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.

2) 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.

Importing all the packages

In [2]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.stats import norm
from scipy.stats import binom
from scipy.stats import geom
import math
```

In [3]:

```python
data=pd.read_csv("aerofit_treadmill.csv")
data
```

Out[3]:

	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

180 rows × 9 columns

Checking the characteristics and structure of the dataset

In [4]:

```python
data.columns
```

Out[4]:

```
Index(['Product', 'Age', 'Gender', 'Education', 'MaritalStatus', 'Usage',
       'Fitness', 'Income', 'Miles'],
      dtype='object')
```

In [5]:

```python
data.shape
```

Out[5]:

```
(180, 9)
```

In [6]:

```
data.info()
```

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

In [8]:

```
data.describe()
```

Out[8]:

	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 [10]:

```
data.describe(include='object')
```

Out[10]:

	Product	Gender	MaritalStatus
count	180	180	180
unique	3	2	2
top	KP281	Male	Partnered
freq	80	104	107

In [335]:

```
product_value_counts,gender_value_counts,ms_value_counts,fitness_value_counts=data['Product'].va
product_value_counts,gender_value_counts,ms_value_counts,fitness_value_counts,usage_value_count
```

Out[335]:

```
(KP281    80
 KP481    60
 KP781    40
 Name: Product, dtype: int64,
 Male      104
 Female     76
 Name: Gender, dtype: int64,
 Partnered    107
 Single        73
 Name: MaritalStatus, dtype: int64,
 3    97
 5    31
 2    26
 4    24
 1     2
 Name: Fitness, dtype: int64,
 3    69
 4    52
 2    33
 5    17
 6     7
 7     2
 Name: Usage, dtype: int64)
```

In [337]:

```
data.isnull().sum()
```

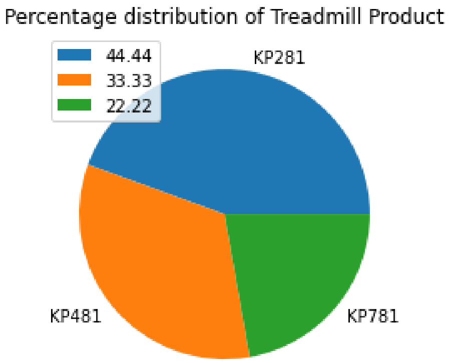
Out[337]:

```
Product          0
Age              0
Gender           0
Education        0
MaritalStatus    0
Usage            0
Fitness          0
Income           0
Miles            0
dtype: int64
```

It is observed that data has no null values

In [96]:

```
pie_data=round(data['Product'].value_counts()/data['Product'].count()*100,2)
plt.pie(x=pie_data,labels=data['Product'].unique())
plt.legend(pie_data,loc='upper left')
plt.title('Percentage distribution of Treadmill Product')
plt.show()
```



In three types of treadmills available the base version which is KP281 has been sold more with 44% of total, thus followed by medium range product KP481 with 33% and high end product with 22%.

Detect Outliers (using boxplot, “describe” method by checking the difference between mean and median)

In [60]:

```
data['Age'].describe()
```

Out[60]:

```
count    180.000000
mean      28.788889
std        6.943498
min       18.000000
25%       24.000000
50%       26.000000
75%       33.000000
max       50.000000
Name: Age, dtype: float64
```

In [62]:

```
age_mean=data['Age'].mean()
age_mean
```

Out[62]:

```
28.788888888888888
```

In [63]:

```
import statistics as stat
age_median=stat.median(data['Age'])
age_median
```

Out[63]:

```
26.0
```

Average Age of the customers is 28.7 but this is contains outliers so, its best to consider median as the mean to know the average age which is 26.

In [67]:

```
age_25p=np.percentile(data['Age'],25)
age_50p=np.percentile(data['Age'],50)
age_75p=np.percentile(data['Age'],75)
```

In [66]:

```
age_50p
```

Out[66]:

```
26.0
```

In [69]:

```
IQR_age=age_75p-age_25p
IQR_age
```

Out[69]:

```
9.0
```

In [70]:

```
upper_whisker_age=age_75p + 1.5*IQR_age
lower_whisker_age=max(age_25p - 1.5*IQR_age,0)
lower_whisker_age,upper_whisker_age
```

Out[70]:

```
(10.5, 46.5)
```

Any age greater than 46.5 age and lower than 10.5 age is considered as outlier for the age group in the data

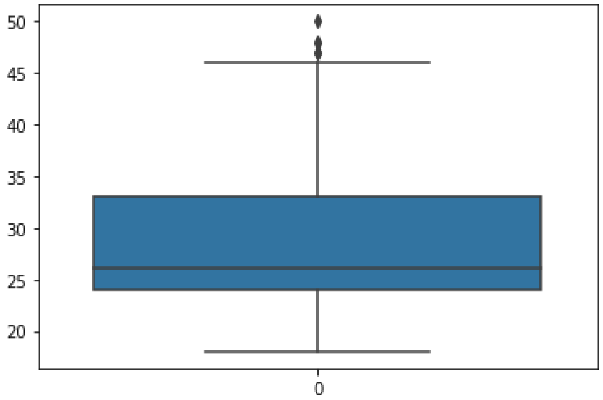
In [71]:
```
age_outliers=data[data['Age']>upper_whisker_age]
age_outliers
```

Out[71]:

	Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles
78	KP281	47	Male	16	Partnered	4	3	56850	94
79	KP281	50	Female	16	Partnered	3	3	64809	66
139	KP481	48	Male	16	Partnered	2	3	57987	64
178	KP781	47	Male	18	Partnered	4	5	104581	120
179	KP781	48	Male	18	Partnered	4	5	95508	180

In [59]:
```
sns.boxplot(data=data['Age'])
```

Out[59]:
```
<AxesSubplot:>
```



There are 5 outliers, because of this there is a increase in mean, its ideal to consider the median which is 50% percentile which gives correct mean age of the purchased people.

In [74]:
```
len(age_outliers)
```

Out[74]:
```
5
```

In [76]:
```
round(len(age_outliers)/data['Age'].shape[0]*100,2) # 2.78% of outliers in data
```

Out[76]:
```
2.78
```

** 3) Check if features like marital status, age have any effect on the product purchased (using countplot, histplots, boxplots etc) **

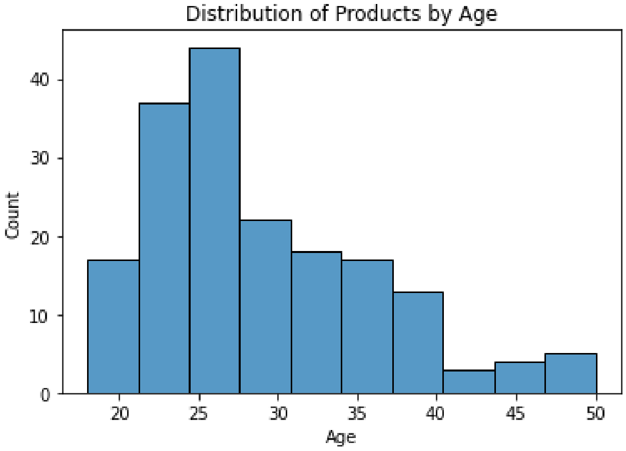
In [97]:
```
#Univariate analysis using countplot, histplot to determine the count of products purchased by 
```

In [101]:
```
data['Age'].unique()
```

Out[101]:
```
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)
```

In [107]:

```
sns.histplot(data=data['Age'],bins=10) #Distribution of products by age
plt.title('Distribution of Products by Age')
plt.show()
```



Most of the customers belong to age group of 22 to 28

In [108]:

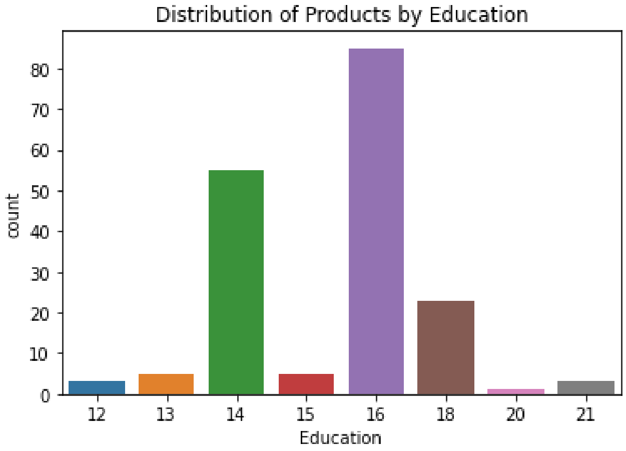
```
data['Education'].unique()
```

Out[108]:

```
array([14, 15, 12, 13, 16, 18, 20, 21], dtype=int64)
```

In [110]:

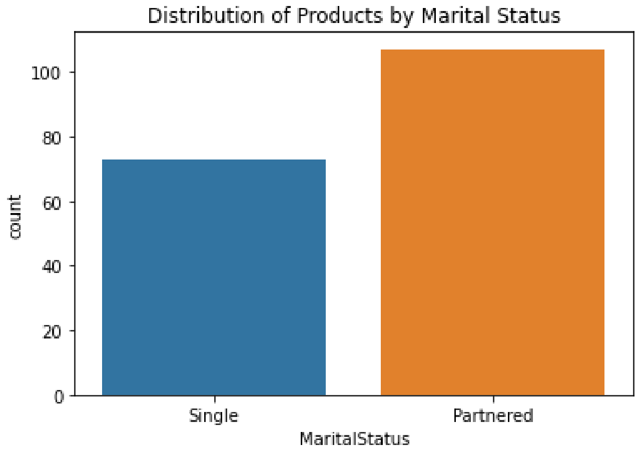
```
sns.countplot(data=data,x=data['Education'])
plt.title('Distribution of Products by Education')
plt.show()
```



Most of the customers are graduates who are intrested in buying treadmill

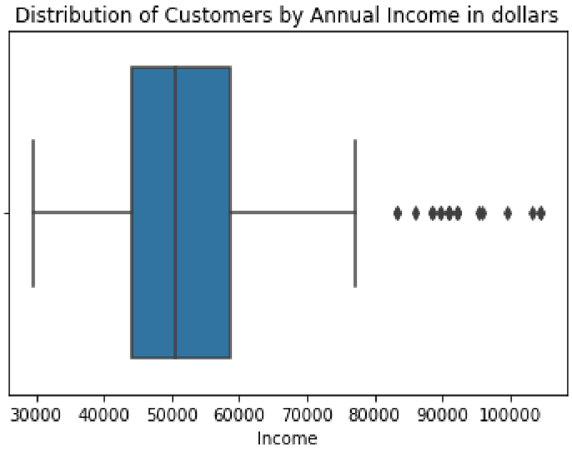
In [154]:

```
sns.countplot(data=data,x='MaritalStatus')
plt.title('Distribution of Products by Marital Status')
plt.show()
```



In [113]:

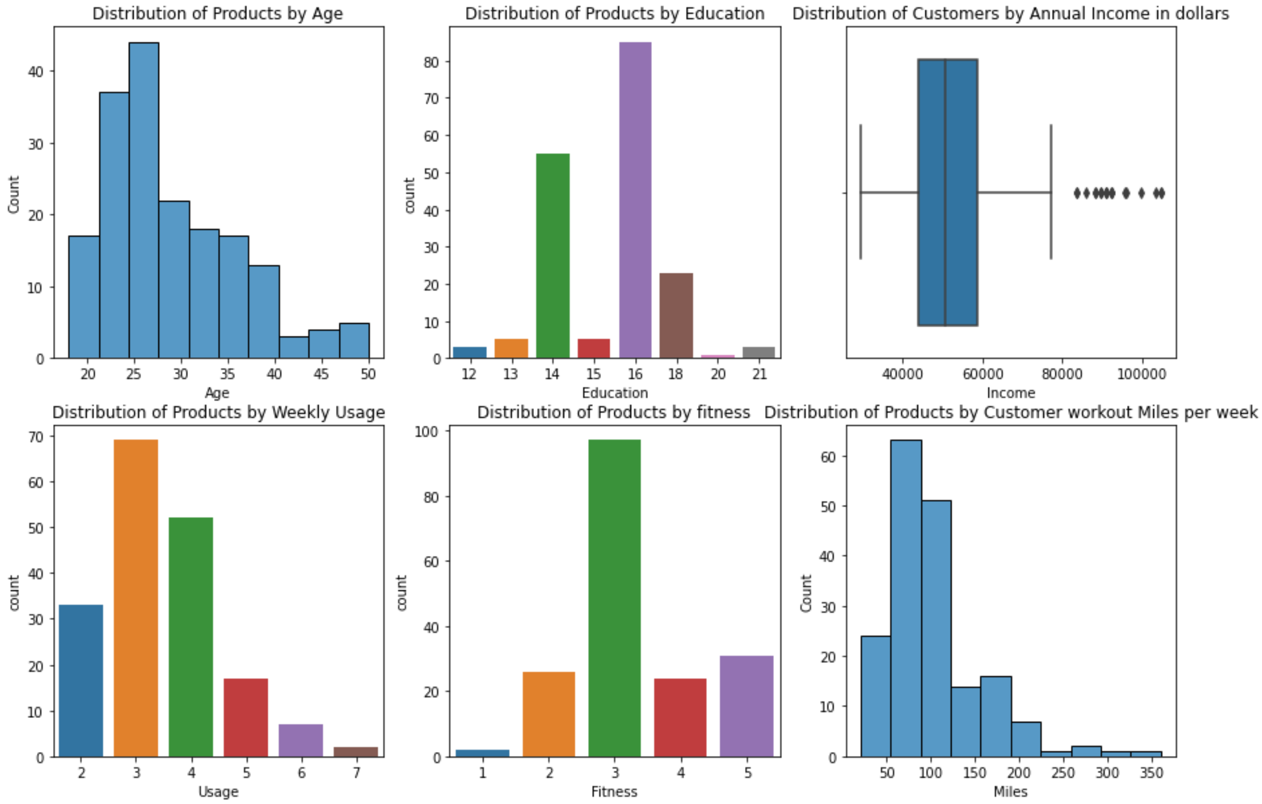
```
sns.boxplot(x=data['Income'])
plt.title('Distribution of Customers by Annual Income in dollars')
plt.show()
```



The distribution of products is high among the middle class customers with Annual income of customers with range betweeen 45k dollars and 60K dollars

In [149]:

```
fig, ax=plt.subplots(2,3,figsize=(15,10))  #Distribution of products by age
sns.histplot(ax=ax[0,0],data=data['Age'],bins=10)
ax[0,0].set_title('Distribution of Products by Age')
#plt.title('Distribution of Products by Age',ax=ax[0,0])

sns.countplot(ax=ax[0,1],data=data,x=data['Education'])
ax[0,1].set_title('Distribution of Products by Education')


sns.boxplot(ax=ax[0,2],x=data['Income'])
ax[0,2].set_title('Distribution of Customers by Annual Income in dollars')

sns.countplot(ax=ax[1,0],data=data,x=data['Usage'])
ax[1,0].set_title('Distribution of Products by Weekly Usage')

sns.countplot(ax=ax[1,1],data=data,x=data['Fitness'])
ax[1,1].set_title('Distribution of Products by fitness')

