```
In [1]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.stats import binom as b

#To wrap title in graph
from textwrap import wrap
```

Importing Dataset

In [2]: df = pd.read_csv('aerofit_treadmill.txt')
 df

	u i									
Out[2]:		Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles
	0	KP281	18	Male	14	Single	3	4	29562	112
	1	KP281	19	Male	15	Single	2	3	31836	75
	2	KP281	19	Female	14	Partnered	4	3	30699	66
	3	KP281	19	Male	12	Single	3	3	32973	85
	4	KP281	20	Male	13	Partnered	4	2	35247	47
	•••									
	175	KP781	40	Male	21	Single	6	5	83416	200
	176	KP781	42	Male	18	Single	5	4	89641	200
	177	KP781	45	Male	16	Single	5	5	90886	160
	178	KP781	47	Male	18	Partnered	4	5	104581	120
	179	KP781	48	Male	18	Partnered	4	5	95508	180

Problem Statement & Anaysis

Problem Statements

We have to check how gender, income education is affecting the choice of customer to purchase a particular Treadmills. We have to find the relationship between them.

We want to recommend the Treadmills to the new customer according to the ustomer characteristics.

By calculating the above relationship we want to increase our Sales for Treadmills

2. Analysis of DataSets

1. Checking for shape

In [3]: df.shape

Out[3]: (180, 9)

2. Checing information & datatype for data set

In [4]: df.info()

```
<class 'pandas.core.frame.DataFrame'>
        RangeIndex: 180 entries, 0 to 179
        Data columns (total 9 columns):
             Column
                            Non-Null Count Dtype
             Product
                            180 non-null
                                            object
         1
             Age
                            180 non-null
                                            int64
             Gender
                            180 non-null
         2
                                            object
             Education
                            180 non-null
                                            int64
             MaritalStatus 180 non-null
                                            object
             Usage
                            180 non-null
                                            int64
             Fitness
                            180 non-null
                                            int64
             Income
                            180 non-null
                                            int64
         8
             Miles
                            180 non-null
                                            int64
        dtypes: int64(6), object(3)
        memory usage: 12.8+ KB
In [5]: #Checking of data types of columns
        df.dtypes
Out[5]: Product
                         object
                          int64
        Age
        Gender
                         object
                          int64
        Education
        MaritalStatus
                         object
        Usage
                          int64
        Fitness
                          int64
        Income
                          int64
        Miles
                          int64
        dtype: object
```

3. Conversion of DataTypes to Category

```
In [6]: #Converting Product from object to Category
df['Product'] = df['Product'].astype('category')

#Converting Gender from object to Category
df['Gender'] = df['Gender'].astype('category')

#Converting MaritalStatus from object to Category
```

```
df['MaritalStatus'] = df['MaritalStatus'].astype('category')
        #Converting Fitness from int to Categorical value
        df['Fitness'] = df['Fitness'].astype('category')
In [7]: df.dtypes
Out[7]: Product
                         category
        Age
                            int64
        Gender
                         category
        Education
                            int64
        MaritalStatus
                         category
                            int64
        Usage
        Fitness
                         category
        Income
                            int64
        Miles
                            int64
        dtype: object
        4. Checking for Null Values
In [8]: df.isna().sum()
Out[8]: Product
                         0
        Age
                         0
        Gender
                         0
        Education
        MaritalStatus
                         0
        Usage
                         0
        Fitness
                         0
        Income
                         0
        Miles
                         0
        dtype: int64
        5. Statistical summary
In [9]: df.describe(include = 'all')
```

Out[9]:		Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles
	count	180	180.000000	180	180.000000	180	180.000000	180.0	180.000000	180.000000
	unique	3	NaN	2	NaN	2	NaN	5.0	NaN	NaN
	top	KP281	NaN	Male	NaN	Partnered	NaN	3.0	NaN	NaN
	freq	80	NaN	104	NaN	107	NaN	97.0	NaN	NaN
	mean	NaN	28.788889	NaN	15.572222	NaN	3.455556	NaN	53719.577778	103.194444
	std	NaN	6.943498	NaN	1.617055	NaN	1.084797	NaN	16506.684226	51.863605
	min	NaN	18.000000	NaN	12.000000	NaN	2.000000	NaN	29562.000000	21.000000
	25%	NaN	24.000000	NaN	14.000000	NaN	3.000000	NaN	44058.750000	66.000000
	50%	NaN	26.000000	NaN	16.000000	NaN	3.000000	NaN	50596.500000	94.000000
	75%	NaN	33.000000	NaN	16.000000	NaN	4.000000	NaN	58668.000000	114.750000
	max	NaN	50.000000	NaN	21.000000	NaN	7.000000	NaN	104581.000000	360.000000

