Aerofit - Descriptive Statistics & Probability

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1 Business Case: Aerofit - Descriptive Statistics & Probability

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[ ]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

import math
from scipy.stats import norm, binom, geom, zscore, ttest_1samp, ttest_ind

sns.set_theme(style="darkgrid")
```

[ ]:
```
aerofit = pd.read_csv("./aerofit_treadmill.csv")
aerofit.head(5)
```

[ ]:

	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

1.1 Provided Inputs

[ ]:
```
price = pd.DataFrame([["KP281", 1500], ["KP481", 1750], ["KP781",␣
↪2500]],columns=["Product", "Price"])
price
```

[ ]:

	Product	Price
0	KP281	1500
1	KP481	1750
2	KP781	2500

1.2 Exploring The Data Set

[ ]:
```
aerofit.shape
```

[ ]: (180, 9)

[ ]:
```
aerofit.size
```

[ ]: 1620

[ ]:
```
aerofit = aerofit[['Product', 'Gender', 'MaritalStatus', 'Age', 'Income',␣
 ↪'Miles', 'Education', 'Fitness', 'Usage']]
```

[ ]:
```
aerofit.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   Gender         180 non-null    object
 2   MaritalStatus  180 non-null    object
 3   Age            180 non-null    int64
 4   Income         180 non-null    int64
 5   Miles          180 non-null    int64
 6   Education      180 non-null    int64
 7   Fitness        180 non-null    int64
 8   Usage          180 non-null    int64
dtypes: int64(6), object(3)
memory usage: 12.8+ KB
```

1.2.1 Missing value detection & fill with relevent data.

[ ]:
```
aerofit.isnull().sum()
```

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

1.2.2 Check for Outliers

[ ]:
```python
def check_outlier(df, x):
    Q1 = df[x].quantile(0.25)
    Q3 = df[x].quantile(0.75)
    IQR = Q3 - Q1
    lower = Q1 - 1.5*IQR
    upper = Q3 + 1.5*IQR
    lower_outlier = df[x][df[x] < lower]
    upper_outlier = df[x][df[x] > upper]

    return {
        'lower': {
            'list': lower_outlier,
            'length': len(lower_outlier)
        },
        'upper': {
            'list': upper_outlier,
            'length': len(upper_outlier)
        }}
```

[ ]:
```python
for i in aerofit[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].
 ↪columns:
    # print(i)
    outlier = check_outlier(aerofit, i)
    print("{} : ({}, {})".format(i, outlier['lower']['length'],␣
 ↪outlier['upper']['length']))
```

```
Age : (0, 5)
Income : (0, 19)
Miles : (0, 13)
Education : (0, 4)
Fitness : (2, 0)
Usage : (0, 9)
```

1.2.3 Conversion of categorical attributes to 'category'.

[ ]:
```python
aerofit['Product'] = aerofit['Product'].astype('category')
aerofit['Gender'] = aerofit['Gender'].astype('category')
aerofit['MaritalStatus'] = aerofit['MaritalStatus'].astype('category')
aerofit.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   Gender         180 non-null    category
```

 2   MaritalStatus 180 non-null   category
 3   Age   180 non-null   int64
 4   Income   180 non-null   int64
 5   Miles   180 non-null   int64
 6   Education   180 non-null   int64
 7   Fitness   180 non-null   int64
 8   Usage   180 non-null   int64
dtypes: category(3), int64(6)
memory usage: 9.5 KB

Insight * 'Product', 'Gender', 'MaritalStatus' are Converted as Type Category.

1.2.4 ****Consolidated Data****

[ ]:
```
def aerofit_categorise(df):
    df["age_group"] = pd.cut(x=df['Age'], bins=[0,15,20,25,30,35,40,45,50],
                    labels=["0-15", "15-20", "20-25", "25-30", "30-35",␣
↪"35-40", "40-45", "45-50"])
    df['age_group'] = df['age_group'].astype('category')

    df["income_group"] = pd.cut(x=df['Income'],␣
↪bins=[0,25000,35000,45000,55000,65000,75000,85000,95000,105000],
                    labels=["0-25K", "25K-35K", "35K-45K", "45K-55K",␣
↪"55K-65K", "65K-75K", "75K-85K", "85K-95K", "95K-105K"])
    df['income_group'] = df['income_group'].astype('category')

    df["miles_group"] = pd.cut(x=df['Miles'],␣
↪bins=[0,20,50,80,110,140,170,200,230,260,290,320,350,380],
                    labels=["0-20", "20-50", "50-80", "80-110", "110-140",␣
↪"140-170", "170-200", "200-230", "230-260", "260-290", "290-320", "320-350",␣
↪"350-380"])
    df['miles_group'] = df['miles_group'].astype('category')

    df['education_group'] = df['Education'].astype('category')
    df['fitness_group'] = df['Fitness'].astype('category')
    df['usage_group'] = df['Usage'].astype('category')

    return df

aerofit = aerofit_categorise(aerofit)
aerofit.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 180 entries, 0 to 179
Data columns (total 15 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   Product           180 non-null    category
```

