Business Problem

The market research team at AeroFit wants to identify the characteristics of the target audience for each type of treadmill offered by the company, to provide a better recommendation of the treadmills to the new customers. The team decides to investigate whether there are differences across the product with respect to customer characteristics.

- 1. Perform descriptive analytics to create a customer profile for each AeroFit treadmill product by developing appropriate tables and charts.
- 1. For each AeroFit treadmill product, construct two-way contingency tables and compute all conditional and marginal probabilities along with their insights/impact on the business.

```
In [1]:
          # Importing necessary python libraries
           import numpy as np
           import pandas as pd
           import matplotlib.pyplot as plt
           import seaborn as sns
 In [2]:
          # Loading dataset
          df = pd.read csv('/Users/bose/Downloads/aerofit.csv')
In [377...
          df.head()
Out[377]:
              Product Age
                            Gender Education MaritalStatus Usage
                                                                   Fitness Income Miles
           0
                KP281
                        18
                              Male
                                           14
                                                     Single
                                                                 3
                                                                      Good
                                                                             29562
                                                                                      112
            1
                KP281
                        19
                               Male
                                           15
                                                     Single
                                                                 2 Average
                                                                             31836
                                                                                      75
           2
                KP281
                        19
                            Female
                                           14
                                                   Partnered
                                                                   Average
                                                                             30699
                                                                                      66
           3
                KP281
                                           12
                                                                             32973
                        19
                              Male
                                                     Single
                                                                   Average
                                                                                      85
           4
                KP281
                        20
                              Male
                                           13
                                                  Partnered
                                                                 4
                                                                      Poor
                                                                             35247
                                                                                      47
```

Observation of basic metrics, shape of data, datatype of attributes -

```
In [ ]: df.info()
```

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```
Untitled
         <class 'pandas.core.frame.DataFrame'>
         RangeIndex: 180 entries, 0 to 179
         Data columns (total 9 columns):
                             Non-Null Count Dtype
          #
              Column
              _____
         ___
                              _____
                                              ____
          0
              Product
                             180 non-null
                                              object
          1
                             180 non-null
                                              int64
              Age
             Gender 180 non-null Education 180 non-null
          2
                                              object
          3
                                              int64
             MaritalStatus 180 non-null
                                              object
          5
              Usage
                             180 non-null
                                              int64
          6
              Fitness
                             180 non-null
                                              int64
          7
              Income
                             180 non-null
                                              int64
          8
                              180 non-null
                                              int64
              Miles
         dtypes: int64(6), object(3)
         memory usage: 12.8+ KB
 In [4]:
         df.shape
         (180, 9)
 Out[4]:
         There are 180 rows and 9 columns in the dataset
In [250...
         # Checking for null values
         df.isna().sum().sum()
Out[250]:
         There are No Null values in the dataset
In [12]: # Datatype of attributes
         df.dtypes
         Product
                           object
Out[12]:
```

```
Age
                  int64
                 object
Gender
Education
                  int64
                 object
MaritalStatus
Usage
                  int64
Fitness
                  int64
Income
                  int64
Miles
                  int64
dtype: object
```

Statistical Summary -

```
In [19]:
          df.describe()
```

Out[19]:

		Age	Education	Usage	Fitness	Income	Miles
	count	180.000000	180.000000	180.000000	180.000000	180.000000	180.000000
	mean	28.788889	15.572222	3.455556	3.311111	53719.577778	103.194444
	std	6.943498	1.617055	1.084797	0.958869	16506.684226	51.863605
	min	18.000000	12.000000	2.000000	1.000000	29562.000000	21.000000
	25%	24.000000	14.000000	3.000000	3.000000	44058.750000	66.000000
	50%	26.000000	16.000000	3.000000	3.000000	50596.500000	94.000000
	75%	33.000000	16.000000	4.000000	4.000000	58668.000000	114.750000
	max	50.000000	21.000000	7.000000	5.000000	104581.000000	360.000000

In [21]: df.describe(include = object)

Out[21]:		Product	Gender	MaritalStatus
	count	180	180	180
	unique	3	2	2
	top	KP281	Male	Partnered
	freq	80	104	107

Converting to Category -

