Business Case: Aerofit – Descriptive Statistics & Probability

Submitted by**: Shivani Prajapati**

About **Aerofit**:

Aerofit is a leading brand in the field of fitness equipment**. Aerofit** provides a product range including machines such as treadmills, exercise bikes, gym equipment, and fitness accessories to cater to the needs of all categories of people.

Task:

3 types of treadmills are given: KP281, KP481, KP781. The task is 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.

Columns

- Product Purchased: KP281, KP481, or KP781
- Age: In years
- Gender: Male/Female
- Education: In years
- Marital Status: Single or partnered
- Usage: The average number of times the customer plans to use the treadmill each week.
- Income: Annual income (in $)
- Fitness: Self-rated fitness on a 1-to-5 scale, where 1 is the poor shape and 5 is the excellent shape.
- Miles: The average number of miles the customer expects to walk/run each week

```
import numpy as np
import pandas as pd

import matplotlib.pyplot as plt
import seaborn as sns
```

Q1. Import the dataset and do usual data analysis steps like checking the structure & characteristics of the dataset

Downloading the data:

```
!gdown 1DLkQw5SurlE0C-QgKQymkiL23eoDlFPf
```

```
Downloading...
From: https://drive.google.com/uc?id=1DLkQw5SurlE0C-QgKQymkiL23eoDlFPf
To: /content/aerofit_treadmill.csv
100% 7.28k/7.28k [00:00<00:00, 19.1MB/s]
```

How the data looks

```
#Read Data
af = pd.read_csv('aerofit_treadmill.csv')
af
```

	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

Next steps: View recommended plots | New interactive sheet

Understanding the Dataset

```
af.shape
```

```
(180, 9)
```

```
af.columns
```

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

Unique values in each column of the dataset:

```
af.nunique()
```

	0
Product	3
Age	32
Gender	2
Education	8
MaritalStatus	2
Usage	6
Fitness	5
Income	62
Miles	37

dtype: int64

```
af.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
```

Columns Product, Gender and MaritalStatus have object datatype. It can be changed to categorical datatype.

```
af = af.astype({'Product': 'category', 'Gender': 'category', 'MaritalStatus': 'category'})
```

```
af.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    category
 1   Age            180 non-null    int64   
 2   Gender         180 non-null    category
 3   Education      180 non-null    int64   
 4   MaritalStatus  180 non-null    category
 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: category(3), int64(6)
memory usage: 9.5 KB
```

```
af.isnull().sum()
```

	0
Product	0
Age	0
Gender	0
Education	0
MaritalStatus	0
Usage	0
Fitness	0
Income	0
Miles	0

dtype: int64

The dataset has no null columns

```
#Data Description
af.describe()
```

	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

```
af['Product'].value_counts()
```

Product	count
KP281	80
KP481	60
KP781	40

dtype: int64

Quick summary:

1. Most common used treadmill is KP281, which is the entry level treadmill and costs least among other treadmills ($1500).
2. Least common used treadmill is KP781. It has advance features and costs most ($2500).
3. 18 is the minimum age of the person who uses a treadmill and 50 is the maximum age.
4. 21 miles is the minimum miles a person is expected to run per week.
5. 360 miles is the maximum miles a person is expected to run per week.

Q3. Check if features like marital status, age have any effect on the product purchased (using countplot, histplots, boxplots etc)

AGE

```
af['Age'].unique()
```

```
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])
```

```
age_bin = range(15, 51, 5)
af['age_group'] = pd.cut(af['Age'], age_bin)
af.head()
```

	Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles	age_group
0	KP281	18	Male	14	Single	3	4	29562	112	(15, 20]
1	KP281	19	Male	15	Single	2	3	31836	75	(15, 20]
2	KP281	19	Female	14	Partnered	4	3	30699	66	(15, 20]
3	KP281	19	Male	12	Single	3	3	32973	85	(15, 20]
4	KP281	20	Male	13	Partnered	4	2	35247	47	(15, 20]

Next steps: View recommended plots New interactive sheet

```
pd.crosstab(af['Product'], af['age_group'], margins = True)
```

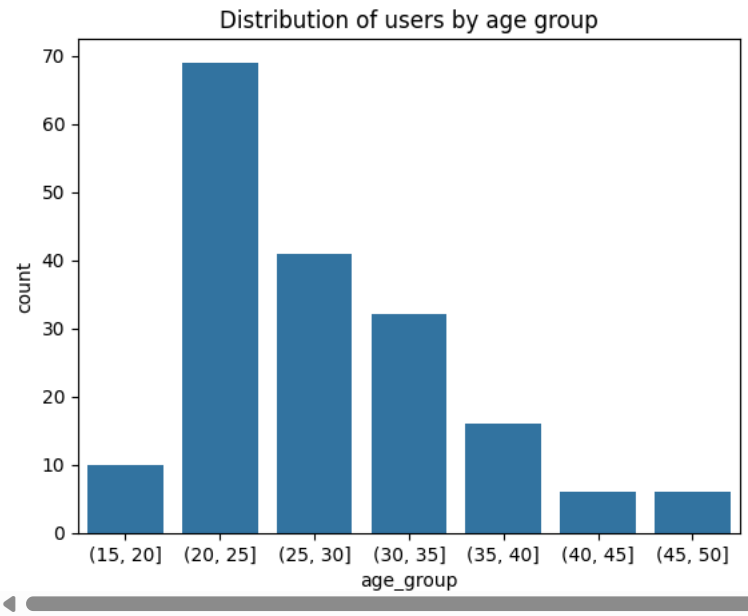
age_group	(15, 20]	(20, 25]	(25, 30]	(30, 35]	(35, 40]	(40, 45]	(45, 50]	All
Product								
KP281	6	28	21	11	8	3	3	80
KP481	4	24	7	17	6	1	1	60
KP781	0	17	13	4	2	2	2	40
All	10	69	41	32	16	6	6	180

```
69/180
```