```
 1   Gender          180 non-null    category
 2   MaritalStatus   180 non-null    category
 3   Age             180 non-null    int64
 4   Income          180 non-null    int64
 5   Miles           180 non-null    int64
 6   Education       180 non-null    int64
 7   Fitness         180 non-null    int64
 8   Usage           180 non-null    int64
 9   age_group       180 non-null    category
 10  income_group    180 non-null    category
 11  miles_group     180 non-null    category
 12  education_group 180 non-null    category
 13  fitness_group   180 non-null    category
 14  usage_group     180 non-null    category
dtypes: category(9), int64(6)
memory usage: 12.7 KB
```

1.2.5 Statistical Summary

Descriptive Statistits

[ ]:
```
aerofit[['Product', 'Gender', 'MaritalStatus']].describe()
```

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

[ ]:
```
aerofit[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].describe()
```

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

            Usage
count  180.000000
mean     3.455556
std      1.084797
min      2.000000
25%      3.000000
50%      3.000000
75%      4.000000
```

```
max      7.000000
```

[ ]:
```
aerofit[['age_group', 'income_group', 'miles_group', 'education_group',␣
 ↪'usage_group', 'fitness_group']].describe()
```

[ ]:
```
       age_group income_group miles_group  education_group  usage_group  \
count        180          180         180              180          180
unique         7            8          11                8            6
top        20-25      45K-55K      80-110               16            3
freq          69           77          66               85           69

        fitness_group
count             180
unique              5
top                 3
freq               97
```

Unique Count

[ ]:
```
aerofit.nunique()
```

[ ]:
```
Product             3
Gender              2
MaritalStatus       2
Age                32
Income             62
Miles              37
Education           8
Fitness             5
Usage               6
age_group           7
income_group        8
miles_group        11
education_group     8
fitness_group       5
usage_group         6
dtype: int64
```

Mean

[ ]:
```
aerofit[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].mean()
```

[ ]:
```
Age             28.788889
Income       53719.577778
Miles          103.194444
Education       15.572222
Fitness          3.311111
Usage            3.455556
dtype: float64
```

Median

```
[ ]: aerofit[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].median()
```

```
[ ]: Age              26.0
     Income        50596.5
     Miles            94.0
     Education        16.0
     Fitness           3.0
     Usage             3.0
     dtype: float64
```

Mode

```
[ ]: for i in aerofit.columns:
       print(i,':',aerofit[i].mode()[0])
```

```
Product : KP281
Gender : Male
MaritalStatus : Partnered
Age : 25
Income : 45480
Miles : 85
Education : 16
Fitness : 3
Usage : 3
age_group : 20-25
income_group : 45K-55K
miles_group : 80-110
education_group : 16
fitness_group : 3
usage_group : 3
```

1.3 Uni Variate Analysis

1.3.1 Product

```
[ ]: aerofit['Product'].unique()
```

```
[ ]: ['KP281', 'KP481', 'KP781']
     Categories (3, object): ['KP281', 'KP481', 'KP781']
```

```
[ ]: aerofit['Product'].value_counts()
```

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

Statitical Analysis

[ ]:
```
aerofit['Product'].describe()
```

[ ]:
```
count        180
unique         3
top        KP281
freq          80
Name: Product, dtype: object
```

[ ]:
```
aerofit['Product'].mode()[0]
```

[ ]:
```
'KP281'
```

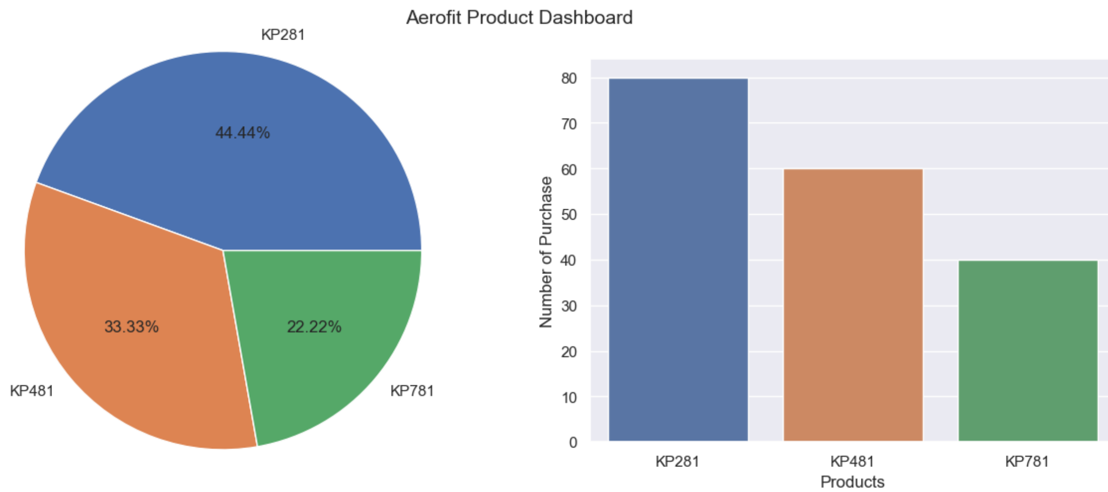
Find Probability

[ ]:
```
aerofit['Product'].value_counts(normalize=True)*100
```

[ ]:
```
KP281    44.444444
KP481    33.333333
KP781    22.222222
Name: Product, dtype: float64
```