```
In [383... df2 = df
    df2.head()
```

```
Out[383]:
               Product Age
                             Gender Education MaritalStatus
                                                                 Usage
                                                                        Fitness
                                                                                 Income Miles
            0
                 KP281
                                             14
                                                                                  29562
                                                                                            112
                         18
                                Male
                                                        Single
                                                              Moderate
                                                                           Good
                 KP281
            1
                         19
                                             15
                                                        Single
                                                                                  31836
                                                                                            75
                                Male
                                                                   Low Average
            2
                 KP281
                         19
                              Female
                                             14
                                                    Partnered
                                                              Moderate
                                                                        Average
                                                                                  30699
                                                                                            66
                 KP281
                         19
                                Male
                                             12
                                                        Single
                                                              Moderate
                                                                       Average
                                                                                  32973
                                                                                            85
            4
                 KP281
                         20
                                Male
                                             13
                                                    Partnered Moderate
                                                                           Poor
                                                                                  35247
                                                                                            47
```

Out[384]:		Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles
	0	KP281	18	Male	14	Single	Moderate	Good	29562	112
	1	KP281	19	Male	15	Single	Low	Average	31836	75
	2	KP281	19	Female	14	Partnered	Moderate	Average	30699	66
	3	KP281	19	Male	12	Single	Moderate	Average	32973	85
	4	KP281	20	Male	13	Partnered	Moderate	Poor	35247	47

```
Product Age Gender Education MaritalStatus Usage Fitness Income Miles
Out[386]:
                 KP281
            0
                         18
                                Male
                                             14
                                                       Single
                                                              Normal
                                                                         Good
                                                                                29562
                                                                                         112
            1
                 KP281
                                             15
                                                                                31836
                                                                                          75
                         19
                                Male
                                                       Single
                                                                 Low Average
            2
                 KP281
                         19
                             Female
                                             14
                                                    Partnered Normal Average
                                                                                30699
                                                                                          66
            3
                 KP281
                         19
                                             12
                                                                                32973
                                                                                          85
                                Male
                                                       Single
                                                              Normal Average
            4
                 KP281
                                             13
                                                    Partnered Normal
                                                                                35247
                                                                                          47
                         20
                                Male
                                                                         Poor
```

Value Counts and Unique Values -

```
In [321... # Number of Unique values in each column
for i in df.columns:
    print(i,':',df[i].nunique())

Product : 3
    Age : 32
    Gender : 2
    Education : 8
    MaritalStatus : 2
    Usage : 6
    Fitness : 5
    Income : 62
    Miles : 37
```

Product column -

```
In []: df['Product'].value_counts()

Out[]: KP281     80
     KP481     60
     KP781     40
     Name: Product, dtype: int64
```

KP281 is the most poular product. Followed by KP481 and then KP781 in that order

```
In [345... print("Unique attributes in Product column :",df['Product'].unique())
Unique attributes in Product column : ['KP281' 'KP481' 'KP781']
```

Gender Column -

```
In [355... df['Gender'].value_counts()
Out[355]: Male     104
    Female     76
    Name: Gender, dtype: int64
```

- There are more **Male** customers compared to **Female**
- Male 104

• **Female** - 76

```
In [356...
         print("Unique attributes in Gender column :",df['Gender'].unique())
          Unique attributes in Gender column : ['Male' 'Female']
          MaritalStatus Column -
In [358...
          df['MaritalStatus'].value_counts()
                         107
          Partnered
Out[358]:
           Single
                          73
           Name: MaritalStatus, dtype: int64

    There are more Partnered customers compared to Single customers

           • Partnered - 107
           • Single - 73
In [359...
         print("Unique attributes in MaritalStatus column :",df['MaritalStatus'].uniq
          Unique attributes in MaritalStatus column : ['Single' 'Partnered']
          Fitness Column -
In [387...
          df2['Fitness'].value_counts()
                         97
          Average
Out[387]:
                         31
           Excellent
           Poor
                         26
           Good
                         24
                          2
           Very Poor
           Name: Fitness, dtype: int64
           • Most customers (97) rate themselves Average in terms of fitness (fitness rating -3)
           • 31 customers are in Excellent shape(fitness rating -5)
In [389...
         print("Unique attributes in Fitness column :",df2['Fitness'].unique())
          Unique attributes in Fitness column : ['Good' 'Average' 'Poor' 'Very Poor'
          'Excellent']
          Usage Column -
In [388...
          df2['Usage'].value_counts()
          Normal
                     138
Out[388]:
           LOW
                      33
           High
           Name: Usage, dtype: int64

    Most customers(138) have a Normal usage of their threadmill (3-5 days per week)