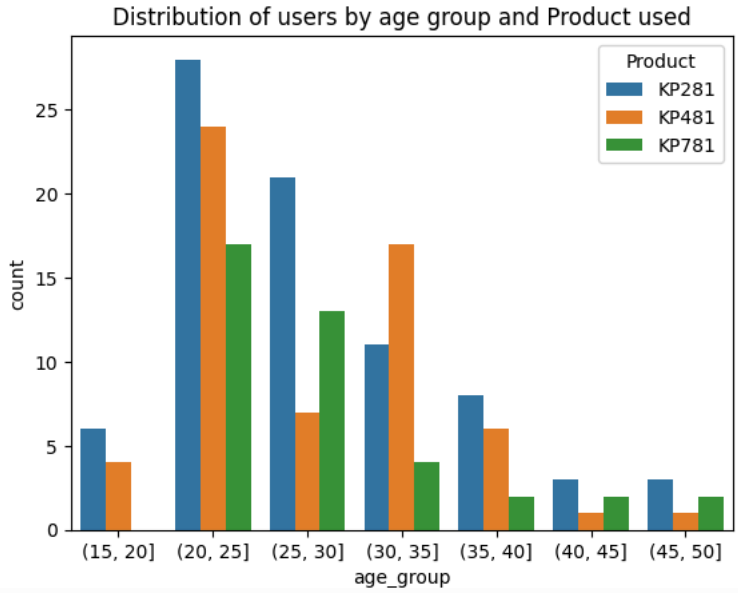
```
0.38333333333333336
```

38% treadmill users fall in the category (20, 25], which is the highest age group.

```
sns.countplot(data = af, x = 'age_group')
plt.title('Distribution of users by age group')
plt.show()
```




```
sns.countplot(data = af, x = 'age_group', hue = 'Product')
plt.title('Distribution of users by age group and Product used')
plt.show()
```



MARITAL STATUS

```
af_marital = af['MaritalStatus'].value_counts()
af_marital
```

MaritalStatus	count
Partnered	107
Single	73

dtype: int64

```
pd.crosstab(af['Product'], af['MaritalStatus'], margins = True)
```

Product	Partnered	Single	All
KP281	48	32	80
KP481	36	24	60
KP781	23	17	40
All	107	73	180

```
int(107*100/180), int(73*100/180)
```

```
(59, 40)
```

```
48/107, 36/107, 23/107
```

```
(0.4485981308411215, 0.3364485981308411, 0.21495327102803738)
```

```
32/73, 24/73, 17/73
```

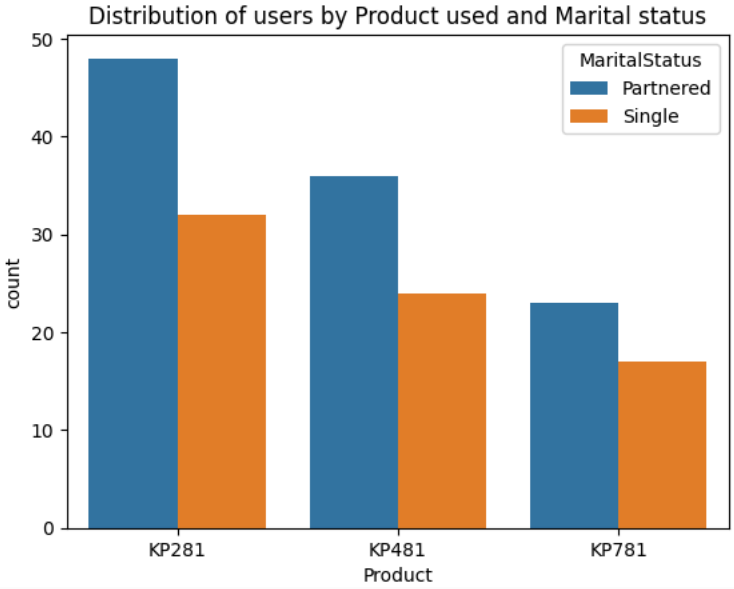
```
(0.4383561643835616, 0.3287671232876712, 0.2328767123287671)
```

```
23/40, 17/40
```

```
(0.575, 0.425)
```

1. ~60% people are partnered and 40% are single.
2. Among partnered, 44% are KP281 users, 33% are KP481 users, and 21% are KP781 users.
3. Among single, 43% are KP281 users, 32% are KP481 users, and 23% are KP781 users.

```
sns.countplot(data = af, x = 'Product', hue = 'MaritalStatus')
plt.title('Distribution of users by Product used and Marital status')
plt.show()
```



1. both in KP281 and KP481, 60% users are partnered and 40% are single.
2. Among KP781 users, 57% are partnered and 43% are single.

GENDER

```
pd.crosstab(af['Product'], af['Gender'], margins = True)
```

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

```
29*100/60, 31*100/60, 7*100/40, 33*100/40
```

```
(48.333333333333336, 51.666666666666664, 17.5, 82.5)
```

While KP281 users are 50% male and 50% female, and KP481 users are 48% female and 52% male, the ratio drastically changes for KP781 users (17.5% female and 82.5% male)

Question: What is the probability of a male customer buying a KP781 treadmill? Answer:

1. Conditional probability of a **male** customer buying a **KP781** treadmill is, P(T/M) = 33/104 = 33%.
2. Conditional probability of a **male** customer buying a **KP281** treadmill is, P(T/M) = 40/104 = 38%.
3. Conditional probability of a **male** customer buying a **KP481** treadmill is, P(T/M) = 31/104 = 30%.
4. Conditional probability of a **female** customer buying a **KP781** treadmill is, P(T/M) = 7/76 = 9%.
5. Conditional probability of a **female** customer buying a **KP281** treadmill is, P(T/M) = 40/76 = 52%.
6. Conditional probability of a **female** customer buying a **KP481** treadmill is, P(T/M) = 29/76 = 38%.

EDUCATION

```
af['Education'].value_counts()
```

Education	count
16	85
14	55
18	23
15	5
13	5
12	3
21	3
20	1

dtype: int64

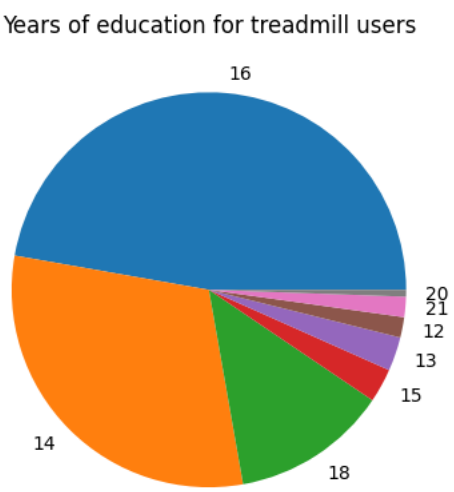
```
education_val = af['Education'].value_counts().index
education_val
```

```
Index([16, 14, 18, 15, 13, 12, 21, 20], dtype='int64', name='Education')
```

```
education_count = af['Education'].value_counts().values
education_count
```

```
array([85, 55, 23,  5,  5,  3,  3,  1])
```

```
fig, ax = plt.subplots()
ax.pie(education_count, labels= education_val)
plt.title('Years of education for treadmill users')
plt.show()
```