Plot the Graph

[ ]:
```
plt.figure(figsize=(15,5)).suptitle("Aerofit Product Dashboard",fontsize=14)

plt.subplot(1, 2, 1)
plt.pie(aerofit['Product'].value_counts().values,labels = aerofit['Product'].
  ↪value_counts().index,radius = 1.3,autopct = '%1.2f%%',) # type: ignore

plt.subplot(1, 2, 2)
sns.countplot(aerofit, x='Product')
plt.xlabel('Products', fontsize=12)
plt.ylabel('Number of Purchase', fontsize=12)

plt.show()
```



Insight * There is only 3 type of Product. which are `KP281`, `KP481` & `KP781`. * There are 80 `KP281` which is equivalent to 44.44%. * There are 60 `KP481` which is equivalent to 33.33%. * There are 40 `KP781` which is equivalent to 22.22%.

1.3.2 Gender

[ ]:
```
aerofit['Gender'].unique()
```

[ ]:
```
['Male', 'Female']
Categories (2, object): ['Female', 'Male']
```

[ ]:
```
aerofit['Gender'].value_counts()
```

[ ]:
```
Male      104
Female     76
Name: Gender, dtype: int64
```

[ ]:
```
aerofit['Gender'].value_counts(normalize=True)*100
```

[ ]:
```
Male      57.777778
Female    42.222222
Name: Gender, dtype: float64
```

Statitical Analysis

[ ]:
```
aerofit['Gender'].describe()
```

[ ]:
```
count      180
unique       2
top       Male
```

```
freq       104
Name: Gender, dtype: object
```

[ ]:
```
aerofit['Gender'].mode()[0]
```

[ ]:
```
'Male'
```

[ ]:
```
aerofit.groupby('Product')["Gender"].describe()
```

[ ]:
```
        count unique     top freq
Product
KP281      80      2  Female   40
KP481      60      2    Male   31
KP781      40      2    Male   33
```

Find Probability

Probability of a `Product` & `Gender` across all Combination *"Product Gender"*

[ ]:
```
pd.crosstab(aerofit['Gender'], aerofit['Product'], normalize=True,␣
 ↪margins=True)*100
```

[ ]:
```
Product      KP281      KP481      KP781         All
Gender
Female   22.222222  16.111111   3.888889   42.222222
Male     22.222222  17.222222  18.333333   57.777778
All      44.444444  33.333333  22.222222  100.000000
```

Probability of `Product's` for given `Gender` *"Product | Gender"*

[ ]:
```
pd.crosstab(aerofit['Gender'], aerofit['Product'], normalize='index',␣
 ↪margins=True)*100
```

[ ]:
```
Product      KP281      KP481      KP781
Gender
Female   52.631579  38.157895   9.210526
Male     38.461538  29.807692  31.730769
All      44.444444  33.333333  22.222222
```

Probability of `Gender` for given `Product` *"Gender | Product"*

[ ]:
```
pd.crosstab(aerofit['Gender'], aerofit['Product'], normalize='columns',␣
 ↪margins=True)*100
```