Non-Graphical Analysis

1. Value Counts

1. Value counts for different Products

2. Value counts for different Gender

```
In [11]: df['Gender'].value counts()
Out[11]: Male
                   104
         Female
                    76
         Name: Gender, dtype: int64
         3. Value counts for MaritalStatus
In [12]: df['MaritalStatus'].value counts()
Out[12]: Partnered
                      107
         Single
                       73
         Name: MaritalStatus, dtype: int64
         4. Value counts for MaritalStatus
In [13]: df['Fitness'].value_counts()
Out[13]: 3
              97
              31
              26
              24
               2
         Name: Fitness, dtype: int64
             2. Unique Values
         1. Unique Values for Ages
In [14]: df['Age'].unique()
Out[14]: array([18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34,
                35, 36, 37, 38, 39, 40, 41, 43, 44, 46, 47, 50, 45, 48, 42],
               dtype=int64)
```

2. Unique values for Education

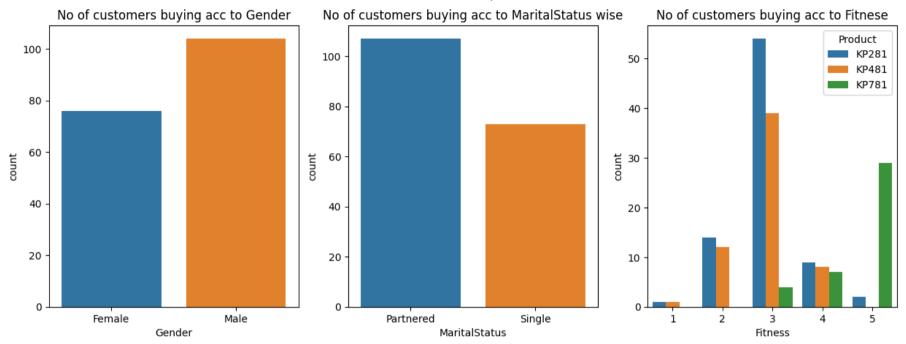
```
In [15]: df['Education'].unique()
Out[15]: array([14, 15, 12, 13, 16, 18, 20, 21], dtype=int64)
         3. Unique Values for Usage
In [16]: df['Usage'].unique()
Out[16]: array([3, 2, 4, 5, 6, 7], dtype=int64)
        4. Unique Values for Miles
In [17]: df['Miles'].unique()
Out[17]: array([112, 75, 66, 85, 47, 141, 103, 94, 113, 38, 188, 56, 132,
               169, 64, 53, 106, 95, 212, 42, 127, 74, 170, 21, 120, 200,
               140, 100, 80, 160, 180, 240, 150, 300, 280, 260, 360], dtype=int64)
         5. Unique Values of Income
In [18]: df['Income'].unique()
Out[18]: array([ 29562, 31836, 30699, 32973, 35247, 37521, 36384, 38658,
                40932, 34110, 39795, 42069, 44343, 45480, 46617, 48891,
                53439, 43206,
                               52302, 51165, 50028,
                                                      54576, 68220, 55713,
                60261, 67083,
                               56850, 59124, 61398, 57987, 64809, 47754,
                               48658, 54781, 48556,
                65220, 62535,
                                                      58516, 53536, 61006,
                57271, 52291,
                               49801, 62251, 64741, 70966, 75946, 74701,
                               88396, 90886, 92131, 77191, 52290, 85906,
                69721, 83416,
               103336, 99601, 89641, 95866, 104581, 95508], dtype=int64)
```