           • 33 customers have Low usage (1-2 days a week)
In [390...
         print("Unique attributes in Usage column :",df['Usage'].unique())
          Unique attributes in Usage column : ['Normal' 'Low' 'High']
```

Visual Analysis

Distribution of data -

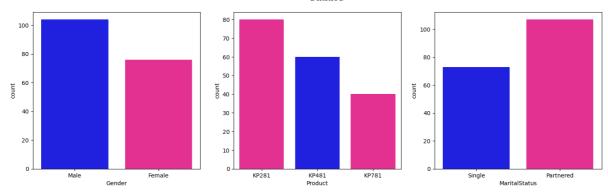
For Continuous Variables -

```
In [322...
         fig, axis = plt.subplots(nrows=2, ncols=3, figsize=(18, 10))
          sns.histplot(data=df, x="Age", ax=axis[0,0], color='deeppink')
          sns.histplot(data=df, x="Education", ax=axis[0,1],color='blue')
          sns.histplot(data=df, x="Usage", ax=axis[0,2],color='deeppink')
          sns.histplot(data=df, x="Fitness", ax=axis[1,0],color='blue')
          sns.histplot(data=df, x="Income", ax=axis[1,1],color='deeppink')
          sns.histplot(data=df, x="Miles", ax=axis[1,2],color='blue')
          plt.show()
                                                                   60
                                       70
           20
                                       30
                                                                   20
                                       20
           100
                                                                   35
                                                                   30
                                                                   25
                                                                  U 20
                                                                   15
                                                                   10
           20
                1.5 2.0 2.5
```

Insights -

- Median Value for Age of customers is 26 years
- Median Value for **Education** is **16** years
- Median Value for **Usage** is **3** days a week
- Median Value for Fitness is 3
- Median Value of Income comes around 54,000
- Median Value for Miles covered is 90 miles

For Categorical Variables -



Insights -

- Male customers are more in number than Female customers
- KP281 is the most popular product, followed by KP481 and KP781 in that order
- Partnered customers tend to buy threadmill more than Single customers

For Newly created categories -

```
In [420... fig, axis = plt.subplots(nrows=1, ncols=2, figsize=(18, 5))