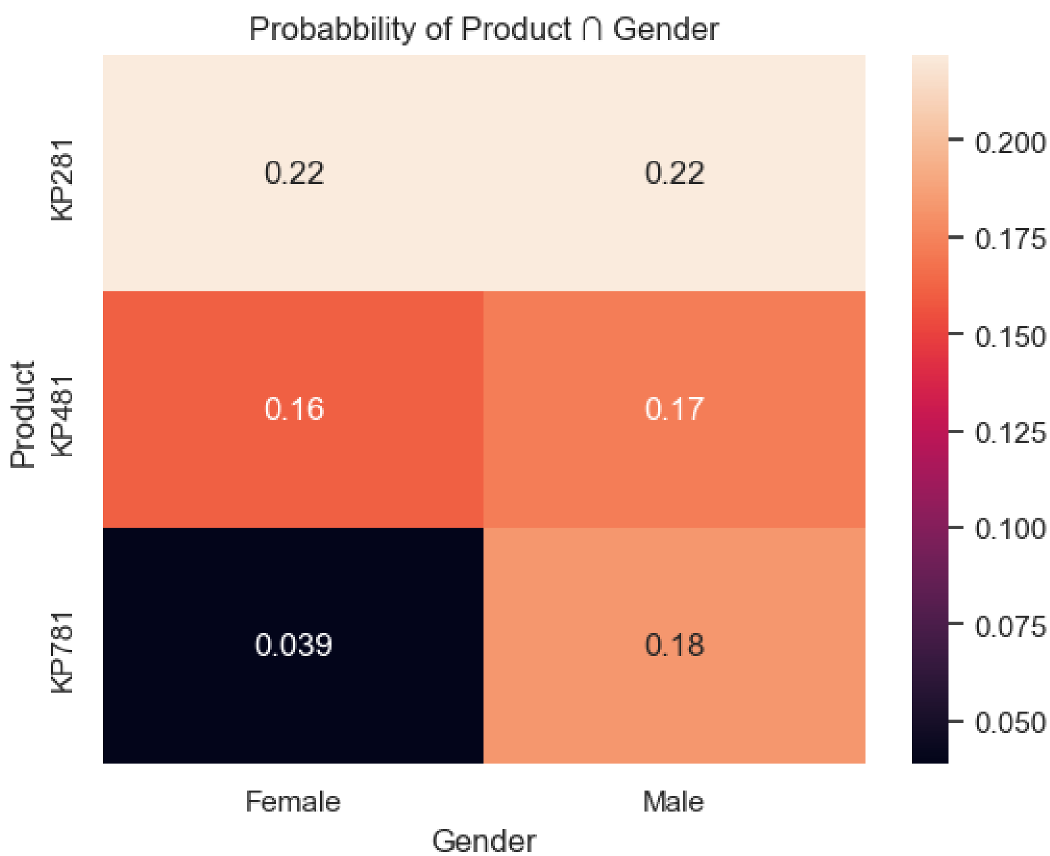
[ ]:
```
Product  KP281      KP481  KP781        All
Gender
Female    50.0  48.333333   17.5  42.222222
Male      50.0  51.666667   82.5  57.777778
```

Plot the Graph

Heat Map

```
[ ]: sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['Gender'],␣
      ↪normalize='all'),annot=True)
     plt.title('Probabbility of Product   Gender', fontsize=12)
```

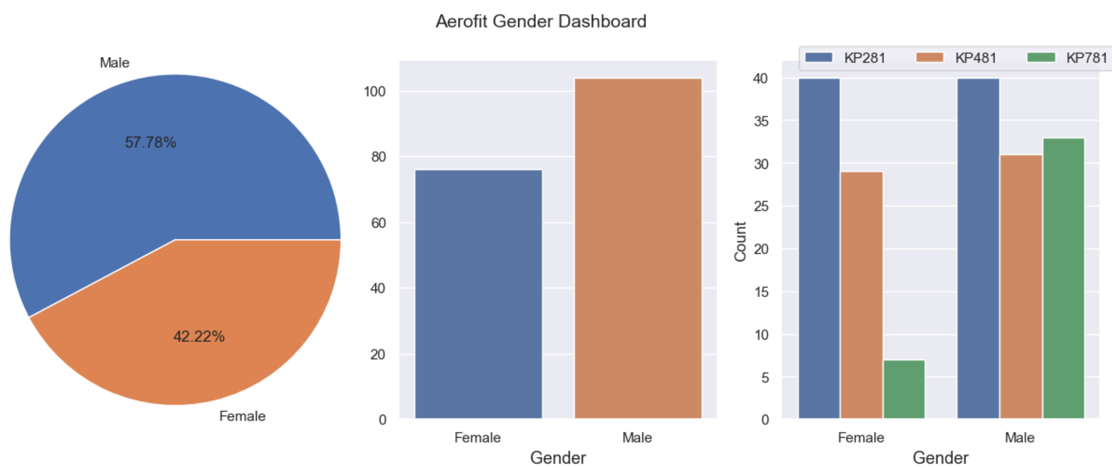
```
[ ]: Text(0.5, 1.0, 'Probabbility of Product   Gender')
```