Visual Analysis

1. Univariate Analysis

Count plot

NO OF PRODUCT PURCHASE ACCORDING TO GENDER, FITNESS & MARITAL STATUS DISTRIBUTION



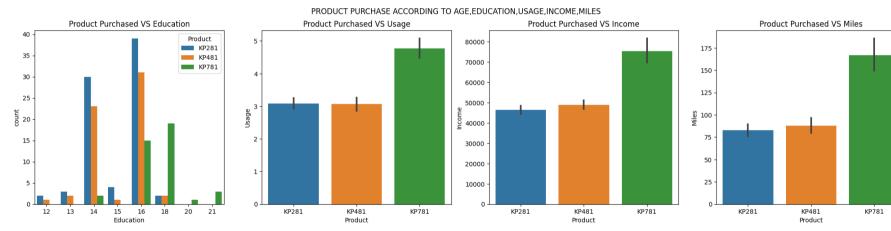
2. Bivariate Analysis

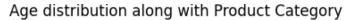
```
plt.subplot(1,4,3)
sns.barplot(data=df,x='Product',y = 'Income')

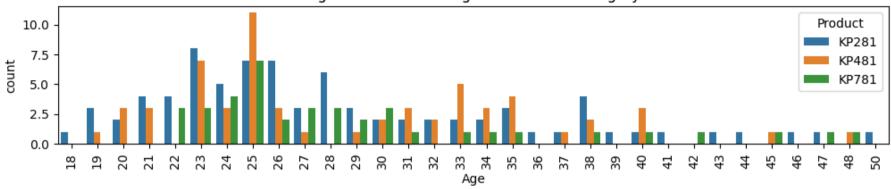
plt.subplot(1,4,4)
sns.barplot(data=df,x='Product',y = 'Miles')

plt.show()

plt.figure(figsize=(12,2))
sns.countplot(data=df,hue='Product',x='Age')
plt.xticks(rotation=90)
plt.title('Age distribution along with Product Category')
plt.show()
```

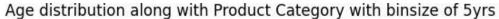


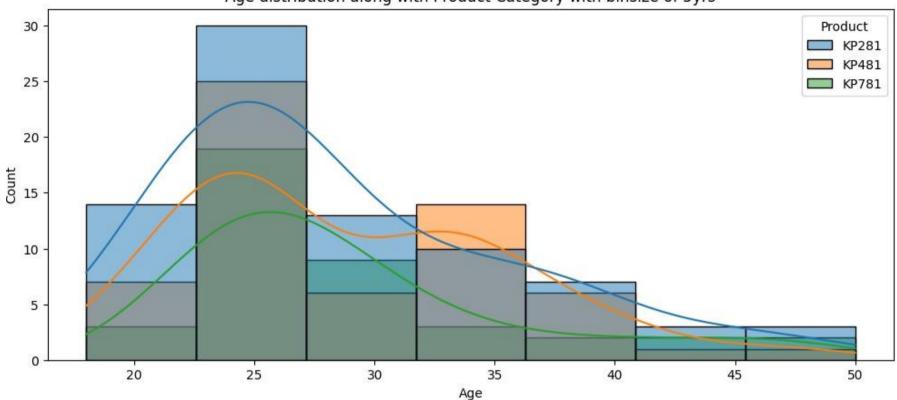




Histogram

```
In [21]: plt.figure(figsize=(12,5))
    sns.histplot(data=df,x='Age',bins=7,kde=True,hue='Product')
    plt.title('Age distribution along with Product Category with binsize of 5yrs')
    plt.show()
```