sns.countplot(data=df2, x="Fitness", ax=axis[0], palette=['blue', 'deeppink'])
sns.countplot(data=df2, x="Usage", ax=axis[1], palette=['blue', 'deeppink'])
plt.show()
```

Insights -

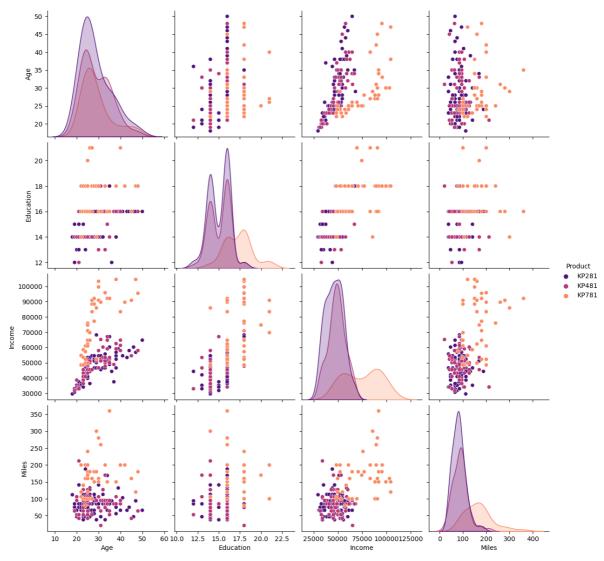
- Most of the customers come in the Average(Fitness Rating = 3) category for
 Fitness
- Most of the customers have **Normal Usage** (3-5 days per week) of their Threadmill

Correlation among different attributes -

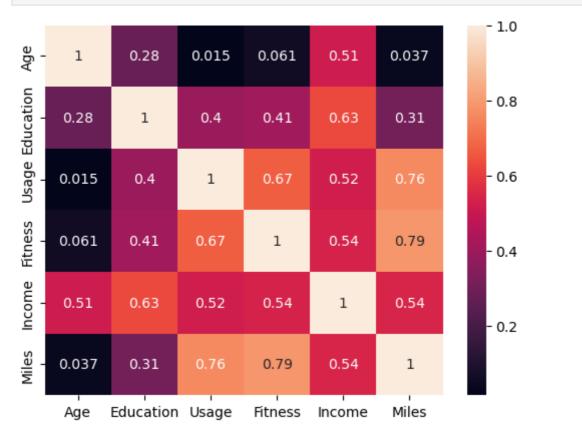
```
In [395... sns.pairplot(data=df, hue='Product', palette= 'magma', height=3)
plt.show()
```

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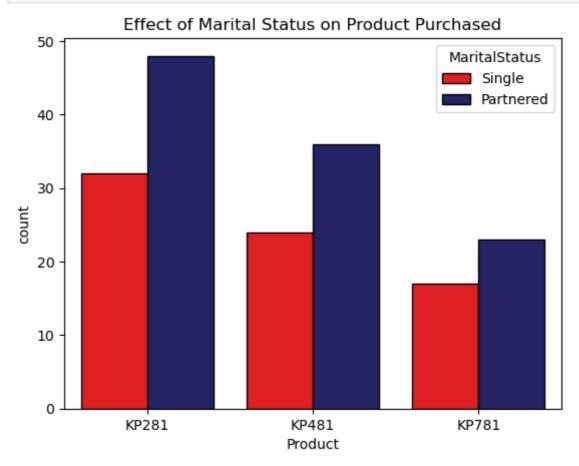
In [339... sns.heatmap(df.corr(), annot=True)
 plt.show()



Inference -

- Fitness is strongly correlated to Miles (correlation factor of 0.79)
- Fitness is strongly correlated to Usage (correlation factor 0.67)
- Usage is strongly correlated to Miles (correlation factor 0.76)
- Age has no strong correlation with any factors except for Income (factor 0.51)
- Age is weakly correlated to Fitness and Usage(0.061 & 0.015)

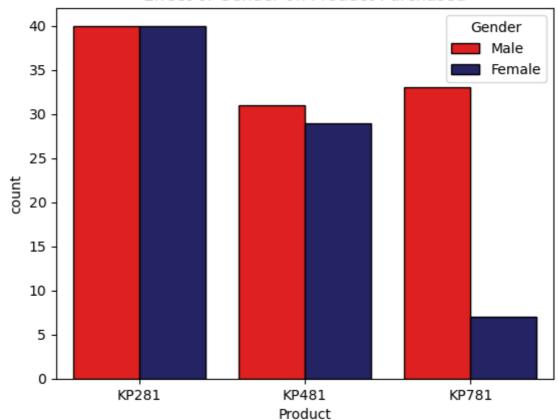
In [251... sns.countplot(x='Product', hue='MaritalStatus', data=df, palette =['red','mi
 plt.title('Effect of Marital Status on Product Purchased')
 plt.show()



- People having Marital Status of Partnered purchase more Threadmills compared to people who are Single
- It is true in the case of all 3 product categories (KP281, KP481, KP781)

```
In [396... sns.countplot(x='Product', hue='Gender', data=df, palette =['red','midnightk
    plt.title('Effect of Gender on Product Purchased')
    plt.show()
```

Effect of Gender on Product Purchased

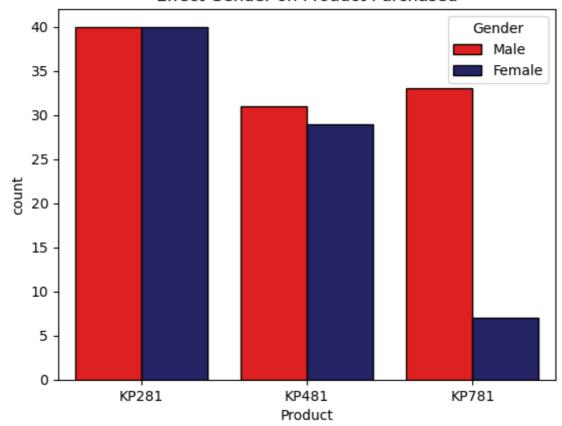


Inference -

- KP281 Both male and female customers equally prefer KP281
- KP481 There is **slightly more number of Male**customers compared to Female
- KP781 Most of the customers using this product are Male

In [279... sns.countplot(x='Product', hue='Gender', data=df, palette =['red','midnightb
 plt.title('Effect Gender on Product Purchased')
 plt.show()

Effect Gender on Product Purchased



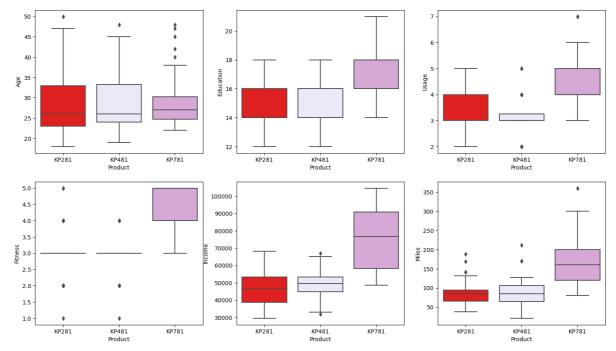
Inference -

- KP281 Equal number of Males and Females purachased this product
- KP481 This category has a slightly more number of Male customers compared to Female
- KP781 Very few number of Female customers compared to Male in this category

Effect of Quantitative attributes on Product Purchased -