Descriptive Plot

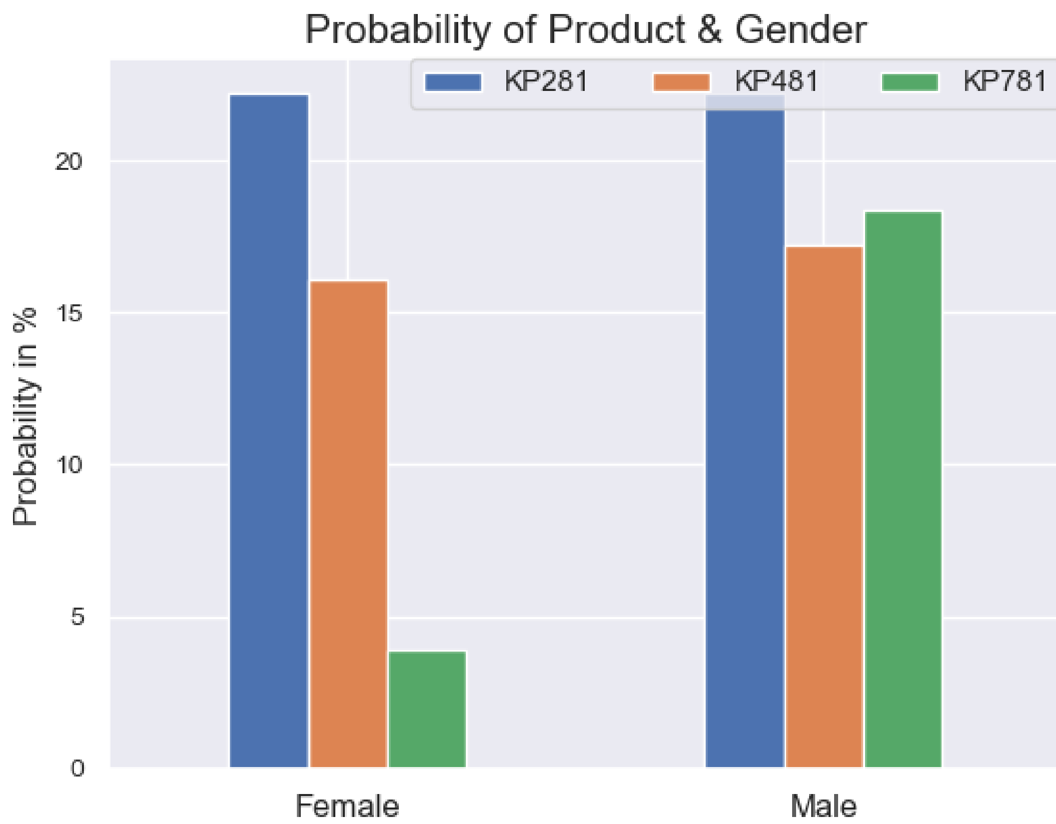
```
[ ]: plt.figure(figsize=(15,5)).suptitle("Aerofit Gender Dashboard",fontsize=14)

     plt.subplot(1, 3, 1)
     plt.pie(aerofit['Gender'].value_counts().values,labels = aerofit['Gender'].
      ↪value_counts().index,radius = 1.3,autopct = '%1.2f%%',) # type: ignore

     plt.subplot(1, 3, 2)
     sns.countplot(aerofit, x='Gender')
     plt.ylabel('', fontsize=12)
     plt.xlabel('Gender', fontsize=13)
     plt.xticks(fontsize=11)
```

```
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(1, 3, 3)
sns.countplot(aerofit, x='Gender', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Gender', fontsize=13)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=-1, ncol=3)

plt.show()
```