Box PLots

```
In [22]: plt.figure(figsize=(15,3))
   plt.subplot(1,5,1)
   sns.boxplot(data=df,x='Age')
   plt.title('Box plot for AGE')

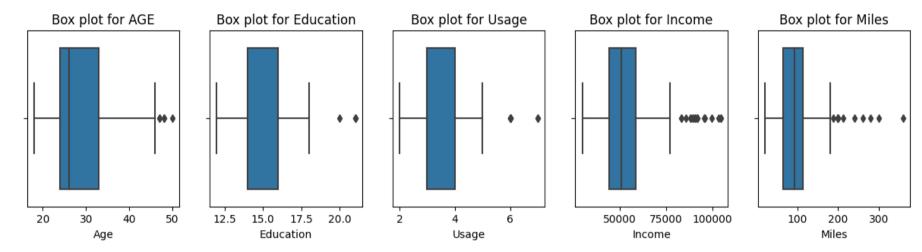
plt.subplot(1,5,2)
   sns.boxplot(data=df,x='Education')
   plt.title('Box plot for Education')

plt.subplot(1,5,3)
   sns.boxplot(data=df,x='Usage')
   plt.title('Box plot for Usage')
```

```
plt.subplot(1,5,4)
sns.boxplot(data=df,x='Income')
plt.title('Box plot for Income')

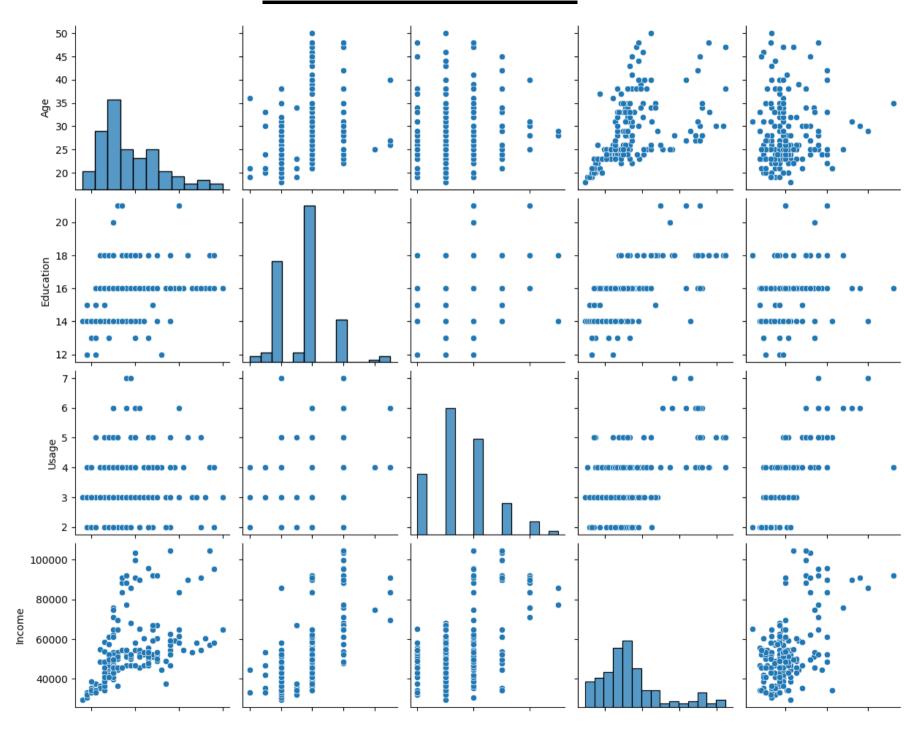
plt.subplot(1,5,5)
sns.boxplot(data=df,x='Miles')
plt.title('Box plot for Miles')
```

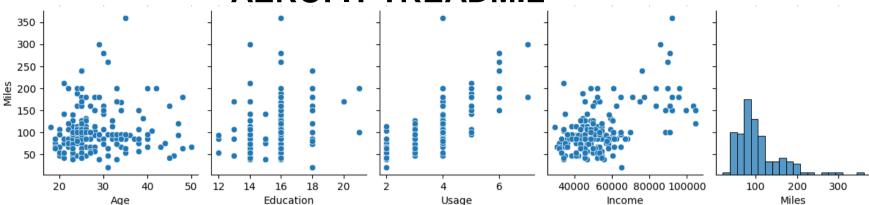
Out[22]: Text(0.5, 1.0, 'Box plot for Miles')



