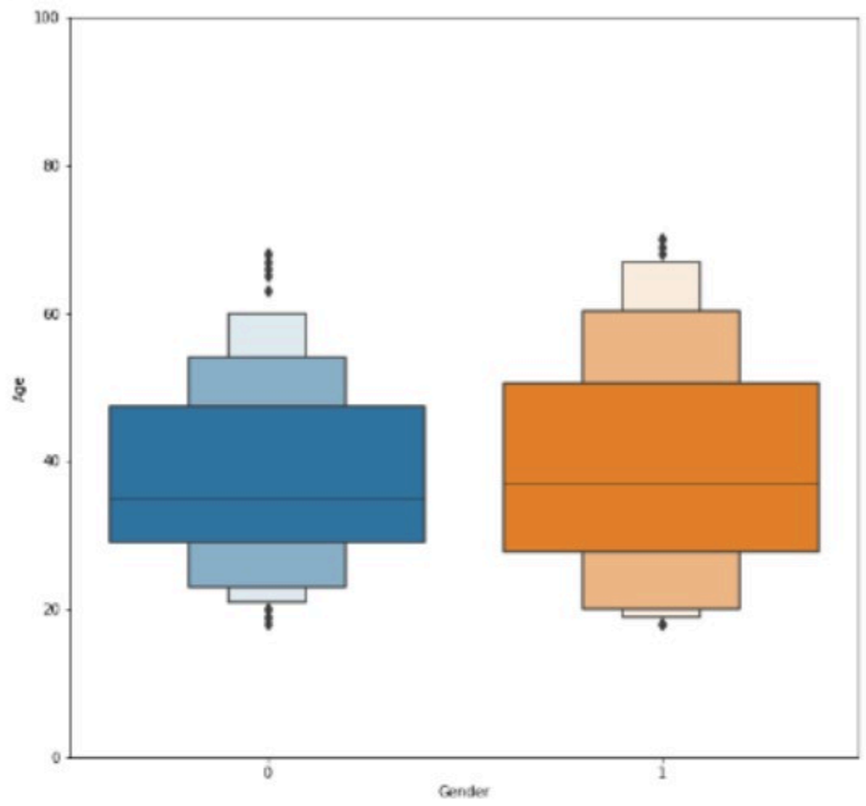

### Scatter plot (Age vs Spending Score)

```
sns.scatterplot(data['Spending Score (1-100)'], data['Age'], hue = data['Gender'])
```



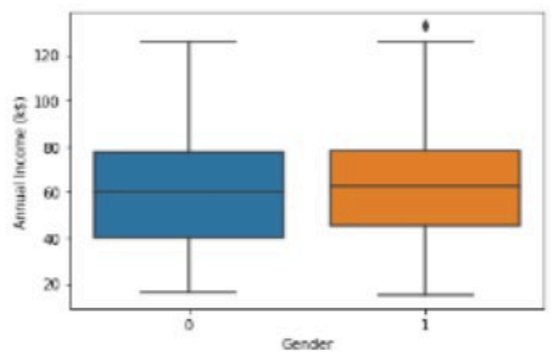
### Gender vs Age Distribution

```
temp = pd.concat([data['Age'], data['Gender']], axis=1)
f, ax = plt.subplots(figsize=(10,10))
fig = sns.boxenplot(x='Gender', y="Age", data=data)
fig.axis(ymin=0, ymax=100);
```