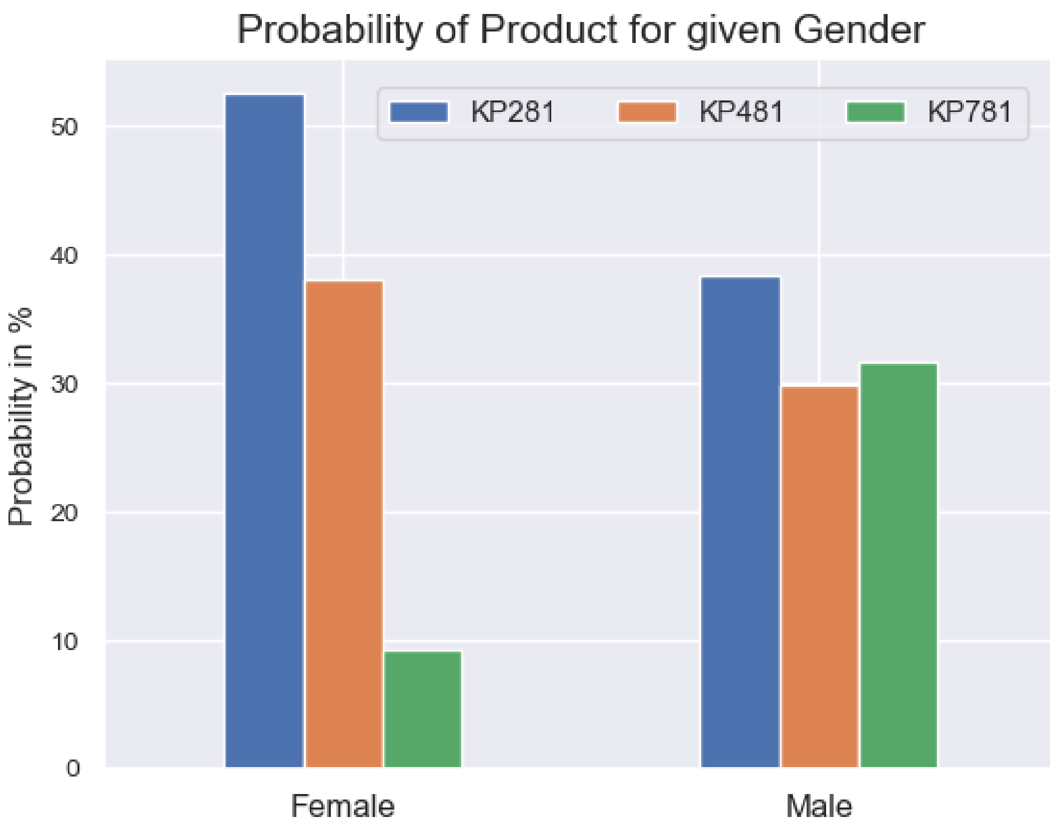


Probability Plot

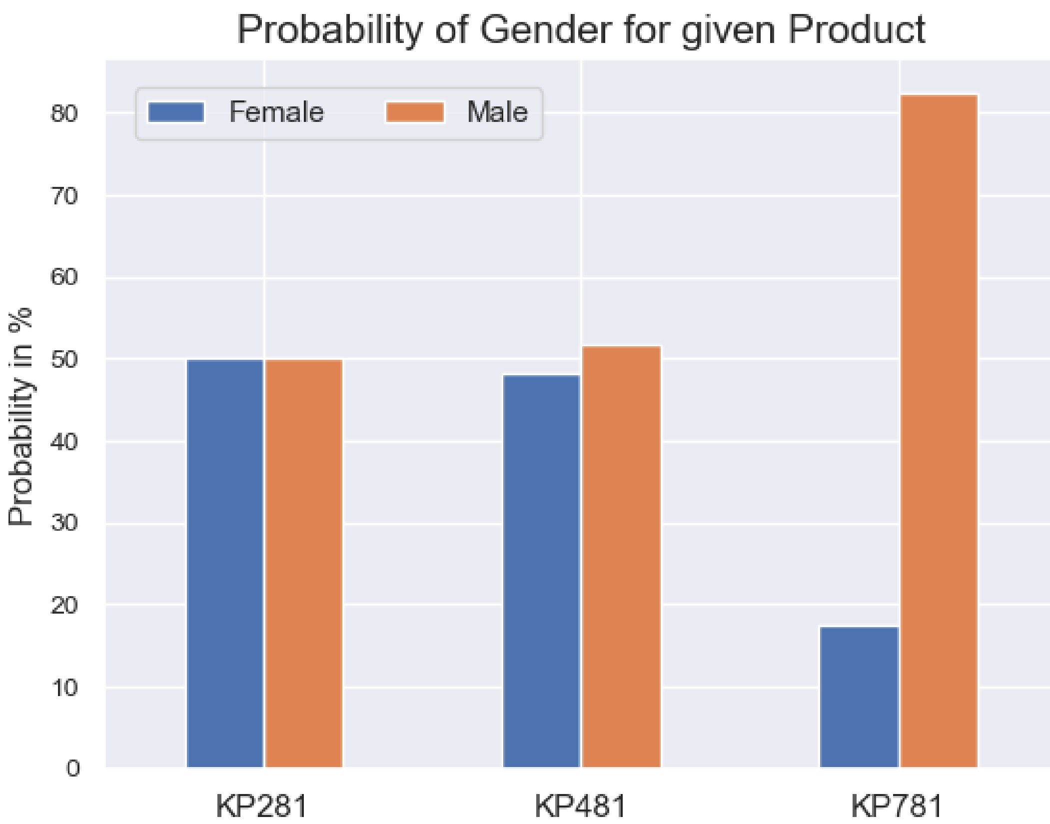
[ ]:
```
(pd.crosstab(aerofit['Gender'], aerofit['Product'], normalize=True)*100).
 ↪plot(kind='bar')
plt.title('Probability of Product & Gender', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(borderaxespad=0, ncol=3)
plt.show()
```




```
[ ]: (pd.crosstab(aerofit['Gender'], aerofit['Product'], normalize="index")*100).
      ↪plot(kind='bar')
     plt.title('Probability of Product for given Gender', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=10)
     plt.legend(borderaxespad=1, ncol=3)
     plt.show()
```