Correlation Detection

```
In [23]: sns.pairplot(data=df)
  plt.show()
```

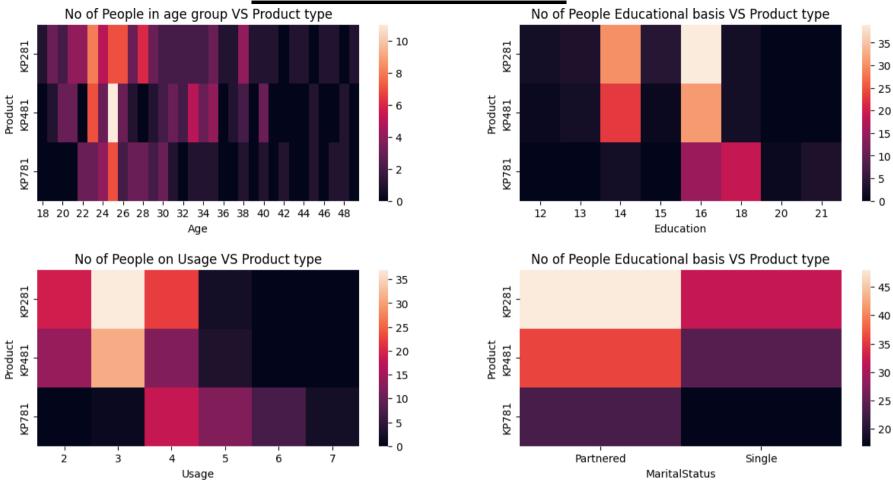


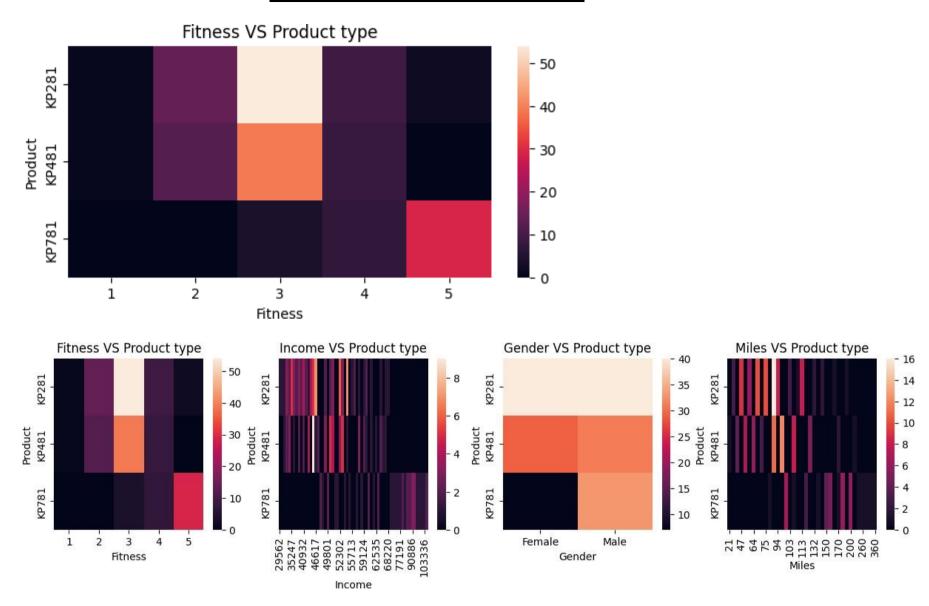


Heat Map

```
In [24]: plt.figure(figsize=(15,3))
         plt.subplot(1,2,1)
         a = df.groupby('Product').Age.value counts().unstack().fillna(0)
         sns.heatmap(a)
         plt.title('No of People in age group VS Product type')
         plt.subplot(1,2,2)
         b = df.groupby('Product')[['Education']].value_counts().unstack().fillna(0)
         sns.heatmap(b)
         plt.title('No of People Educational basis VS Product type')
         plt.show()
         plt.figure(figsize=(15,3))
         plt.subplot(1,2,1)
         a = df.groupby('Product').Usage.value_counts().unstack().fillna(0)
         sns.heatmap(a)
         plt.title('No of People on Usage VS Product type')
         plt.subplot(1,2,2)
         b = df.groupby('Product')[['MaritalStatus']].value_counts().unstack().fillna(0)
         sns.heatmap(b)
         plt.title('No of People Educational basis VS Product type')
         plt.show()
         plt.figure(figsize=(15,3))
```

```
plt.subplot(1,2,1)
a1 = pd.crosstab(df.Product,columns=[df.Fitness])
sns.heatmap(a1)
plt.title('Fitness VS Product type')
plt.figure(figsize=(15,3))
plt.subplot(1,4,1)
a1 = pd.crosstab(df.Product,columns=[df.Fitness])
sns.heatmap(a1)
plt.title('Fitness VS Product type')
plt.subplot(1,4,2)
a1 = pd.crosstab(df.Product,columns=[df.Income])
sns.heatmap(a1)
plt.title('Income VS Product type')
plt.subplot(1,4,3)
a1 = pd.crosstab(df.Product,columns=[df.Gender])
sns.heatmap(a1)
plt.title('Gender VS Product type')
plt.subplot(1,4,4)
a1 = pd.crosstab(df.Product,columns=[df.Miles])
sns.heatmap(a1)
plt.title('Miles VS Product type')
plt.show()
```