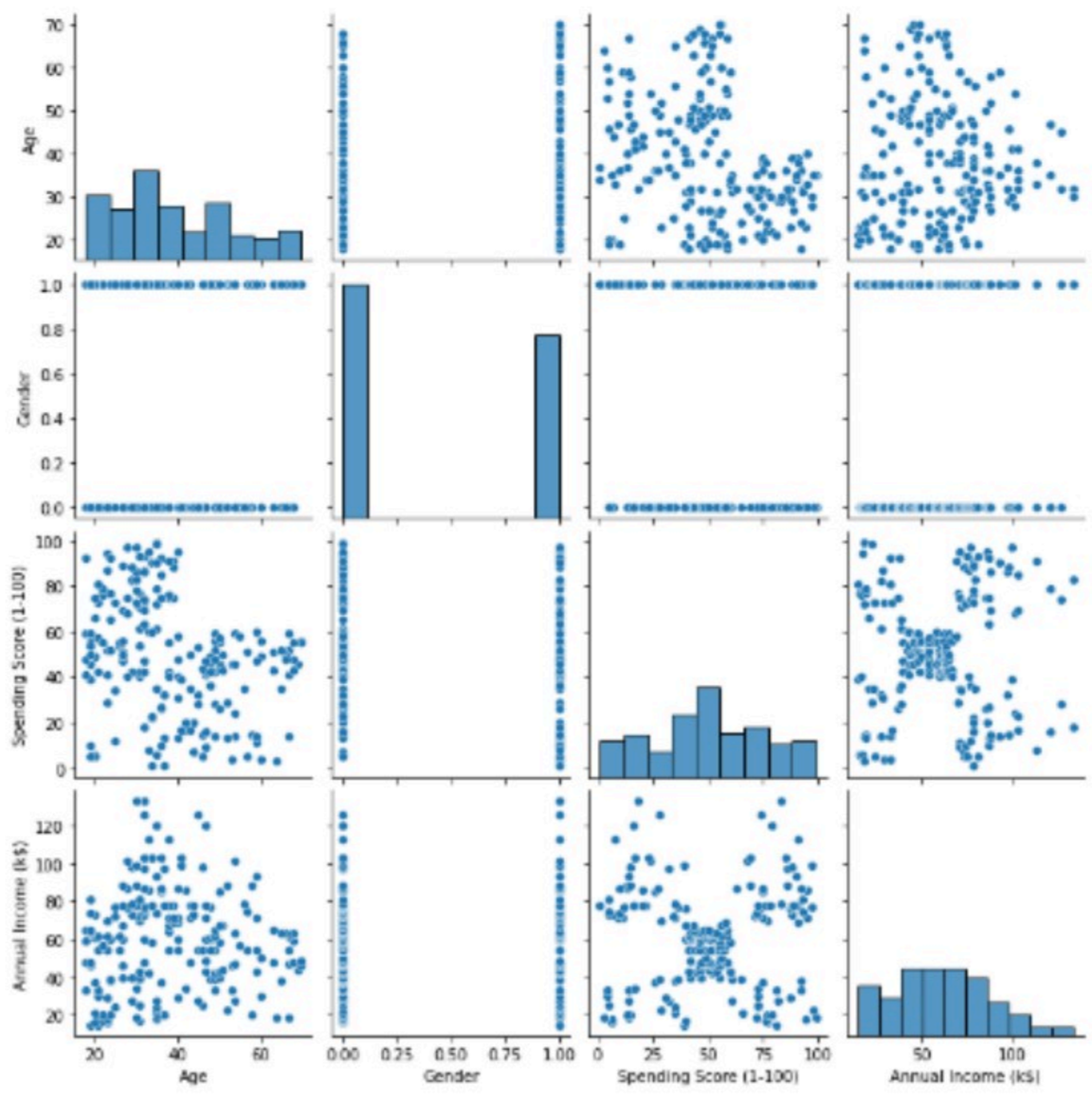

### Annual Income vs Gender Countplot

```
sns.boxplot(x=data['Gender'],y=data['Annual Income (k$)'])
```

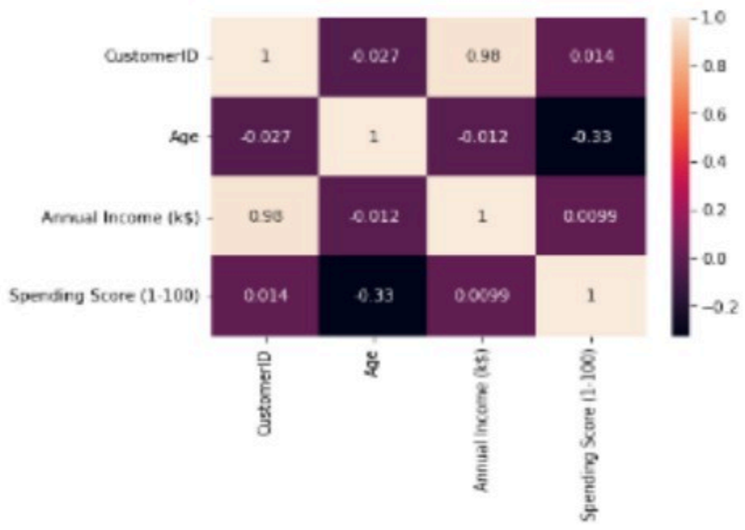



- Multi-Variate Analysis

```
sns.pairplot(data=data[["Age", "Gender","Spending Score (1-100)","Annual Income (k$)"]])
```



```
sns.heatmap(data.corr(),annot=True)
```