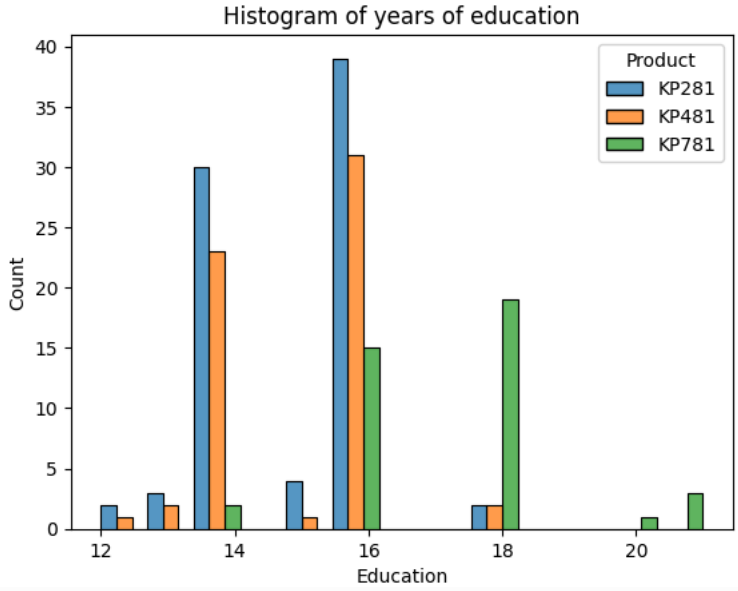

```
pd.crosstab(af['Product'], af['Education'], margins = True)
```

Product	12	13	14	15	16	18	20	21	All
KP281	2	3	30	4	39	2	0	0	80
KP481	1	2	23	1	31	2	0	0	60
KP781	0	0	2	0	15	19	1	3	40
All	3	5	55	5	85	23	1	3	180

1. among KP781 users, 47.5% (19/40) have **18 years** of education, and 37% (15/40) have **16 years** of education.
2. among KP481 users, 51% (31/60) have **16 years** of education, and 38% (23/60) have **14 years** of education.
3. among KP281 users, 48% (39/80) have **16 years** of education, and 37.5% (30/80) have **14 years** of education.
4. among people with higher years of education (18, 20 and 21 years), users have only purchased KP781 product.

```
sns.histplot(data = af, x = 'Education', hue = 'Product', multiple = 'dodge')
plt.title('Histogram of years of education')
plt.show()
```

```
plt.show()
```



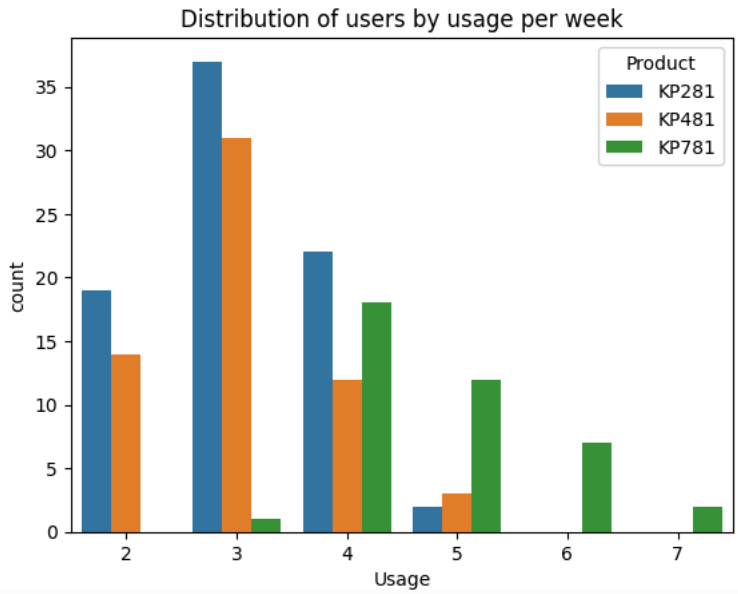
USAGE

```
pd.crosstab(af['Product'], af['Usage'], margins = True)
```

Usage	2	3	4	5	6	7	All
Product							
KP281	19	37	22	2	0	0	80
KP481	14	31	12	3	0	0	60
KP781	0	1	18	12	7	2	40
All	33	69	52	17	7	2	180

1. among KP281 users, 46% (37/80) use 3 times a week, and 27.5% (22/80) use 4 times a week.
2. among KP481 users, 51% (31/60) use 3 times a week, and 23% (14/60) use 2 times a week.
3. among KP781 users, 45% (18/40) use 4 times a week, and 30% (12/40) use 5 times a week.
4. users of KP781 treadmill are more consistent, and use it atleast 4 times a week. they can also go up to 7 times a week. which means they are more fitness obsessed.
5. users of other treadmills use them on an average 4 times a week and are less consistent.

```
sns.countplot(data = af, x = 'Usage', hue = 'Product', dodge = True)
plt.title('Distribution of users by usage per week')
plt.show()
```



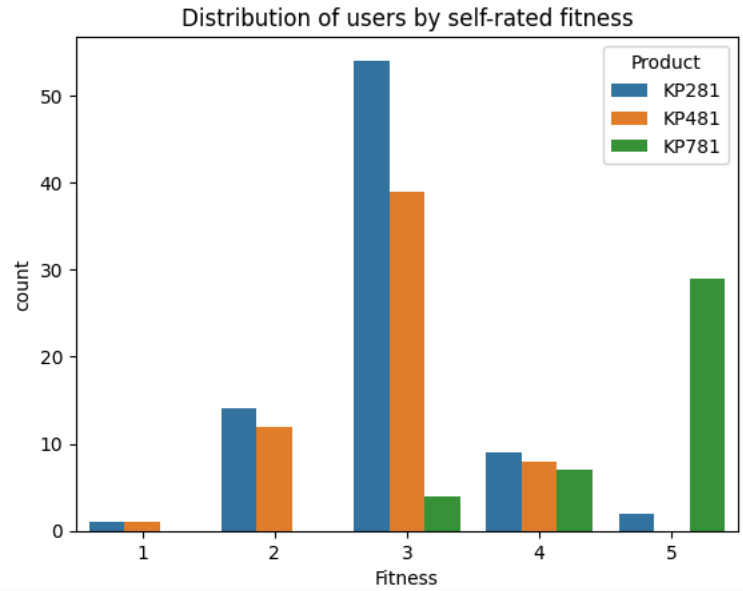
FITNESS

```
pd.crosstab(af['Product'], af['Fitness'], margins= True)
```