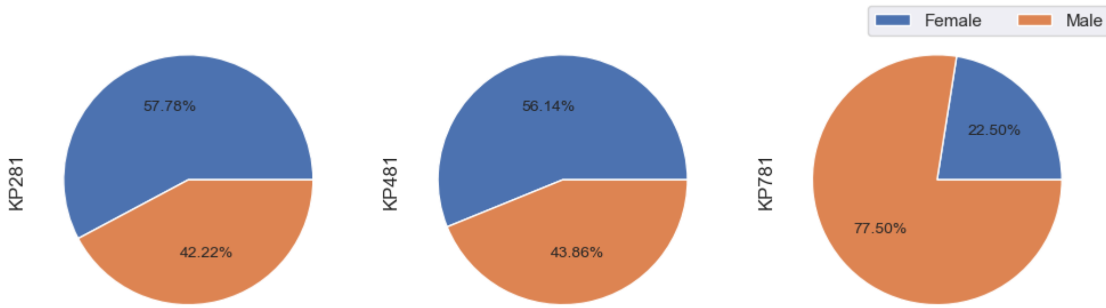


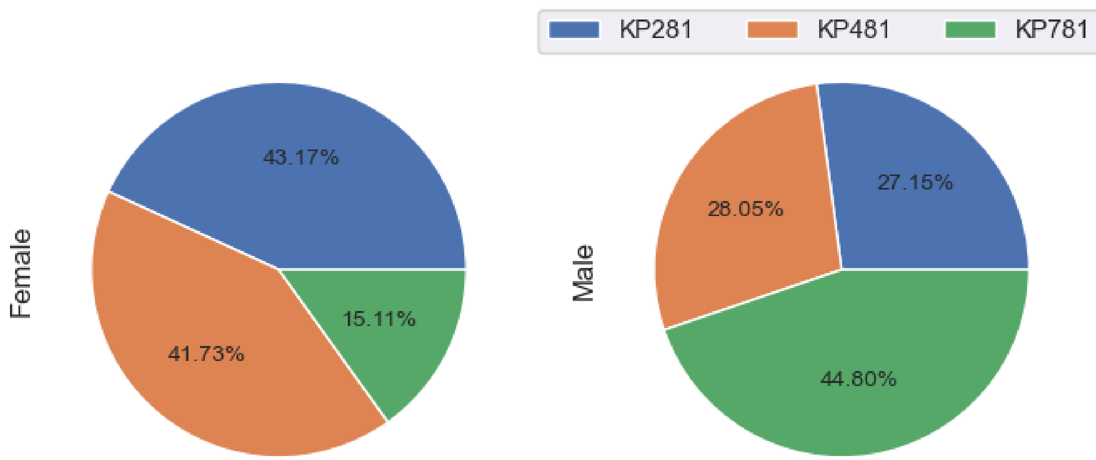

```
[ ]: (pd.crosstab(aerofit['Product'], aerofit['Gender'], normalize="index")*100).
      ↪plot(kind='bar')
     plt.title('Probability of Gender for given Product', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=10)
     plt.legend(borderaxespad=1, ncol=2)
     plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['Gender'], aerofit['Product'], normalize="index").
       ↪plot(kind='pie', subplots=True, figsize=(12,4), labeldistance=None,␣
       ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=3)
     plt.show()
     pd.crosstab(aerofit['Product'], aerofit['Gender'], normalize="index").
       ↪plot(kind='pie', subplots=True, figsize=(8,4), labeldistance=None,␣
       ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=3)
     plt.show()
```





Insight * There are 104 `Male` which is equivalent to 57.78%. * There are 76 `Female` which is equivalent to 42.22%.

1.3.3 Marital Status

[ ]:
```
aerofit['MaritalStatus'].unique()
```

[ ]:
```
['Single', 'Partnered']
Categories (2, object): ['Partnered', 'Single']
```

[ ]:
```
aerofit['MaritalStatus'].value_counts()
```

[ ]:
```
Partnered    107
Single        73
Name: MaritalStatus, dtype: int64
```

```
[ ]: aerofit['MaritalStatus'].value_counts(normalize=True)*100
```

```
[ ]: Partnered    59.444444
     Single       40.555556
     Name: MaritalStatus, dtype: float64
```

Statitical Analysis

```
[ ]: aerofit['MaritalStatus'].describe()
```

```
[ ]: count            180
     unique             2
     top        Partnered
     freq             107
     Name: MaritalStatus, dtype: object
```

```
[ ]: aerofit['MaritalStatus'].mode()[0]
```

```
[ ]: 'Partnered'
```

```
[ ]: aerofit.groupby('Product')["MaritalStatus"].describe()
```

```
[ ]:         count unique        top freq
     Product
     KP281      80      2  Partnered   48
     KP481      60      2  Partnered   36
     KP781      40      2  Partnered   23
```

Find Probability

Probability of a Product & Marital Status across all Combination *"Product Marital Status"*

```
[ ]: pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'], normalize=True,␣
       ↪margins=True)*100
```

```
[ ]: Product            KP281      KP481      KP781         All
     MaritalStatus
     Partnered      26.666667  20.000000  12.777778   59.444444
     Single         17.777778  13.333333   9.444444   40.555556
     All            44.444444  33.333333  22.222222  100.000000
```

Probability of Product's for given Marital Status *"Product | Marital Status"*

```
[ ]: pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'], normalize='index',␣
       ↪margins=True)*100
```

```
[ ]: Product            KP281      KP481      KP781
     MaritalStatus
     Partnered      44.859813  33.644860  21.495327
```

```
Single          43.835616  32.876712  23.287671
All             44.444444  33.333333  22.222222
```

Probability of `Marital Status` for given `Product` *"Marital Status | Product"*

[ ]:
```
pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'], normalize='columns',␣
↪margins=True)*100
```