## Question-4:

## Perform descriptive statistics on the dataset.

## Solution:

```
data.describe()
```

| | CustomerID | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| **count** | 200.000000 | 200.000000 | 200.000000 | 200.000000 |
| **mean** | 100.500000 | 38.850000 | 60.560000 | 50.200000 |
| **std** | 57.879185 | 13.969007 | 26.264721 | 25.823522 |
| **min** | 1.000000 | 18.000000 | 15.000000 | 1.000000 |
| **25%** | 50.750000 | 28.750000 | 41.500000 | 34.750000 |
| **50%** | 100.500000 | 36.000000 | 61.500000 | 50.000000 |
| **75%** | 150.250000 | 49.000000 | 78.000000 | 73.000000 |
| **max** | 200.000000 | 70.000000 | 137.000000 | 99.000000 |

```
data.info
```

```
data.shape
```

```
(200, 5)
```

## Question-5:

## Check for Missing values and deal with them.

## Solution:

```
data.isnull().any() #Inference: The dataset has no null values
```

```
CustomerID              False
Gender                  False
Age                     False
Annual Income (k$)      False
Spending Score (1-100)  False
dtype: bool
```

```
data.drop('CustomerID',axis=1,inplace=True)
data.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| 0 | Male | 19 | 15 | 39 |
| 1 | Male | 21 | 15 | 81 |
| 2 | Female | 20 | 16 | 6 |
| 3 | Female | 23 | 16 | 77 |
| 4 | Female | 31 | 17 | 40 |

## Question-6:

## Find the outliers and replace the outliers.

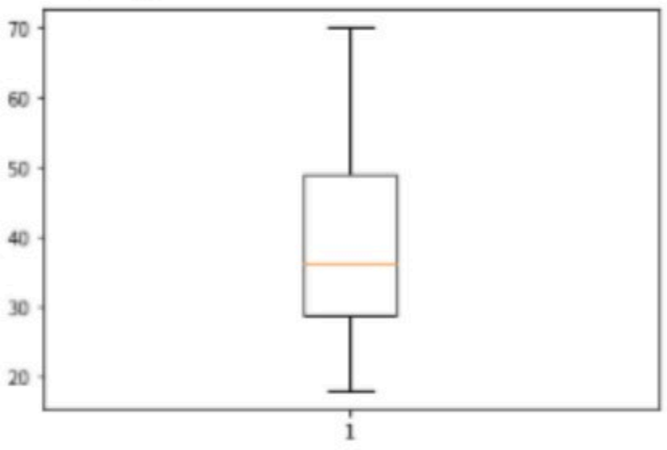
## Solution:

```
for i in data:
    if data[i].dtype=='int64':
        q1=data[i].quantile(0.25)
        q3=data[i].quantile(0.75)
        iqr=q3-q1
        upper=q3+1.5*iqr
        lower=q1-1.5*iqr
        data[i]=np.where(data[i] >upper, upper, data[i])
        data[i]=np.where(data[i] <lower, lower, data[i])
```

## After removing outliers, boxplot will be like

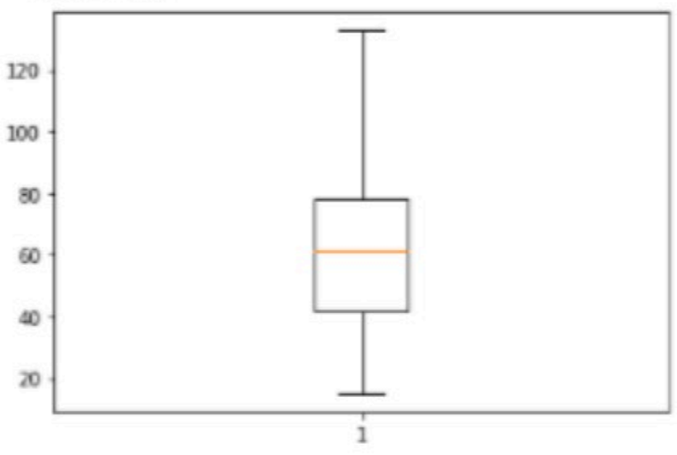
```
plt.boxplot(data['Age'])
```