Fitness	1	2	3	4	5	All
Product						
KP281	1	14	54	9	2	80
KP481	1	12	39	8	0	60
KP781	0	0	4	7	29	40
All	2	26	97	24	31	180

1. More fitness rating of 4 or 5 are given by KP781 users.
2. Though more people are using KP281 model, advanced model users are more satisfied with their self-given ratings.

```
sns.countplot(data = af, x = 'Fitness', hue = 'Product')
plt.title('Distribution of users by self-rated fitness')
plt.show()
```



INCOME

```
af[af['Product'] == 'KP281'].describe()
```

	Age	Education	Usage	Fitness	Income	Miles
count	80.000000	80.000000	80.000000	80.00000	80.00000	80.000000
mean	28.550000	15.037500	3.087500	2.96250	46418.02500	82.787500
std	7.221452	1.216383	0.782624	0.66454	9075.78319	28.874102
min	18.000000	12.000000	2.000000	1.00000	29562.00000	38.000000
25%	23.000000	14.000000	3.000000	3.00000	38658.00000	66.000000
50%	26.000000	16.000000	3.000000	3.00000	46617.00000	85.000000
75%	33.000000	16.000000	4.000000	3.00000	53439.00000	94.000000
max	50.000000	18.000000	5.000000	5.00000	68220.00000	188.000000

```
af[af['Product'] == 'KP481'].describe()
```

	Age	Education	Usage	Fitness	Income	Miles
count	60.000000	60.000000	60.000000	60.00000	60.000000	60.000000
mean	28.900000	15.116667	3.066667	2.90000	48973.650000	87.933333
std	6.645248	1.222552	0.799717	0.62977	8653.989388	33.263135
min	19.000000	12.000000	2.000000	1.00000	31836.000000	21.000000
25%	24.000000	14.000000	3.000000	3.00000	44911.500000	64.000000
50%	26.000000	16.000000	3.000000	3.00000	49459.500000	85.000000
75%	33.250000	16.000000	3.250000	3.00000	53439.000000	106.000000
max	48.000000	18.000000	5.000000	4.00000	67083.000000	212.000000

```
af[af['Product'] == 'KP781'].describe()
```

	Age	Education	Usage	Fitness	Income	Miles
count	40.000000	40.000000	40.000000	40.000000	40.00000	40.000000
mean	29.100000	17.325000	4.775000	4.625000	75441.57500	166.900000
std	6.971738	1.639066	0.946993	0.667467	18505.83672	60.066544
min	22.000000	14.000000	3.000000	3.000000	48556.00000	80.000000
25%	24.750000	16.000000	4.000000	4.000000	58204.75000	120.000000
50%	27.000000	18.000000	5.000000	5.000000	76568.50000	160.000000
75%	30.250000	18.000000	5.000000	5.000000	90886.00000	200.000000
max	48.000000	21.000000	7.000000	5.000000	104581.00000	360.000000

```
af['Income'].value_counts().index
```

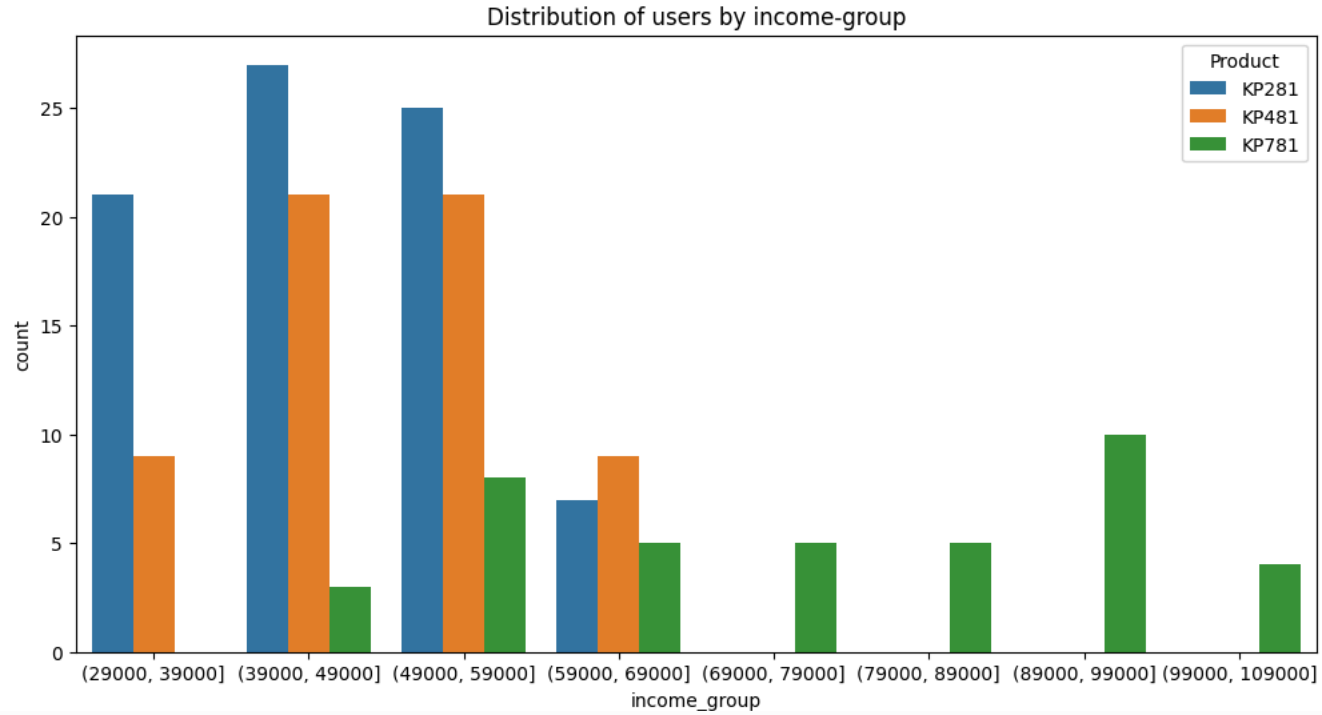
```
Index([ 45480,  52302,  53439,  54576,  46617,  51165,  50028,  40932,  48891,
        43206,  38658,  34110,  35247,  32973,  57987,  36384,  44343,  60261,
        59124,  90886,  92131,  64809,  56850,  61398,  39795,  67083,  47754,
        31836,  37521,  42069,  88396,  83416, 104581,  89641,  49801,  64741,
        48556,  61006,  55713,  68220,  30699,  29562,  58516,  54781,  62535,
        65220,  70966,  62251,  57271,  52291,  53536,  48658,  69721,  74701,
        77191,  75946,  52290,  85906,  99601, 103336,  95866,  95508],
      dtype='int64', name='Income')
```

```
income_bin = range(29000, 110000, 10000)
af['income_group'] = pd.cut(af['Income'], income_bin)
af.head()
```