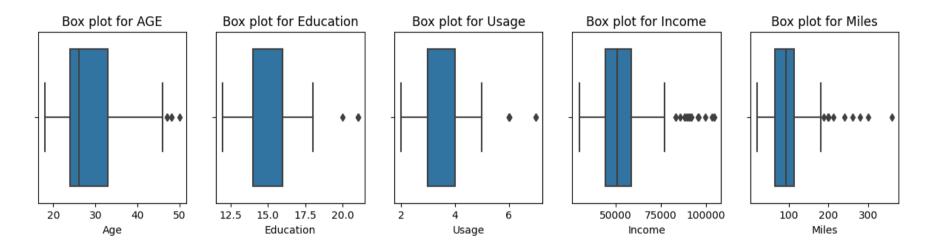




Outliers Detections: The values with black dot in box plots are the outliers . We have to remove this outliers

Missing Values & Outliers Detection

Outliers Detection



Outliers: This are the Black dots in BOX plot shown above

```
In [25]: #Use 25% & 75% to calculate IQR= 75% - 25%
# outliers > 75% + 1.5 * IQR
df.describe()
```

```
Education
                                           Usage
                                                        Income
                                                                     Miles
                       Age
Out[25]: -
          count 180.000000 180.000000 180.000000
                                                     180.000000 180.000000
                             15.572222
                                         3.455556
                                                   53719.577778 103.194444
          mean
                  28.788889
                   6.943498
                              1.617055
                                         1.084797
                                                   16506.684226
                                                                 51.863605
            std
                  18.000000
                             12.000000
                                         2.000000
                                                   29562.000000
                                                                 21.000000
            min
            25%
                  24.000000
                             14.000000
                                         3.000000
                                                   44058.750000
                                                                 66.000000
            50%
                  26.000000
                             16.000000
                                         3.000000
                                                   50596.500000
                                                                 94.000000
            75%
                  33.000000
                             16.000000
                                         4.000000
                                                   58668.000000 114.750000
                  50.000000
                             21.000000
                                         7.000000 104581.000000 360.000000
            max
In [26]: # Outliers for Age
          df.loc[df['Age']>47,'Age']
Out[26]: 79
                  50
          139
                  48
          179
                  48
          Name: Age, dtype: int64
In [27]: # Outliers for Education
          df.loc[df['Education']>19,'Education']
Out[27]: 156
                  20
          157
                  21
          161
                  21
          175
                  21
          Name: Education, dtype: int64
In [28]: # Outliers for Usage
```

df.loc[df['Usage']>5.5,'Usage']

```
Out[28]: 154
         155
                6
         162
                6
         163
                7
                6
         164
         166
                7
         167
                6
         170
                6
         175
                6
         Name: Usage, dtype: int64
In [29]: # Outliers for Miles
         df.loc[df['Miles']>187.875,'Miles']
Out[29]: 23
                188
         84
                212
         142
                200
         148
                200
         152
                200
         155
                240
         166
                300
         167
                280
         170
                260
         171
                200
         173
                360
         175
                200
         176
                200
         Name: Miles, dtype: int64
         Missing Values Detection
In [30]: df.isna().sum()
```

```
Out[30]: Product 0
Age 0
Gender 0
Education 0
MaritalStatus 0
Usage 0
Fitness 0
Income 0
Miles 0
dtype: int64
```

Probability Calculations

Category wise Product Probability

```
In [31]: S = df.shape[0]
a1 = df.loc[df['Product']=='KP281','Product'].shape[0]
print('Probability of TreadMill to be KP281 is {}'.format(round(a1/S,4)))

a2 = df.loc[df['Product']=='KP481','Product'].shape[0]
print('Probability of TreadMill to be KP481 is {}'.format(round(a2/S,4)))

a3 = df.loc[df['Product']=='KP781','Product'].shape[0]
print('Probability of TreadMill to be KP781 is {}'.format(round(a3/S,4)))

Probability of TreadMill to be KP281 is 0.4444
Probability of TreadMill to be KP481 is 0.3333
Probability of TreadMill to be KP781 is 0.2222

1.Gender Vs Product

In [32]: pd.crosstab(df.Product,df.Gender,margins=True)
```