```
In [178... fig, axis = plt.subplots(nrows=2, ncols=3, figsize=(18, 10))

sns.boxplot(x="Product", y="Age", data=df, ax=axis[0,0], palette=['red','lav sns.boxplot(data=df, x="Product", y="Education", ax=axis[0,1], palette=['red sns.boxplot(data=df, x="Product", y="Usage", ax=axis[0,2],palette=['red','la sns.boxplot(data=df, x="Product", y="Fitness", ax=axis[1,0],palette=['red','sns.boxplot(data=df, x="Product", y="Income", ax=axis[1,1],palette=['red','la sns.boxplot(data=df, x="Product", y="Miles", ax=axis[1,2],palette=['red','la plt.show()
```



Effect of Quantitative attributes on Product Purchased -

- *Age* :
 - Cutomers buying products KP281 and KP481 have the same median age of 27 and in the range (23 to 34) years
 - Customers buying KP781 have a higher median age of 28 years and fall in the range of (25 to 30) years
- Education:
 - Cutomers of KP281 and KP481 have an education in the range of 14 to 16
 years
 - Customers of KP781 have an higher education in the range of 16 to 18 years
- Usage:
 - KP281 customers use it for (3 to 4) times a week
 - KP481 customers use it for 3 days per week
 - KP781 customers use their threadmill more times a week, around 4 to 5 times per week
- Fitness:
 - More **fit customers** (rating of 4 to 5) tend to **purchase KP781**
- Income
 - Low income customers prefer KP281 and KP481 (KP281 40k to 54k) (KP481 45k to 54k)
 - People with **High Income** tend to **purchase KP781** more than the other models (KP781 60k to 90k)
- Miles:
 - KP281 and KP481 customers cover around 60 to 110 miles a week
 - KP781 customers cover around 120 to 200 miles a week

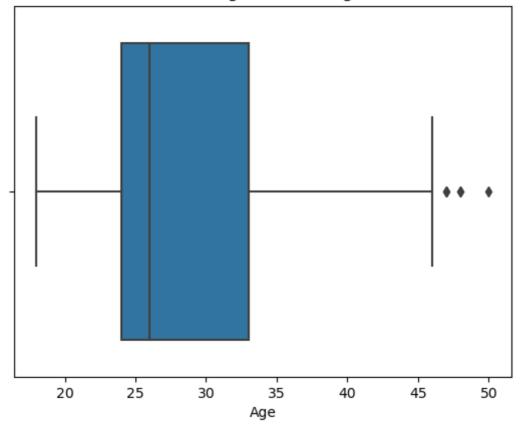
```
In [422... # Check for missing or null values
    df.isna().sum()
```

```
Out[422]: Product 0
Age 0
Gender 0
Education 0
MaritalStatus 0
Usage 0
Fitness 0
Income 0
Miles 0
dtype: int64
```

As you can see there is **No Missing or Null values** in the dataset

```
In [266... sns.boxplot(x='Age',data=df)
  plt.title('Detecting outlier for Age ')
  plt.show()
  print('Median is ',df['Age'].median())
  print('Mean is ',df['Age'].mean())
  print('Difference between mean and median is 2.78')
```

Detecting outlier for Age



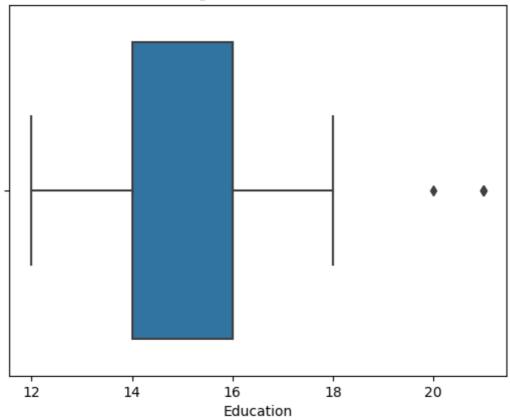
Median is 26.0 Mean is 28.7888888888888 Difference between mean and median is 2.78

- Majority of the customer's **Age** fall in the range **24 to 33**
- There are 3 outliers above the age of 45
- Differnce between mean and median is 2.78