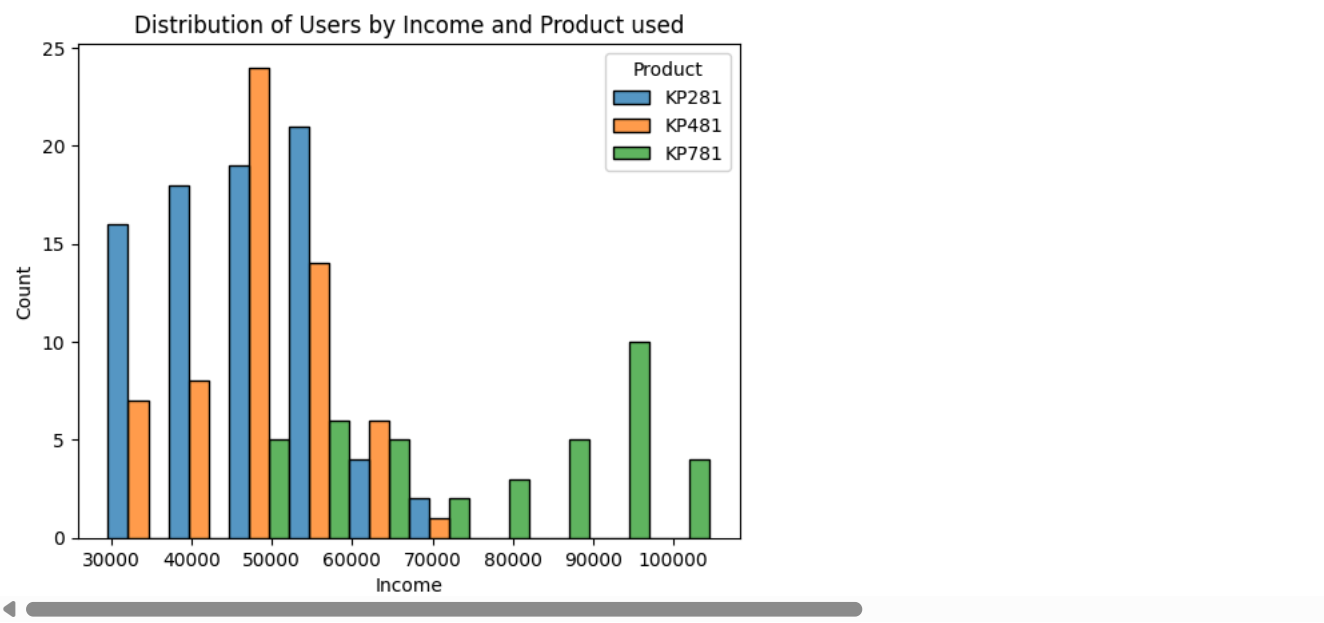
	Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles	age_group	income_group
0	KP281	18	Male	14	Single	3	4	29562	112	(15, 20]	(29000, 39000]
1	KP281	19	Male	15	Single	2	3	31836	75	(15, 20]	(29000, 39000]
2	KP281	19	Female	14	Partnered	4	3	30699	66	(15, 20]	(29000, 39000]
3	KP281	19	Male	12	Single	3	3	32973	85	(15, 20]	(29000, 39000]
4	KP281	20	Male	13	Partnered	4	2	35247	47	(15, 20]	(29000, 39000]

Next steps: View recommended plots New interactive sheet

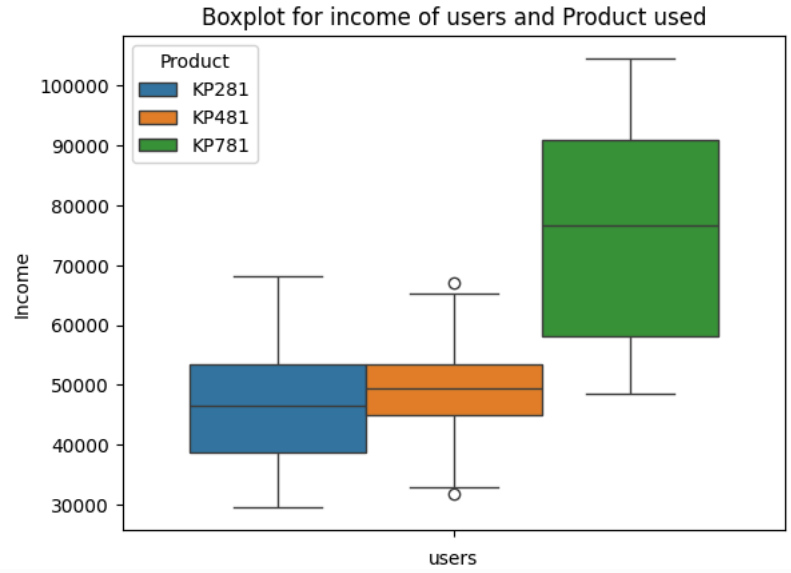
```
plt.figure(figsize = (12,6))
sns.countplot(data = af, x = 'income_group', hue = 'Product')
plt.title('Distribution of users by income-group')
plt.show()
```




```
sns.histplot(data = af, x = 'Income', bins = 10, hue = 'Product', multiple= 'dodge')
plt.title('Distribution of Users by Income and Product used')
plt.show()
```




```
sns.boxplot(data = af, y = 'Income', hue = 'Product')
plt.title('Boxplot for income of users and Product used')
plt.xlabel('users')
plt.show()
```