```
{'whiskers': [,
  ],
 'caps': [,
  ],
 'boxes': [],
 'medians': [],
 'fliers': [],
 'means': []}
```



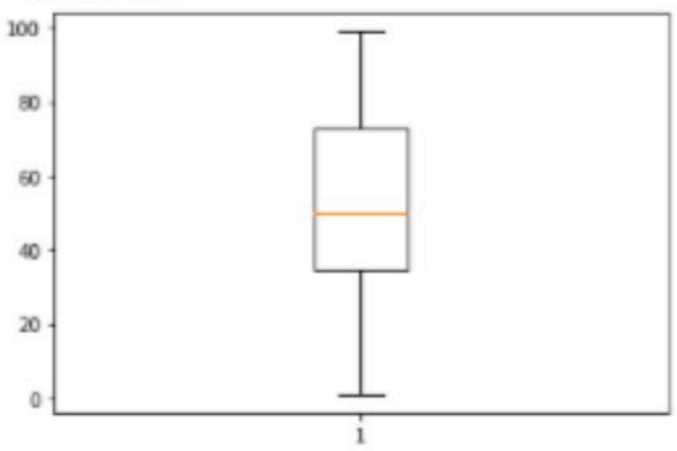

```
plt.boxplot(data['Annual Income (k$)'])
```

```
{'whiskers': [,
  ],
 'caps': [,
  ],
 'boxes': [],
 'medians': [],
 'fliers': [],
 'means': []}
```




```
plt.boxplot(data['Spending Score (1-100)'])
```

```
{'whiskers': [,
  ],
 'caps': [,
  ],
 'boxes': [],
 'medians': [],
 'fliers': [],
 'means': []}
```



## Question-7:

## Check for Categorical columns and perform encoding.

## Solution:

```
from sklearn.preprocessing import LabelEncoder
l_en = LabelEncoder()
```

```
data['Gender'] = l_en.fit_transform(data['Gender'])
data.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| 0 | 1 | 19.0 | 15.0 | 39.0 |
| 1 | 1 | 21.0 | 15.0 | 81.0 |
| 2 | 0 | 20.0 | 16.0 | 6.0 |
| 3 | 0 | 23.0 | 16.0 | 77.0 |
| 4 | 0 | 31.0 | 17.0 | 40.0 |

## Question-8:

## Scaling the data.

## Solution:

```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
data_scaled = scaler.fit_transform(data)
data_scaled[0:5]
```

```
array([[1.        , 0.01923077, 0.        , 0.3877551 ],
       [1.        , 0.05769231, 0.        , 0.81632653],
       [0.        , 0.03846154, 0.00849257, 0.05102041],
       [0.        , 0.09615385, 0.00849257, 0.7755102 ],
       [0.        , 0.25      , 0.01698514, 0.39795918]])
```

## Question-9:

## Perform any of the clustering algorithms

## Solution:

```
from sklearn.cluster import KMeans
km = KMeans()
res = km.fit_predict(data_scaled)
res
```

```
array([2, 2, 1, 1, 1, 1, 5, 1, 0, 1, 0, 1, 5, 1, 4, 2, 1, 2, 0, 1, 2, 2,
       5, 2, 5, 2, 5, 2, 5, 1, 0, 1, 0, 2, 5, 1, 5, 1, 5, 1, 5, 2, 0, 1,
       5, 1, 5, 1, 1, 1, 5, 2, 1, 0, 5, 0, 5, 0, 1, 0, 0, 2, 5, 5, 0, 2,
       5, 5, 2, 1, 0, 5, 5, 5, 0, 2, 5, 2, 1, 5, 0, 2, 0, 5, 1, 0, 5, 1,
       1, 5, 5, 2, 0, 5, 1, 2, 5, 1, 0, 2, 1, 5, 0, 2, 0, 1, 5, 0, 0, 0,
       0, 1, 5, 2, 1, 1, 5, 5, 5, 5, 2, 5, 6, 7, 1, 6, 4, 7, 0, 7, 4, 7,
       1, 6, 4, 6, 3, 7, 4, 6, 3, 7, 1, 6, 4, 7, 4, 6, 3, 7, 4, 7, 3, 6,
       3, 6, 4, 6, 4, 6, 5, 6, 4, 6, 4, 6, 4, 6, 3, 7, 4, 7, 4, 7, 3, 6,
       4, 7, 4, 7, 3, 6, 4, 6, 3, 7, 3, 7, 3, 6, 3, 6, 4, 6, 3, 6, 3, 7,
       4, 7], dtype=int32)
```

```
data1 = pd.DataFrame(data_scaled, columns = data.columns)
data1.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| 0 | 1.0 | 0.019231 | 0.000000 | 0.387755 |
| 1 | 1.0 | 0.057692 | 0.000000 | 0.816327 |
| 2 | 0.0 | 0.038462 | 0.008493 | 0.051020 |
| 3 | 0.0 | 0.096154 | 0.008493 | 0.775510 |
| 4 | 0.0 | 0.250000 | 0.016985 | 0.397959 |