```
In [268... sns.boxplot(x='Education',data=df)
  plt.title('Detecting outlier for Education ')
  plt.show()
  print('Median is ',df['Education'].median())
```

```
print('Mean is ',df['Education'].mean())
print('Difference between mean and median is 0.427')
```

Detecting outlier for Education

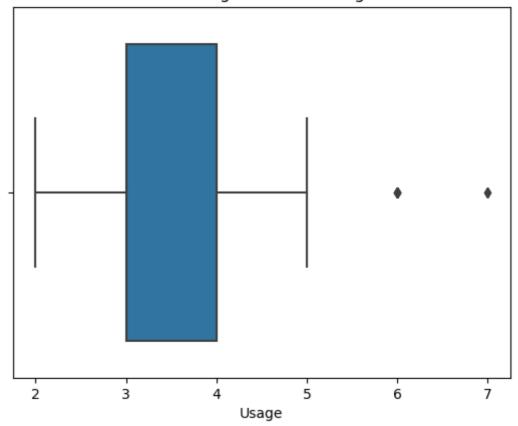


Median is 16.0 Mean is 15.5722222222222 Difference between mean and median is 0.427

- Majority of the customer's **Education** fall in the range **14 to 16 years**
- There are 2 outliers above the value of 18 years
- Differnce between mean and median is **0.427**

```
In [271... sns.boxplot(x='Usage',data=df)
  plt.title('Detecting outlier for Usage')
  plt.show()
  print('Median is ',df['Usage'].median())
  print('Mean is ',df['Usage'].mean())
  print('Difference between mean and median is 0.455')
```

Detecting outlier for Usage

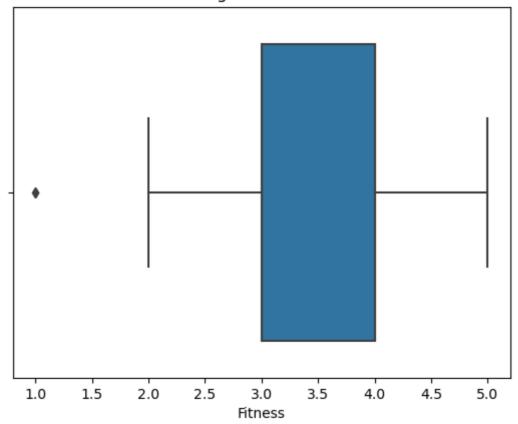


Median is 3.0 Mean is 3.45555555555557 Difference between mean and median is 0.455

- Majority of the customer's **Usage** fall in the range **3 to 4 times a week**
- There are 2 outliers above the value of 5 times a week
- Differnce between mean and median is 0.455

```
In [320... sns.boxplot(x='Fitness',data=df)
  plt.title('Detecting outlier for Fitness')
  plt.show()
  print('Median is ',df['Fitness'].median())
  print('Mean is ',df['Fitness'].mean())
  print('Difference between mean and median is 0.311')
```

Detecting outlier for Fitness

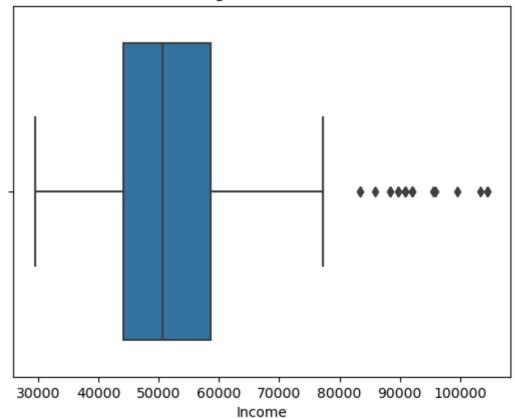


Median is 3.0 Mean is 3.31111111111111 Difference between mean and median is 0.311

- Majority of the customer's gave themselves a Fitness Rating in the range 3 to 4
- There is 1 outlier below the value of 2
- Differnce between mean and median is 0.311