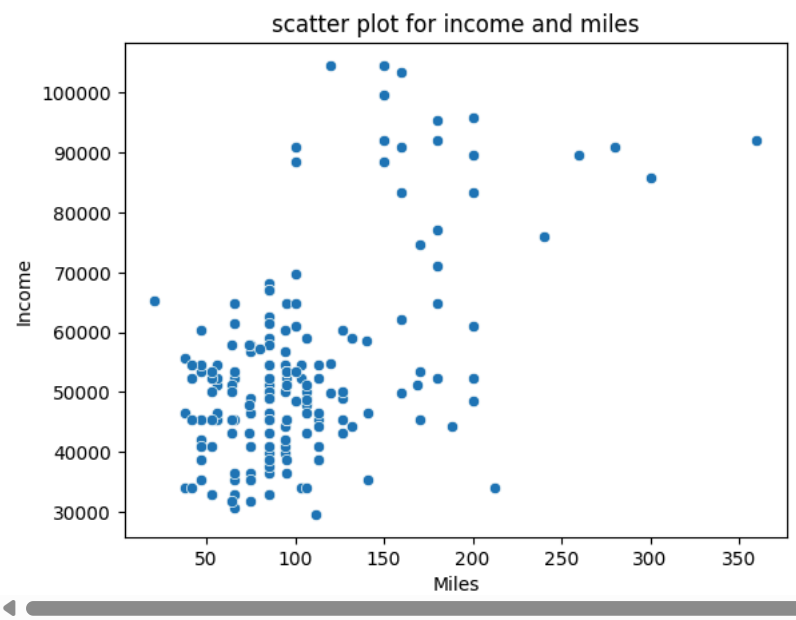
Miles

```
af.head()
```

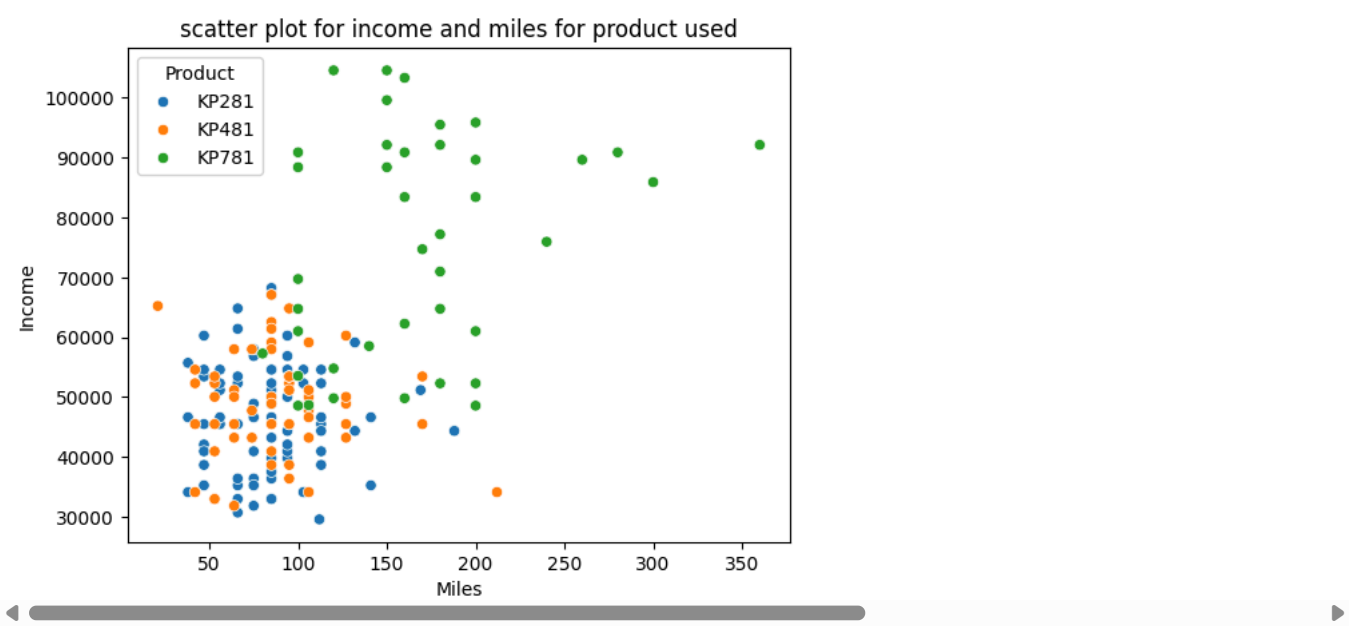
	Product	Age	Gender	Education	MaritalStatus	Usage	Fitness	Income	Miles	age_group	income_group
0	KP281	18	Male	14	Single	3	4	29562	112	(15, 20]	(29000, 39000]
1	KP281	19	Male	15	Single	2	3	31836	75	(15, 20]	(29000, 39000]
2	KP281	19	Female	14	Partnered	4	3	30699	66	(15, 20]	(29000, 39000]
3	KP281	19	Male	12	Single	3	3	32973	85	(15, 20]	(29000, 39000]
4	KP281	20	Male	13	Partnered	4	2	35247	47	(15, 20]	(29000, 39000]

Next steps: View recommended plots New interactive sheet

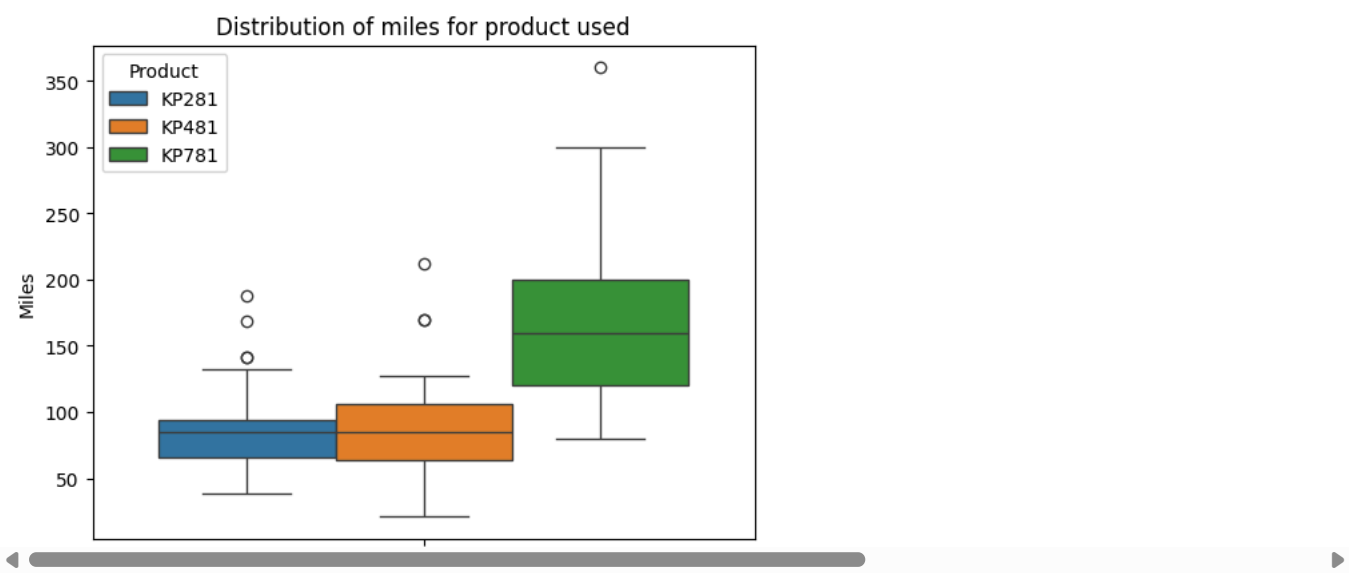
```
sns.scatterplot(data = af, x = 'Miles', y = 'Income')
plt.title('scatter plot for income and miles')
plt.show()
```




```
sns.scatterplot(data = af, x = 'Miles', y = 'Income', hue = 'Product')
plt.title('scatter plot for income and miles for product used')
plt.show()
```




```
sns.boxplot(data = af, y = 'Miles', hue = 'Product')
plt.title('Distribution of miles for product used')
plt.show()
```