```
data1['kclus']  = pd.Series(res)
data1.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) | kclus |
|---|---|---|---|---|---|
| 0 | 1.0 | 0.019231 | 0.000000 | 0.387755 | 2 |
| 1 | 1.0 | 0.057692 | 0.000000 | 0.816327 | 2 |
| 2 | 0.0 | 0.038462 | 0.008493 | 0.051020 | 1 |
| 3 | 0.0 | 0.096154 | 0.008493 | 0.775510 | 1 |
| 4 | 0.0 | 0.250000 | 0.016985 | 0.397959 | 1 |

```
data1['kclus'].unique()
```

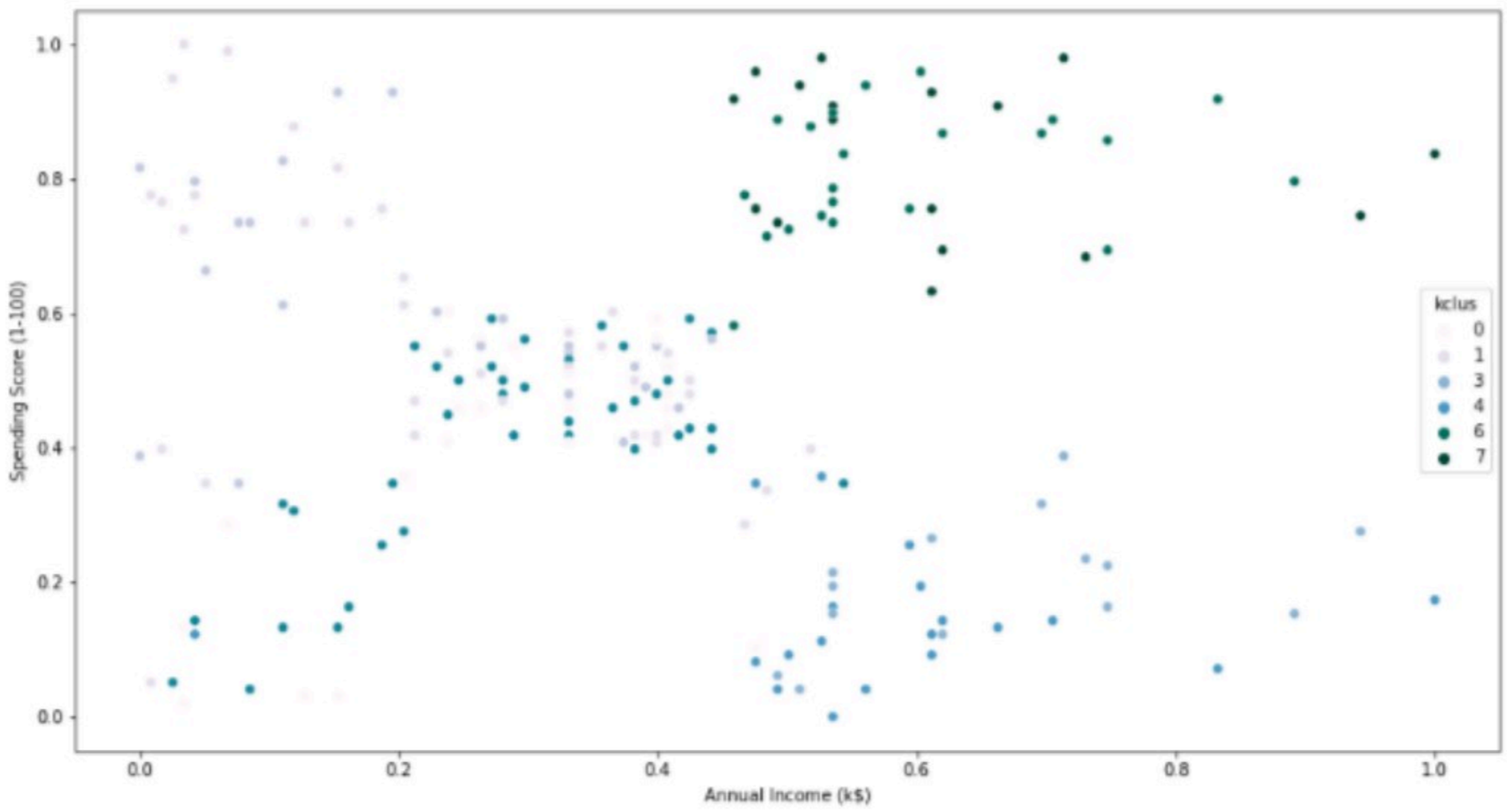
```
array([2, 1, 5, 0, 4, 6, 7, 3], dtype=int32)
```

```
data1['kclus'].value_counts()
```

```
5    39
1    37
0    26
2    24
6    22
4    20
7    18
3    14
Name: kclus, dtype: int64
```

```
import matplotlib.pyplot as plt

fig,ax = plt.subplots(figsize=(15,8))
sns.scatterplot(x=data1['Annual Income (k$)'],
                y=data1['Spending Score (1-100)'],
                hue=data1['kclus'],
                palette='PuBuGn')
plt.show()
```




```
ind = data1.iloc[:,0:4]
ind.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| 0 | 1.0 | 0.019231 | 0.000000 | 0.387755 |
| 1 | 1.0 | 0.057692 | 0.000000 | 0.816327 |
| 2 | 0.0 | 0.038462 | 0.008493 | 0.051020 |
| 3 | 0.0 | 0.096154 | 0.008493 | 0.775510 |
| 4 | 0.0 | 0.250000 | 0.016985 | 0.397959 |