```
In [276... sns.boxplot(x='Income',data=df)
  plt.title('Detecting outlier for Income')
  plt.show()
  print('Median is ',df['Income'].median())
  print('Mean is ',df['Income'].mean())
  print('Difference between mean and median is 3123.077')
```

Detecting outlier for Income

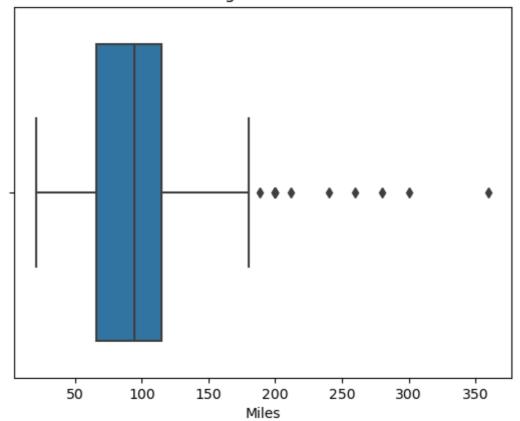


Median is 50596.5 Mean is 53719.5777777778 Difference between mean and median is 3123.077

- Majority of the customer's have Income in the range 45,000 to 60,000 dollars
- There are 11 outlier above the value of 78,000 dollars
- Differnce between mean and median is 3123.077 dollars

```
In [278... sns.boxplot(x='Miles',data=df)
  plt.title('Detecting outlier for Miles')
  plt.show()
  print('Median is ',df['Miles'].median())
  print('Mean is ',df['Miles'].mean())
  print('Difference between mean and median is 9.194')
```

Detecting outlier for Miles



Median is 94.0 Mean is 103.194444444444 Difference between mean and median is 9.194

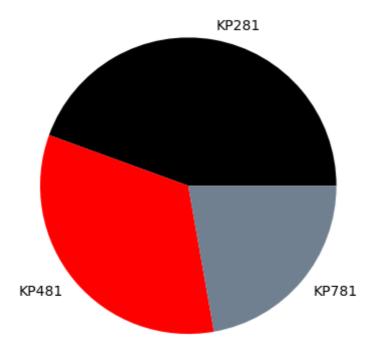
Inference -

- Average Number of Miles the customer expects to walk/run each week falls in the range 60 to 110 miles
- There are 8 outlier above the value of 180 miles
- Differnce between mean and median is 9.194 miles

Marginal Probability and Conditional Probability -

```
In [291...
          # Marginal Probability
          round(df['Product'].value counts(normalize=True)*100,2)
          KP281
                    44.44
Out[291]:
          KP481
                    33.33
          KP781
                    22.22
          Name: Product, dtype: float64
In [292... d = df['Product'].value_counts()
          colors = ['black','red','slategray']
          plt.pie(d.values, labels=d.index, colors=colors)
          plt.title('Products')
          plt.show()
```

TV Show vs Movies



- **KP281** type treadmill was purchased by **44.4%** of the customers.
- KP481 type was purchased by 33.3% of customers.
- Wheres type KP781 was purchased by 22.2% customers

- 57.78% customers are Males
- Whereas 42.22% customers are Females

- 59.44% customers are Partneres=d
- Whereas 40.56% customers are Single

```
In []: # Usage
round(df['Usage'].value_counts(normalize=True)*100,2).reset_index()
```

Out[]:		index	Usage
		0	3	38.33
		1	4	28.89
		2	2	18.33
		3	5	9.44
		4	6	3.89
		5	7	1.11

- Majority of customers (38.33%) customers use their threadmill for 3 days a week
- Around 1.11% customers use it for 7 days a week

- Majority of customers (53.89%) customers have given themselves a rating of 3 out of 5
- Around 17.22% customers have 5/5 ratings

Conditional Probability -

Probability for each Product given Gender -

```
In [414... #Joint Probability Table
          pd.crosstab(df['Gender'],df['Product'],margins=True,normalize=True).round(2)
Out [414]: Product KP281 KP481 KP781
                                          All
           Gender
            Female
                     22.0
                                         42.0
                            16.0
                                    4.0
                     22.0
             Male
                            17.0
                                   18.0
                                         58.0
                     44.0
               ΑII
                            33.0
                                   22.0 100.0
          #Conditional Probability Table
In [415...
          pd.crosstab(index = df["Gender"], columns = df["Product"], margins = True, n
```

 Out [415]:
 Product
 KP281
 KP481
 KP781

 Gender
 Female
 53.0
 38.0
 9.0

 Male
 38.0
 30.0
 32.0

 All
 44.0
 33.0
 22.0

Inference -

P(Male): 0.58 P(Female): 0.42

P(KP781 | Male): 0.32 P(KP481 | Male): 0.30 P(KP281 | Male): 0.38

P(KP781 | Female): 0.09 P(KP481 | Female): 0.38 P(KP281 | Female): 0.53

Insights -

Probability of customer being **Male** is **58%**Probability of customer being **Female** is **42%**

Probability of Male customer buying KP781 is 32% Probability of Male customer buying KP481 is 30%

Probability of Male customer buying KP281 is 38%

Probability of Female customer buying KP781 is 9%

Probability of Female customer buying KP481 is 38%

Probability of Female customer buying KP281 is 53%

Probability for each Product given MaritalStatus -