1. KP781 has the highest mileage performance but also shows the most variability, including some very high outliers.

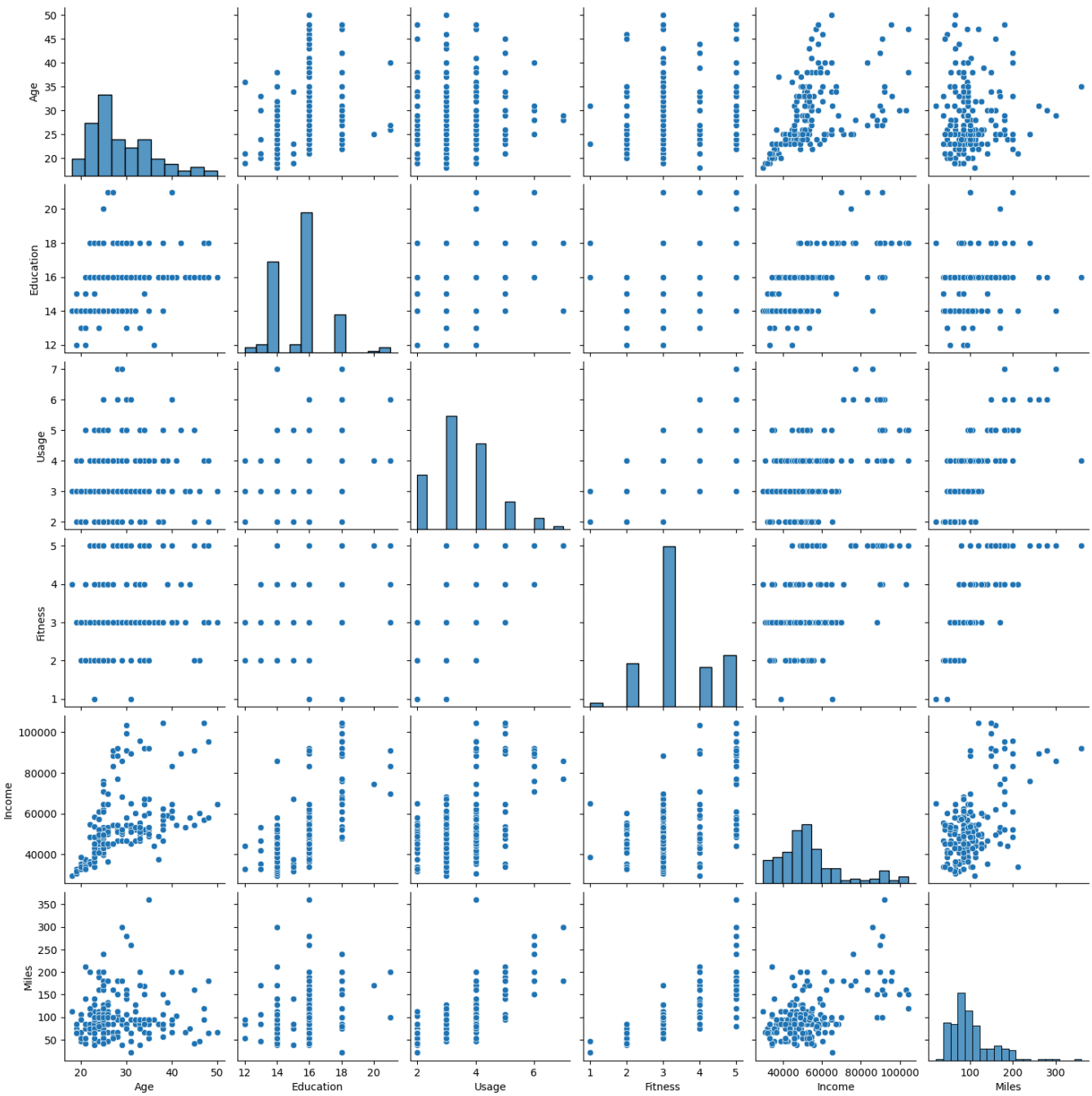
2. KP481 performs slightly better than KP281 but still has a similar range.