```
dep = data1.iloc[:,4:]
dep.head()
```

| | kclus |
|---|---|
| 0 | 2 |
| 1 | 2 |
| 2 | 1 |
| 3 | 1 |
| 4 | 1 |

## Question-10:

### Split the data into training and testing

### Solution:

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(ind,dep,test_size=0.3,random_state=1)
x_train.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| **116** | 0.0 | 0.865385 | 0.424628 | 0.428571 |
| **67** | 0.0 | 0.961538 | 0.280255 | 0.479592 |
| **78** | 0.0 | 0.096154 | 0.331210 | 0.520408 |
| **42** | 1.0 | 0.576923 | 0.203822 | 0.357143 |
| **17** | 1.0 | 0.038462 | 0.050955 | 0.663265 |

```
x_test.head()
```

| | Gender | Age | Annual Income (k$) | Spending Score (1-100) |
|---|---|---|---|---|
| **58** | 0.0 | 0.173077 | 0.263270 | 0.510204 |
| **40** | 0.0 | 0.903846 | 0.195329 | 0.346939 |
| **34** | 0.0 | 0.596154 | 0.152866 | 0.132653 |
| **102** | 1.0 | 0.942308 | 0.399151 | 0.591837 |
| **184** | 0.0 | 0.442308 | 0.713376 | 0.387755 |

```
y_train.head()
```

| | kclus |
|---|---|
| **116** | 5 |
| **67** | 5 |
| **78** | 1 |
| **42** | 0 |
| **17** | 2 |

```
y_test.head()
```

| | kclus |
|---|---|
| **58** | 1 |
| **40** | 5 |
| **34** | 5 |
| **102** | 0 |
| **184** | 3 |

```
from sklearn.linear_model import LinearRegression
lr = LinearRegression()
lr.fit(x_train,y_train)
```

```
LinearRegression()
```

```
pred_test = lr.predict(x_test)
pred_test[0:5]
```

```
array([[3.02305666],
       [2.86200206],
       [1.8181892 ],
       [3.65694382],
       [5.20753531]])
```

## Question-11:

### Measure the performance using Metrics.

```
from sklearn.metrics import mean_squared_error,mean_absolute_error
from sklearn.metrics import accuracy_score
mse = mean_squared_error(pred_test,y_test)
print("The Mean squared error is: ", mse)
rmse = np.sqrt(mse)
print("The Root mean squared error is: ", rmse)
mae = mean_absolute_error(pred_test,y_test)
print("The Mean absolute error is: ", mae)
acc = lr.score(x_test,y_test)
print("The accuracy is: ", acc)
```

```
The Mean squared error is:  4.129095307017881
The Root mean squared error is:  2.0320175459424266
The Mean absolute error is:  1.773889224271428
The accuracy is:  0.23922702772586257
```