Out[32]:	Gender	Female	Male	All
	Product			
	KP281	40	40	80
	KP481	29	31	60
	KP781	7	33	40
	All	76	104	180

```
In [33]: print()
        print('__'*40)
       print("Buying of **KP281** on Basis of Gender Calculation")
        #Probability that a person buy KP281 irrespective of gender
        print('Probability that a person buy KP281 irrespective of gender is {}'.format(round(80/180,2)))
        #Probability that a person buy KP281 given Male
        print('Probability that a person buy KP281 given Male is {}'.format(round(40/80,2)))
        #Probability that a person buy KP281 given Female
        print('Probability that a person buy KP281 given Female is {}'.format(round(40/80,2)))
        print()
       print('__'*40)
       print("Buying of **KP481** on Basis of Gender Calculation")
        #Probability that a person buy KP481 irrespective of gender
        print('Probability that a person buy KP481 irrespective of gender is {}'.format(round(60/180,2)))
        #Probability that a person buy KP481 given Male
        print('Probability that a person buy KP481 given Male is {}'.format(round(31/60,2)))
        #Probability that a person buy KP481 given Female
       print('Probability that a person buy KP481 given Female is {}'.format(round(29/60,2)))
```

```
print()
print(' '*40)
print("Buying of **KP781** on Basis of Gender Calculation")
#Probability that a person buy KP781 irrespective of gender
print('Probability that a person buy KP781 irrespective of gender is {}'.format(round(40/180,2)))
#Probability that a person buy KP781 given Male
print('Probability that a person buy KP781 given Male is {}'.format(round(33/40,2)))
#Probability that a person buy KP781 given Female
print('Probability that a person buy KP781 given Female is {}'.format(round(7/40,2)))
print()
print('__'*40)
Buying of **KP281** on Basis of Gender Calculation
Probability that a person buy KP281 irrespective of gender is 0.44
Probability that a person buy KP281 given Male is 0.5
Probability that a person buy KP281 given Female is 0.5
Buying of **KP481** on Basis of Gender Calculation
Probability that a person buy KP481 irrespective of gender is 0.33
Probability that a person buy KP481 given Male is 0.52
Probability that a person buy KP481 given Female is 0.48
Buying of **KP781** on Basis of Gender Calculation
Probability that a person buy KP781 irrespective of gender is 0.22
Probability that a person buy KP781 given Male is 0.82
Probability that a person buy KP781 given Female is 0.17
```

2. Marital Status Vs Product

```
In [34]: pd.crosstab(df.Product,df.MaritalStatus,margins=True)
Out[34]: MaritalStatus Partnered Single All
            Product
             KP281
                             32 80
             KP481
                             24 60
                        36
             KP781
                        23
                             17 40
               ΑII
                       107
                             73 180
In [35]: print()
        print('__'*40)
        print("Buying of **KP281** on Basis of MaritalStatus")
        #Probability that a person buy KP281 irrespective of MaritalStatus
        print('Probability that a person buy KP281 irrespective of MaritalStatus is {}'.format(round(80/180,2)))
        #Probability that a person buy KP281 given Married/Parterned
        print('Probability that a person buy KP281 given Married/Parterned is {}'.format(round(48/80,2)))
        #Probability that a person buy KP281 given Unmarried/Single
        print('Probability that a person buy KP281 given Unmarried/Single is {}'.format(round(32/80,2)))
        print()
        print(' '*40)
        print("Buying of **KP481** on Basis of MaritalStatus")
        #Probability that a person buy KP481 irrespective of MaritalStatus
        print('Probability that a person buy KP481 irrespective of MaritalStatus is {}'.format(round(60/180,2)))
        #Probability that a person buy KP481 given Married/parterned
        print('Probability that a person buy KP481 given Married/parterned is {}'.format(round(36/60,2)))
```

```
#Probability that a person buy KP481 given Unmarried/Single
print('Probability that a person buy KP481 given Unmarried/Single is {}'.format(round(24/60,2)))
print()
print(' '*40)
print("Buying of **KP781** on Basis of MaritalStatus")
#Probability that a person buy KP781 irrespective of MaritalStatus
print('Probability that a person buy KP781 irrespective of MaritalStatus is {}'.format(round(40/180,2)))
#Probability that a person buy KP781 given Married/parterned
print('Probability that a person buy KP781 given Married/parterned is {}'.format(round(23/40,2)))
#Probability that a person buy KP781 given Unmarried/Single
print('Probability that a person buy KP781 given Unmarried/Single is {}'.format(round(17/40,2)))
print()
print(' '*40)
Buying of **KP281** on Basis of MaritalStatus
Probability that a person buy KP281 irrespective of MaritalStatus is 0.44
Probability that a person buy KP281 given Married/Parterned is 0.6
Probability that a person buy KP281 given Unmarried/Single is 0.4
Buying of **KP481** on Basis of MaritalStatus
Probability that a person buy KP481 irrespective of MaritalStatus is 0.33
Probability that a person buy KP481 given Married/parterned is 0.6
Probability that a person buy KP481 given Unmarried/Single is 0.4
Buying of **KP781** on Basis of MaritalStatus
Probability that a person buy KP781 irrespective of MaritalStatus is 0.22
Probability that a person buy KP781 given Married/parterned is 0.57
Probability that a person buy KP781 given Unmarried/Single is 0.42
```