```
In [416... #Joint Probability Table
pd.crosstab(df['MaritalStatus'],df['Product'],margins=True,normalize=True).r
```

Out[416]: Product KP281 KP481 KP781 All **MaritalStatus Partnered** 27.0 20.0 13.0 59.0 Single 18.0 13.0 9.0 41.0 ΑII 44.0 33.0 22.0 100.0

```
In [417... #Conditional Probability Table
pd.crosstab(index = df["MaritalStatus"], columns = df["Product"], margins =
```

Product KP281 KP481 KP781 Out [417]:

MaritalStatus

Partnered	45.0	34.0	21.0
Single	44.0	33.0	23.0
All	44.0	33.0	22.0

Inference -

P(Single): 0.41 P(Partnered): 0.59

P(KP781 | Single): 0.23 P(KP481 | Single): 0.33 P(KP281 | Single): 0.44

P(KP781 | Partnered): 0.21 P(KP481 | Partnered): 0.34 P(KP281 | Partnered): 0.45

Insights -

Probability of customer being **Single** is **41%** Probability of customer being Partnered is 59%

Probability of Single customer buying KP781 is 23% Probability of Single customer buying KP481 is 33% Probability of Single customer buying KP281 is 44%

Probability of Partnered customer buying KP781 is 21% Probability of Partnered customer buying KP481 is 34% Probability of Partnered customer buying KP281 is 45%

Business Insights -

KP281-

- KP281 is the most economical product as well as the product with most number of sales
- Age group of customers fall in the range of 23 to 34 years. Median Age of customers is 27
- Customers have education of around 14 to 16 years
- Users of KP281 use it for 3 to 4 times a week
- Users of KP281 have given themselves low rating in terms of Fitness
- Mostly Low Income groups prefer KP281 (ie Income in the range 40k to 54k)
- Users using KP281 walk/run around 60 to 100 miles a week

KP481-

- Age group of customers fall in the range of 24 to 34 years. Median Age of customers is 27
- Customers have education of around 14 to 16 years
- Users of KP481 use it for 3 times a week
- Users of KP481 have given themselves low rating in terms of Fitness
- Mostly Low Income groups prefer KP481 (ie Income in the range 45k to 54k)
- Users using KP481 walk/run around 60 to 110 miles a week

In []:

KP781-

- This is the most **premium product** from the brand
- Age group of customers fall in the range of 25 to 30 years. Median Age of customers is 28
- Customers have education of around 16 to 18 years
- Users of KP781 use it for 4 to 5 times a week
- Users of KP781 have given themselves High rating (4 to 5) in terms of Fitness
- Mostly **High Income** groups prefer KP781 (ie Income in the range **60k to 90k**)
- Users using KP781 walk/run around 120 to 200 miles a week
- Customers of KP781 tend to take their Fitness very seriously. They are the most dedicated set of customers.

Recommendation -

- Participation of Single customers are less compared to Partnered customers. So aerofit should do Ad campaigns for Single customers to make them more intersted in their fitness and hence their products.
- Female customers are very low in the KP781 product category. KP781 are mostly
 only bought by High Income group customers. From this group Female participation
 is very less. Aerofit should do some social media marketing and and enagage
 with more Female audiences.
- Most of the customers fall in the age range of 24 to 34 years. Aerofit should do
 more direct advertising through retail stores and Supermarkets for the people
 above the age of 35. These advertising should highlight the risk of diseases in
 Old Age from the lack of exercise. This can be made more convincing by including
 recommendations from Doctors.
- Create a Mobile App to interact and motivate the customers. Things like Daily
 Tasks and Rewards can be included to motivate the customers

• Usage of KP281 and KP 481 are low. We should motivate the customers to workout more often. These can be done through alerts from the mobile app.

In []:	
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