sns.histplot(ax=ax[1,2],data=data['Miles'],bins=10)
ax[1,2].set_title('Distribution of Products by Customer workout Miles per week')
plt.show()
```



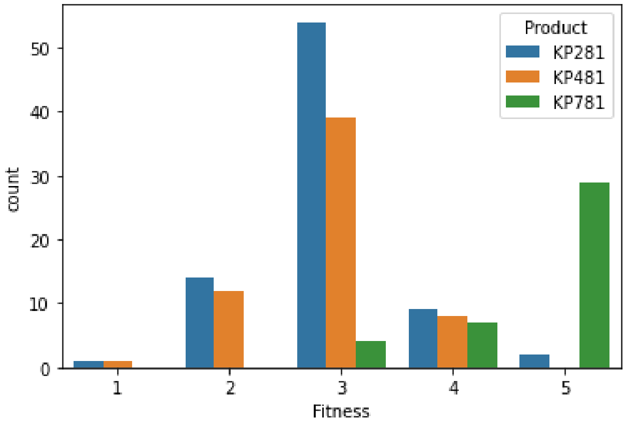
People who are intermediate level in terms of fitness,usage are more interested in buying tredmill than the very active people as they want to start their fitness regime at home

In [150]:

```
#Bivariate Analysis of different types of data variables
```

In [151]:

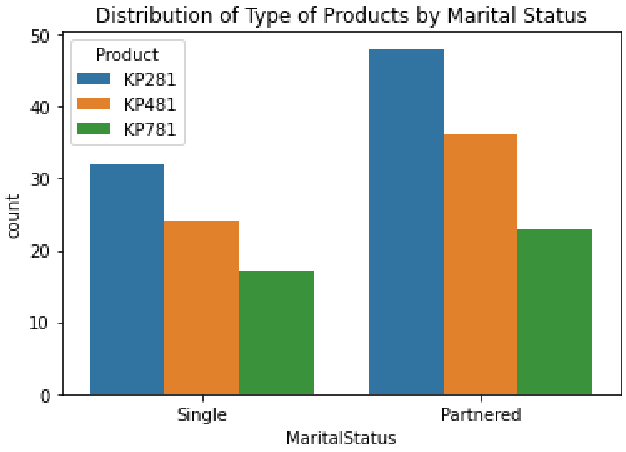
```
sns.countplot(data=data,x='Fitness',hue='Product')
plt.show()
```



People with intermediate fitness and low in fitness are considering base verison of treadmill first i.e KP281 followed by KP481 and people with high fitness want the higher end product which is of high cost i.e KP781.

In [156]:

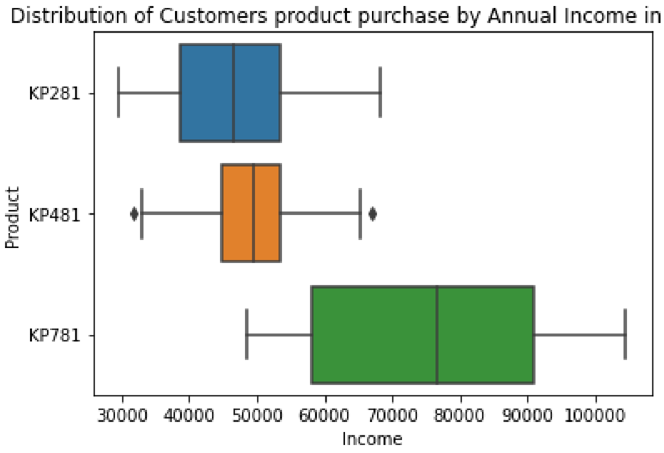
```
sns.countplot(data=data,x='MaritalStatus',hue='Product')
plt.title('Distribution of Type of Products by Marital Status')
plt.show()
```



Looks like Partnered people holds the high distribution considering they have lot of responsibilities and less time to go out for run will prefer treadmill for home run

In [160]:

```
sns.boxplot(x=data['Income'],y=data['Product'])
plt.title('Distribution of Customers product purchase by Annual Income in dollars')
plt.show()
```



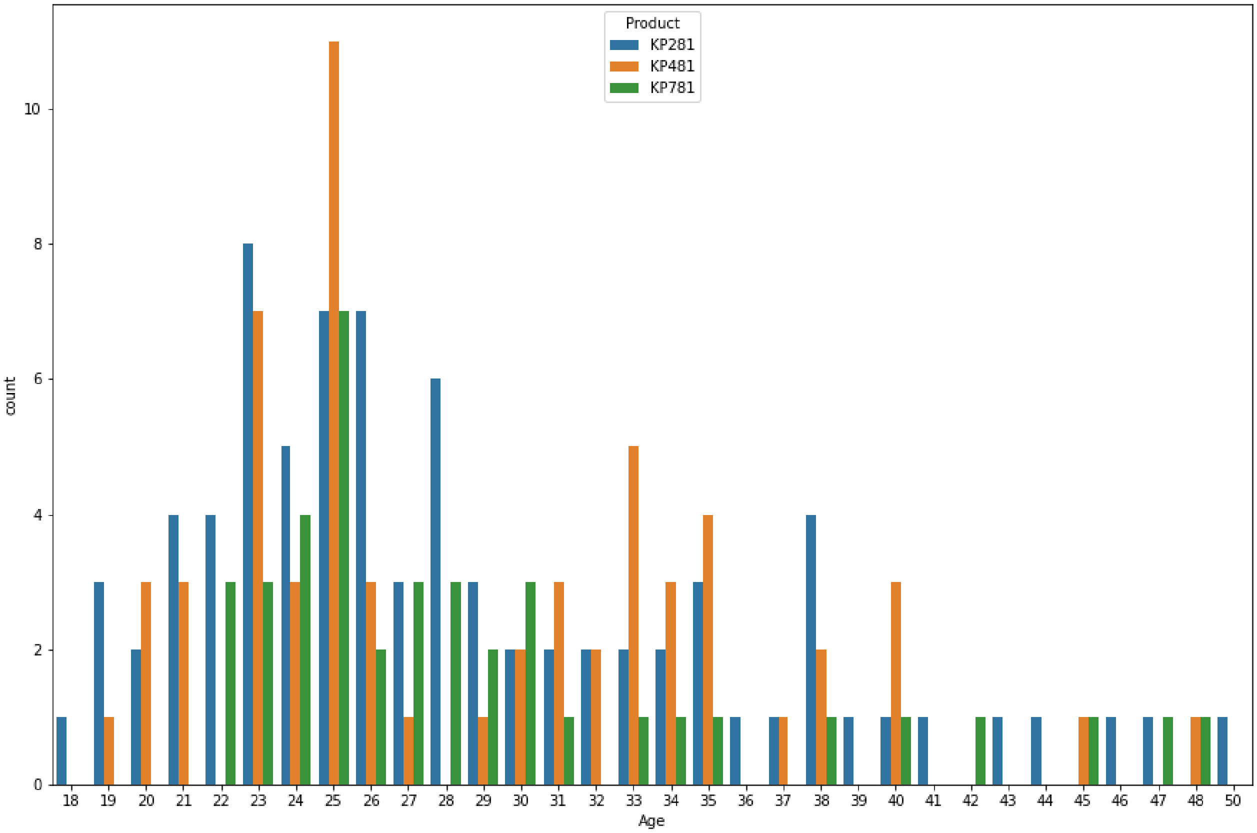
Boxplot clearly shows based on the income levels, the customer bought the product. Product bought is directly proportional to the customer income.

In [214]:

```
plt.figure(figsize=(15,10))
sns.countplot(data=data[['Age','Product']], x=data['Age'],hue='Product')
plt.title('Distribution of Products by Age')
```

Out[214]:

```
<AxesSubplot:xlabel='Age', ylabel='count'>
```

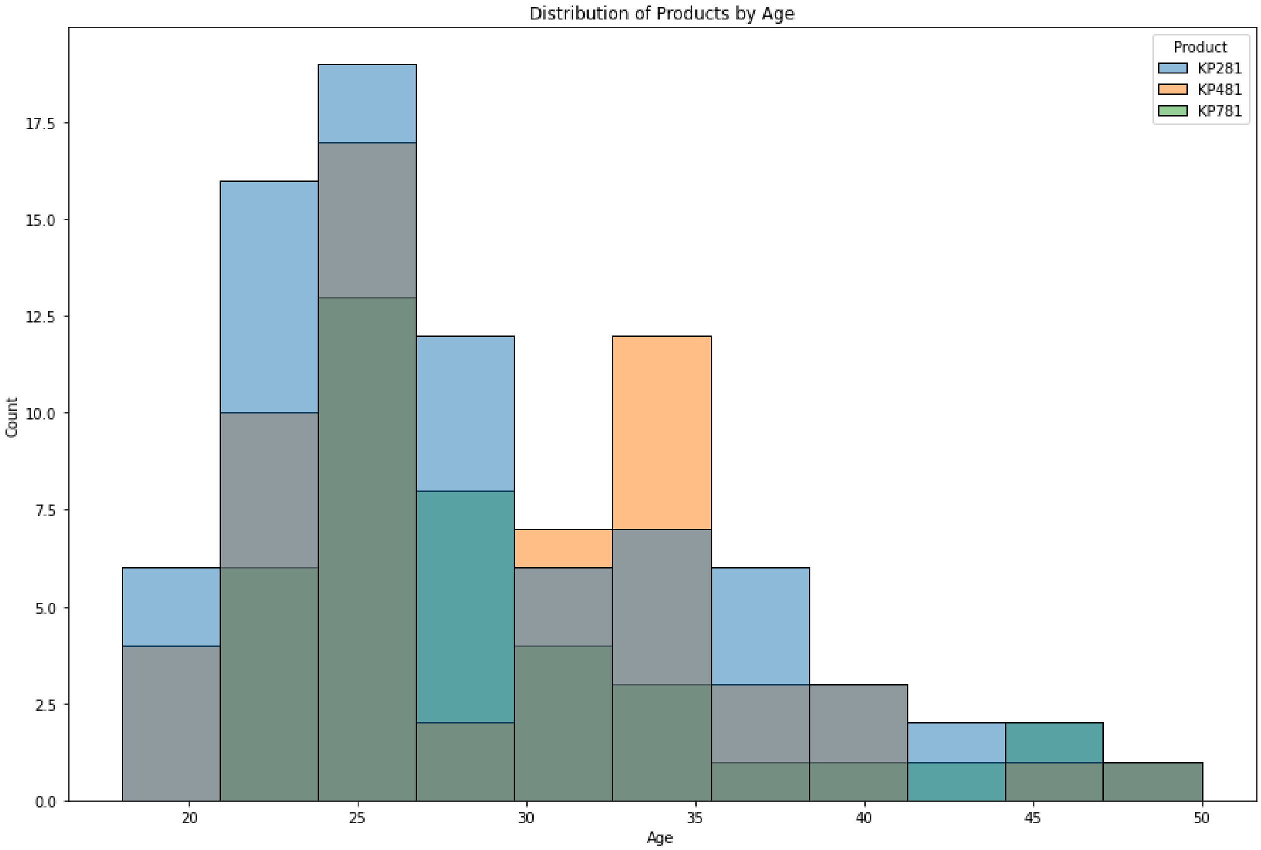


From the above count plot, we can assume that teenagers are strictly confined to base versions, where people who are financially independent are will to opt for the mid level and higher level treadmills i.e KP481 and KP781

Customers with age 25 bought medium product KP481 more than ever compared to other ages & products

In [227]:

```
plt.figure(figsize=(15,10))
sns.histplot(data=data[['Age','Product']], x=data['Age'],hue='Product')
plt.title('Distribution of Products by Age')
plt.show()
```

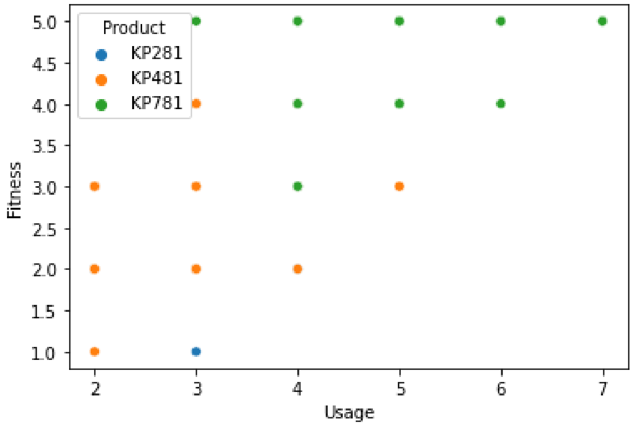


In [ ]:

```
#Multivariate Analysis
```

In [244]:

```
sns.scatterplot(data=data,x='Usage',y='Fitness',hue='Product')
plt.show()
```



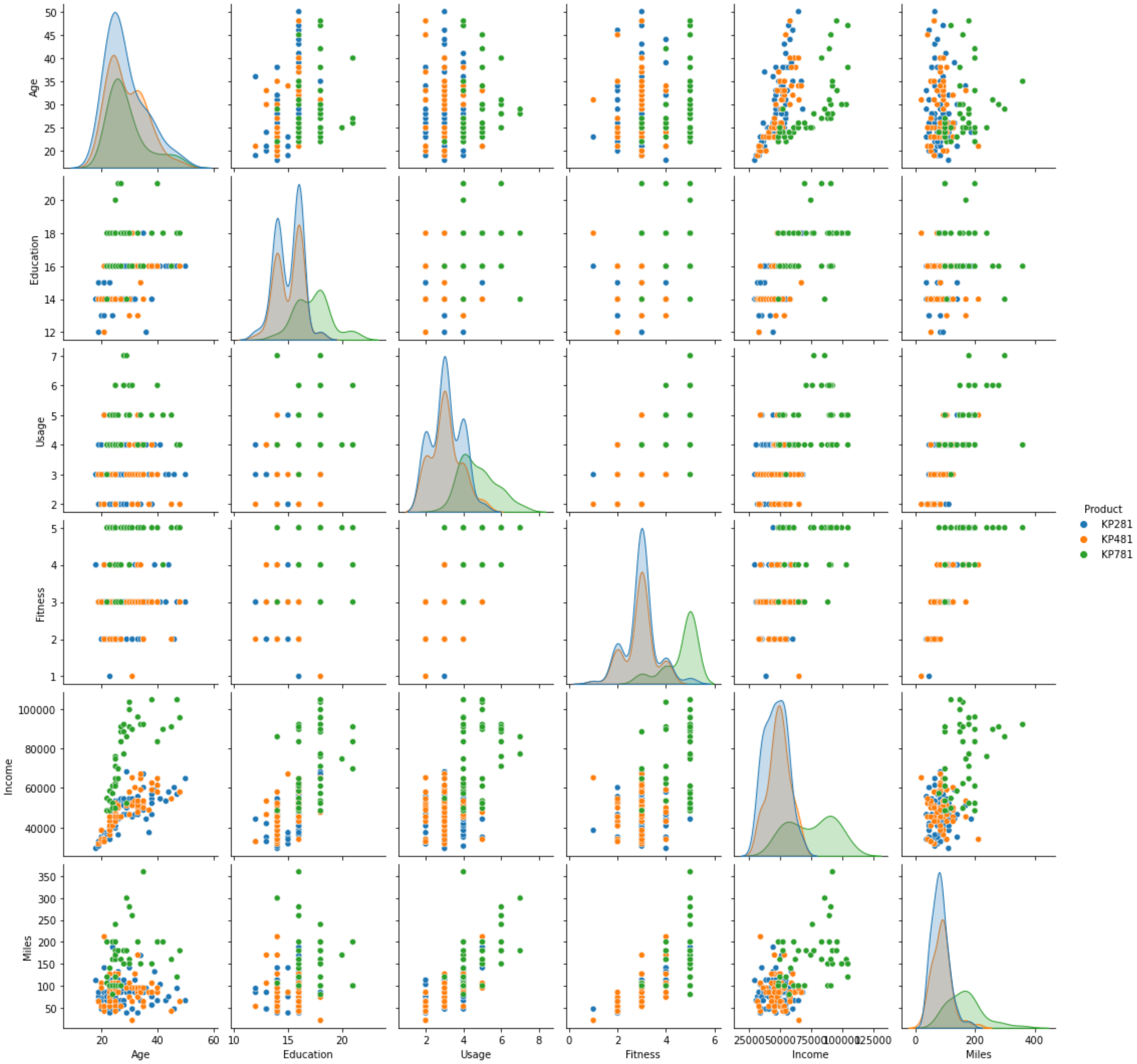
The above scatterplot clearly shows people with high fitness and high usage use the high end treadmill KP781

In [245]:

```
sns.pairplot(data=data,hue='Product')
plt.show()
```

Out[245]:

```
<seaborn.axisgrid.PairGrid at 0x23ad80f8f40>
```



In [246]:

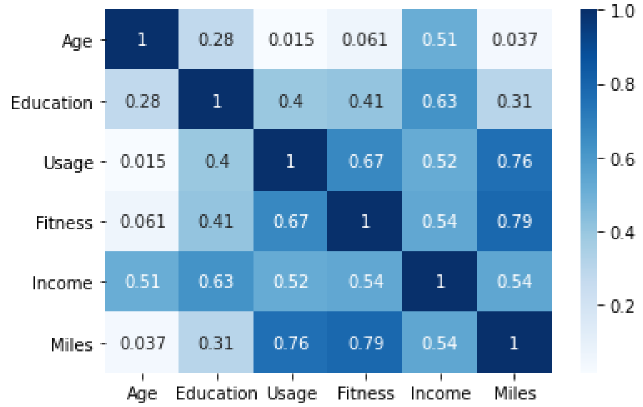
```
data.corr()
```

Out[246]:

	Age	Education	Usage	Fitness	Income	Miles
Age	1.000000	0.280496	0.015064	0.061105	0.513414	0.036618
Education	0.280496	1.000000	0.395155	0.410581	0.625827	0.307284
Usage	0.015064	0.395155	1.000000	0.668606	0.519537	0.759130
Fitness	0.061105	0.410581	0.668606	1.000000	0.535005	0.785702
Income	0.513414	0.625827	0.519537	0.535005	1.000000	0.543473
Miles	0.036618	0.307284	0.759130	0.785702	0.543473	1.000000

In [248]:

```
sns.heatmap(data=data.corr(),annot=True,cmap='Blues')
plt.show()
```



Pairplots and heatmaps are the charts which are used to show corelation between all the variables present in the how two variables are giving insights of customers interests in choosing products

Mariginal & Conditional Probabilities through pandas corsstab normalize

In [298]:

```
ct1=pd.crosstab(data['Gender'],data['Product'],margins=True,margins_name='Total')
ct1
```

Out[298]:

Product	KP281	KP481	KP781	Total
Gender				
Female	40	29	7	76
Male	40	31	33	104
Total	80	60	40	180

In [301]:

```
pd.crosstab(data['Gender'],data['Product'],margins=True,normalize=1)
```

Out[301]:

Product	KP281	KP481	KP781	All
Gender				
Female	0.5	0.483333	0.175	0.422222
Male	0.5	0.516667	0.825	0.577778

In [302]:

```
pd.crosstab(data['Gender'],data['Product'],margins=True,normalize=0)
```

Out[302]:

Product	KP281	KP481	KP781
Gender			
Female	0.526316	0.381579	0.092105
Male	0.384615	0.298077	0.317308
All	0.444444	0.333333	0.222222

Marginal probability of a customer buying KP281,KP481,KP781 are 0.44,0.33,0.22 respectivly

Marginal probability of a male customer buying KP281,KP481,KP781 are 0.38,0.29,0.31 respectivly

Marginal probability of a female customer buying KP281,KP481,KP781 are 0.52,0.38,0.09 respectivly

Here Customers are more willing to buy the base product based on their income,fitness levels i.e KP281 as it has more probability.

Among males and females, males are more interested to buy the higher end treadmill model KP781

Conditional Probabilities of KP281,KP481,KP781 given that customer is female are 0.53,0.38,0.09 and customer is

In [309]:

```
#Joint probabilty
```

In [310]:

```
ct1
```

Out[310]:

Product	KP281	KP481	KP781	Total
Gender				
Female	40	29	7	76
Male	40	31	33	104
Total	80	60	40	180

In [323]:

```
KP281_and_Female_prob=round(ct1.iloc[0,0]/ct1.Total[2],2)
KP281_and_Female_prob
```

Out[323]:

```
0.22
```

In [325]:

```
KP481_and_Female_prob=round(ct1.KP481[0]/ct1.Total[2],2)
KP481_and_Female_prob
```

Out[325]:

```
0.16
```

In [326]:

```
KP781_and_Female_prob=round(ct1.KP781[0]/ct1.Total[2],2)
KP781_and_Female_prob
```

Out[326]:

```
0.04
```

In [328]:

```
KP281_and_male_prob=round(ct1.iloc[0,0]/ct1.Total[2],2)
KP281_and_male_prob
```

Out[328]:

```
0.22
```

In [329]:

```
KP481_and_male_prob=round(ct1.KP481[1]/ct1.Total[2],2)
KP481_and_male_prob
```

Out[329]:

```
0.17
```

In [330]:

```
KP781_and_male_prob=round(ct1.KP781[1]/ct1.Total[2],2)
KP781_and_male_prob
```

Out[330]:

```
0.18
```

Joint probabilities of customer being the female wrt the product being KP281,KP481,KP781 are 0.22,0.16,0.04

Joint probabilities of customer being the male wrt the product being KP281,KP481,KP781 are 0.22,0.17,0.18

In [331]:

```
#Conditional Probabilities
```

In [333]:

```
prob_KP281_given_Female=round(ct1.iloc[0,0]/ct1.Total[0],2)
print(prob_KP281_given_Female)
prob_KP481_given_Female=round(ct1.KP481[0]/ct1.Total[0],2)
print(prob_KP481_given_Female)
prob_KP781_given_Female=round(ct1.KP781[0]/ct1.Total[0],2)
print(prob_KP781_given_Female)
```

```
0.53
0.38
0.09
```

In [334]:

```
prob_KP281_given_male=round(ct1.iloc[0,1]/ct1.Total[1],2)
print(prob_KP281_given_male)
prob_KP481_given_male=round(ct1.KP481[1]/ct1.Total[1],2)
print(prob_KP481_given_male)
prob_KP781_given_male=round(ct1.KP781[1]/ct1.Total[1],2)
print(prob_KP781_given_male)
```

```
0.28
0.3
0.32
```

Summary of Business Insights based on Analysis

It is observed that data has no null values

In three types of treadmills available the base version which is KP281 has been sold more with 44% of total, thus followed by medium range product KP481 with 33% and high end product with 22%.

Average Age of the customers is 28.7 but this is contains outliers so, its best to consider median as the mean to know the average age which is 26.

There are 5 outliers, because of this there is a increase in mean, its ideal to consider the median which is 50% percentile which gives correct mean age of the purchased people.

Most of the customers belong to age group of 22 to 28.

Most of the customers are graduates who are intrested in buying treadmill.

The distribution of products is high among the middle class customers with Annual income of customers with range betweeen 45k dollars and 60K dollars.

People who are intermediate level in terms of fitness,usage are more interested in buying tredmill than the very active people as they want to start their fitness regime at home.

People with intermediate fitness and low in fitness are considering base verison of treadmill first i.e KP281 followed by KP481 and people with high fitness want the higher end product which is of high cost i.e KP781.

Looks like Partnered people holds the high distribution considering they have lot of responsibilities and less time to go out for run will prefer treadmill for home run.

Boxplot clearly shows based on the income levels, the customer bought the product. Product bought is directly proportional to the customer income.

From the count plot, we can assume that teenagers are strictly confined to base versions, where people who are financially independent are will to opt for the mid level and higher level treadmills i.e KP481 and KP781

Customers with age 25 bought medium product KP481 more than ever compared to other ages & products.

The scatterplot b/w fitness,usage,products clearly shows people with high fitness and high usage use the high end treadmill KP781.

Pairplots and heatmaps are the charts which are used to show corelation between all the variables present in the how two variables are giving insights of customers interests in choosing products.

Marginal probability of a customer buying KP281,KP481,KP781 are 0.44,0.33,0.22 respectivly

Marginal probability of a male customer buying KP281,KP481,KP781 are 0.38,0.29,0.31 respectivly

Marginal probability of a female customer buying KP281,KP481,KP781 are 0.52,0.38,0.09 respectivly

Customers are more willing to buy the base product based on their income,fitness levels i.e KP281 as it has more probability.

Among males and females, males are more interested to buy the higher end treadmill model KP781.

Conditional Probabilities of KP281,KP481,KP781 given that customer is female are 0.53,0.38,0.09 and customer is male are 0.28, 0.3, 0.32.

Joint probabilities of customer being the female wrt the product being KP281,KP481,KP781 are 0.22,0.16,0.04.

Recommendations

1) From the data it is visible that most of customers are not shy to invest on their health priorities by buying treadmill based on their fitness and usage. Aerofit should give training and show the analysis to sales people for pitching the product based on their fitness levels,usage and income.

2) We can see that medium range product KP481 is highly preferred among median age groups and customers with intermediate fitness. So, Aerofit could think of some offers on high end products and tempt this section of customers to opt for KP781.

3) We can see that females are more interested in the base versions, I would suggest Aerofit to conduct women fitness campaigns and offer goodies or provide discount for the high end products.

4) Aerofit can implement the trade in feature of old product for the old customers and offer discount in new products. These feature will give hope for the customer to return in future.

5) Aerofit should concentrate Marketing products on different streams such as TV, youtube,newspapers where we can spread the word which will help the families to buy product as the treadmill can be used by whole family which is why customers will be more interested in it.

In [ ]:

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