3. KP281 has the lowest mileage and the least variability, making it more consistent but lower in performance.

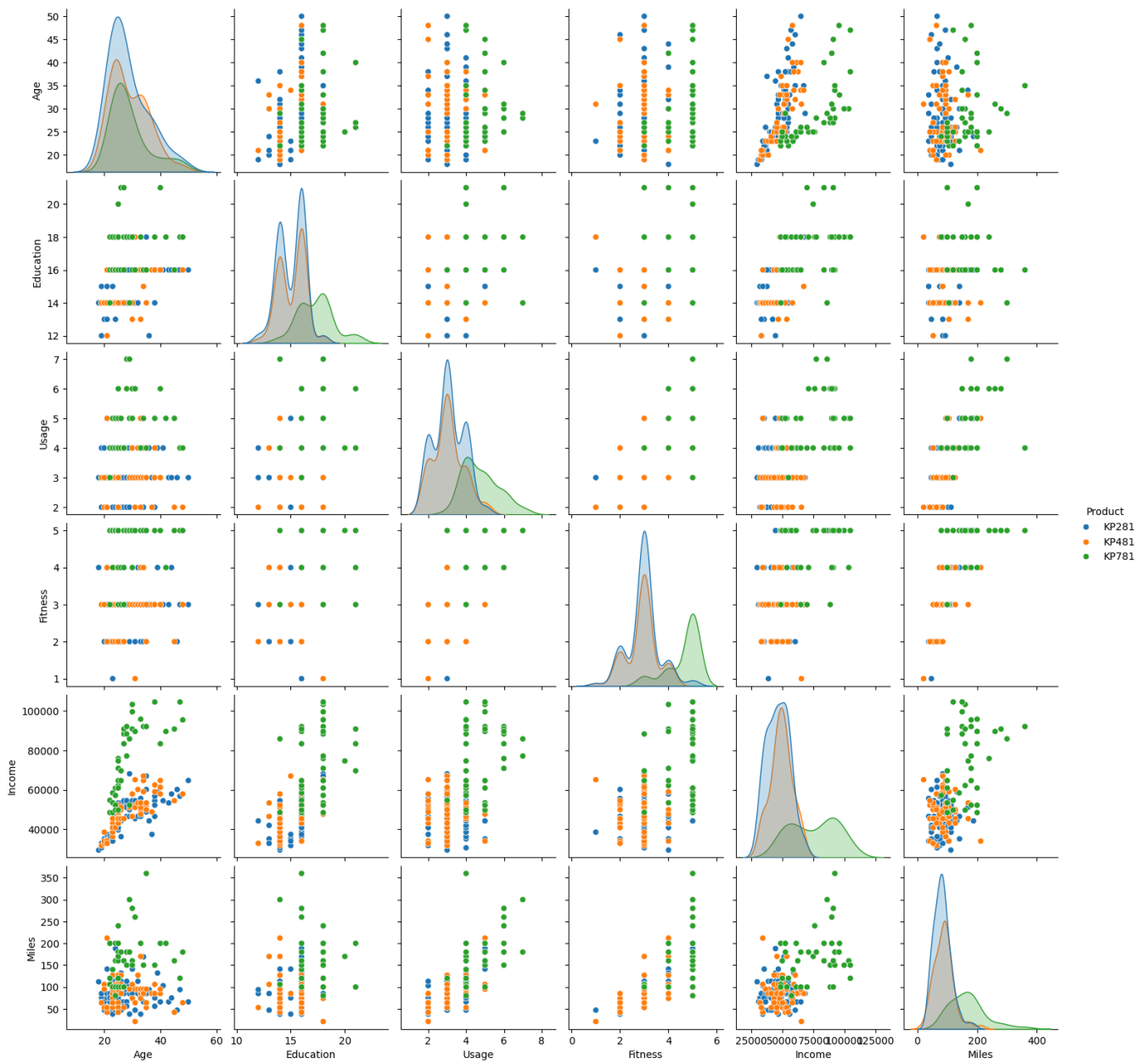
Question: Check correlation among different factors using heat maps or pair plots.

```
sns.pairplot(data = af)
plt.show()
```

[+]




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



Insights:

1. income and miles convered shows positive correlation. Meaning, as income increases, miles covered also increases. KP781 users have higher income than other users.
2. Income and age are also correlated.

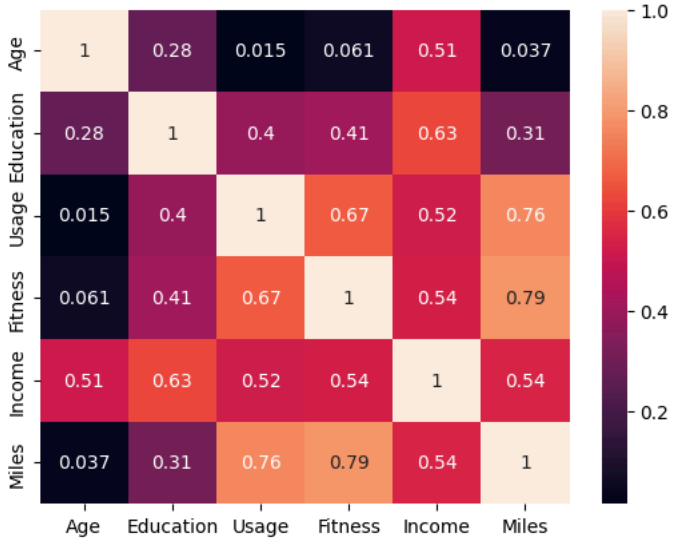
Heatmap

```
cor = af.select_dtypes(include= ['number']).corr()
cor
```

	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

Next steps: View recommended plots | New interactive sheet

```
sns.heatmap(cor, annot = True)
plt.show()
```



*summary: *

1. education and income are correlated.
2. usage and fitness are correlated. The more a person uses treadmill per week, the more fit he/ she gets.
3. usage and miles are correlated.
4. Miles and fitness are correlated. More miles covered, more fit a person gets.

Double-click (or enter) to edit

KP281:

1. This product is for beginners.
2. People of all age group use KP281, but maximum users fall in the age group 20 to 30 years.
3. Chances of a male user buying this model is 38%, but chances of a female user buying this model are 52%. Hence, company should focus more on female customers for this model.
4. Company should focus on users with less years of education group (13 years to 16 years).
5. Company should focus on users who have less time and are not so consistent with running and typically use it for 2 to 4 times a week.
6. Minimum income of users is $ 29,562, maximum is $ 68,220, and median income of users of this product is $ 46,617. Hence company should consider the income range while choosing the customers for this product.
7. Since income and miles are correlated, people who run consistently but less miles lie in this product category.

KP481:

1. This product is for intermediate users.
2. Most of the users fall in the age group 20 to 35 years.
3. Chances of male users buying this treadmill is 30% and female user buying this treadmill is 38%. So, company should focus on both genders equally.
4. Company should focus on users with average years of education group (14 years to 16 years).
5. Company should focus on users who run 2 to 4 times per week.
6. Minimum income of users is $ 31836, maximum is $ 67083, and median income of users of this product is $ 49459.5. Hence company should consider the income range while choosing the customers for this product.

KP781:

1. This product is for users who are fitness enthusiasts
2. Among KP781 users, ~83% users are male, which shows that male population is a perfect group to focus on for this group, but also significant focus can be given on female fitness enthusiasts.
3. People with higher years of education (16 to 21 years) should be targeted for KP781 product.
4. Company should focus on users who are seriously focussed on running and run up to 7 times per week.
5. Company should target people who like to maintain highest physique.
6. Users of this product comes from high income group. (median income is $76,578.5)