Business Insights based on Non-Graphical and Visual Analysis

Insight baased on Visual Analysis

1: It can be seen from Graph that higly Educated people(> = 18yrs) tend to buy **KP781** more frequently compared to people with less year of Education buys **KP281** and also some people buy **KP481**

2: People with Higher Average Usage no of Hours(i.e. Hours >= 3) a week uses **KP781** and remaining people choses **KP281** or **KP481** as per their requirements

3 : People with Highest Income prefer(income >= 48000) **KP781** as they can afford the price

4: People with the higher average number of miles choses KP781 followed by KP481 and then least by KP281

5: from Heatmap we can say that People using **KP781** are lying in Age group of **22 to 30**, People using **KP481** are lying in Age group of **20 to 42**, People using **KP281** are lying in Age group of **19 to 38**

: Pec ole in the age range of 22-28 Uses Treadmill more compared to people of other Ages

6: From Count plot. The no of people having a Fitness score of 5(i.e. best shape) prefer KP781 more.

People with fitness Score lying between 2.5-4 prefer KP481 & people with score < 2.5 were using KP281

: KP 81 having an additional impact on the Fitness Score

7: Observation from Scatterplots & Pair plots:

: People with age > 25, People with Education in Years >= 18 were having Income higher as compared to other people 7.2 : People with age < 35, People with Education < 18, People with Income <60000 were walking More miles

Insight based on Non Graphical Analysis

8 : No of People buyings **KP281**(i.e. 44.4 %) is more followed by **KP481**(i.e. 33.33 %) & Then **KP781**(i.e. 22.22 %). The above figure in bracket indicate Probability of People buying Treadmill w/o any criteria

9: for KP281 & KP481 Gender effect is not much effect but for KP781 Male Prefer more compared to Female as shown below

: Probability that a person buy **KP281 given Male is 0.5** & & person buy **KP281 given Female is 0.5**. No effect of Gender **9.2**: Probability that a person buy **KP481 given Male is 0.52** & & person buy **KP481 given Female is 0.48** No effect of Gender **9.3**: Probability that a person buy **KP781 given Male is 0.82** & & person buy **KP781 given Female is 0.17**. There is an effect of Gender

10: Probability of Married/Partnered buying Treadmill is more compared to Unmarried/Single

: Probability that a person buy **KP281** given Married/Parterned is 0.6 & person buy **KP281** given Unmarried/Single is 0.4 **10.2**: Probability that a person buy **KP481** given Married/Parterned is 0.6 & person buy **KP481** given Unmarried/Single is 0.4 **10.3**: Probability that a person buy **KP781** given Married/Parterned is 0.57 & person buy **KP781** given Unmarried/Single is 0.42

Recommendations

1: People with Higher Education will have higer Salary/Income and they often buy **KP781** more compared to other. So its better to reccomend them this product

- 2: People having a **Fitness Score of 5**. Mostly Prefer **KP781** so we can say for a Person who is willing to having a good fitness we should recommend **KP781**.
- 3: People who are Married/Partnered buy Treadmill more so its better to give discount on price to increase Sales
- **4 :** People at Younger **Age < 20** buys **KP281** more frequently. So its better to recomend this kind of Treadmill to younger People
- **5 : Male** having a higer chance of buying **KP781** Compared to Female. So its better to recommend this Treadmills to **Males**.If we want to increase Sales then we can provide Discount on Price