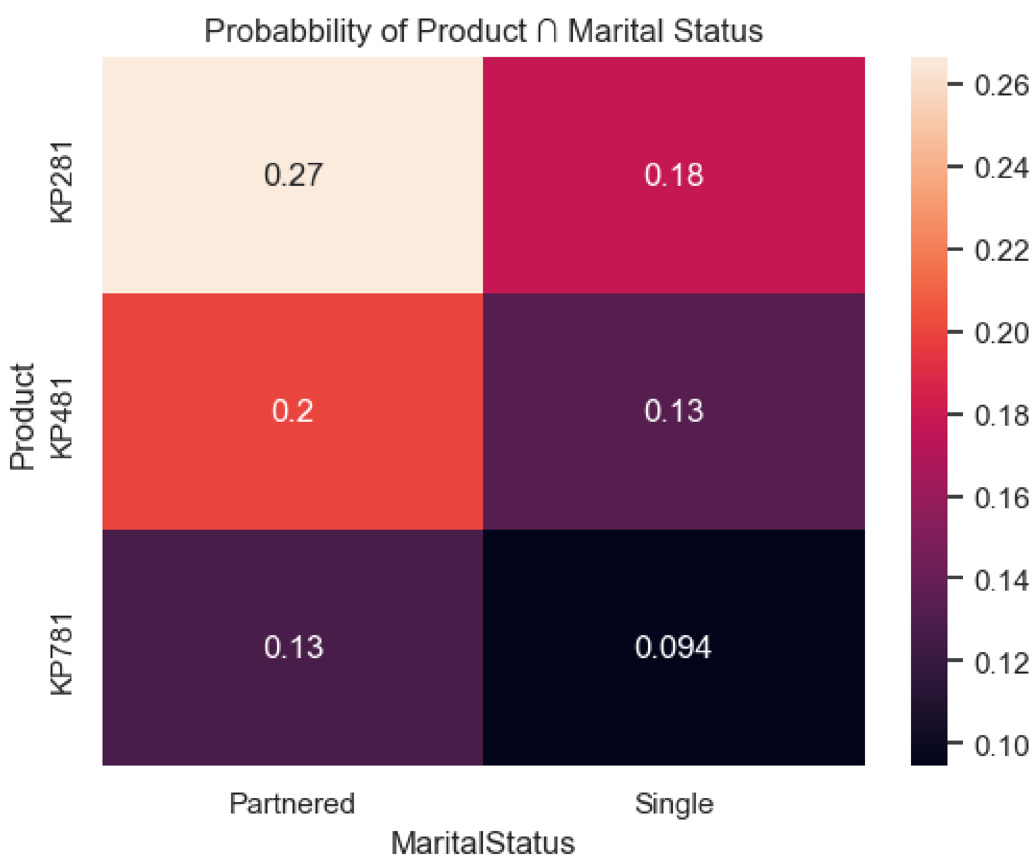
[ ]:
```
Product        KP281  KP481  KP781        All
MaritalStatus
Partnered       60.0   60.0   57.5  59.444444
Single          40.0   40.0   42.5  40.555556
```

Plot the Graph

`Heat Map`

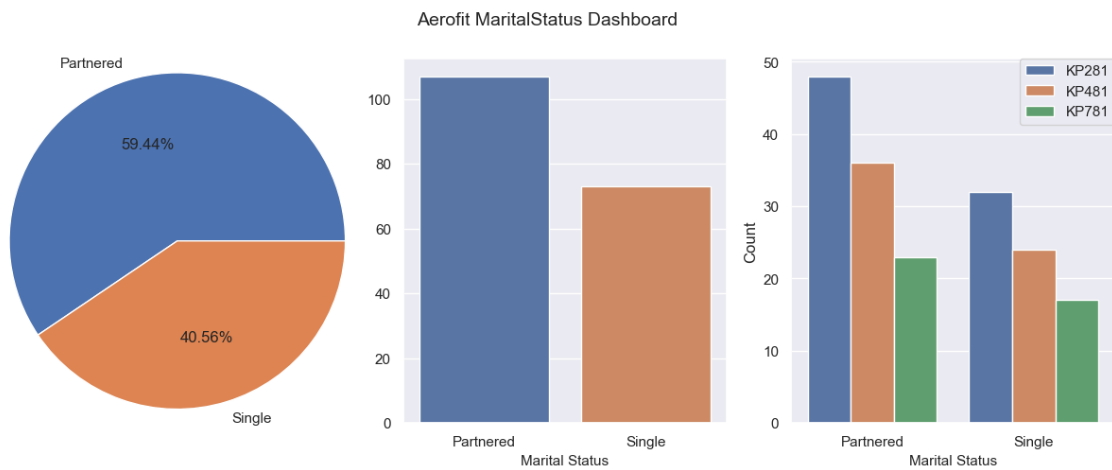
[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['MaritalStatus'],␣
↪normalize='all'),annot=True)
plt.title('Probabbility of Product  Marital Status', fontsize=12)
```

[ ]:
```
Text(0.5, 1.0, 'Probabbility of Product  Marital Status')
```



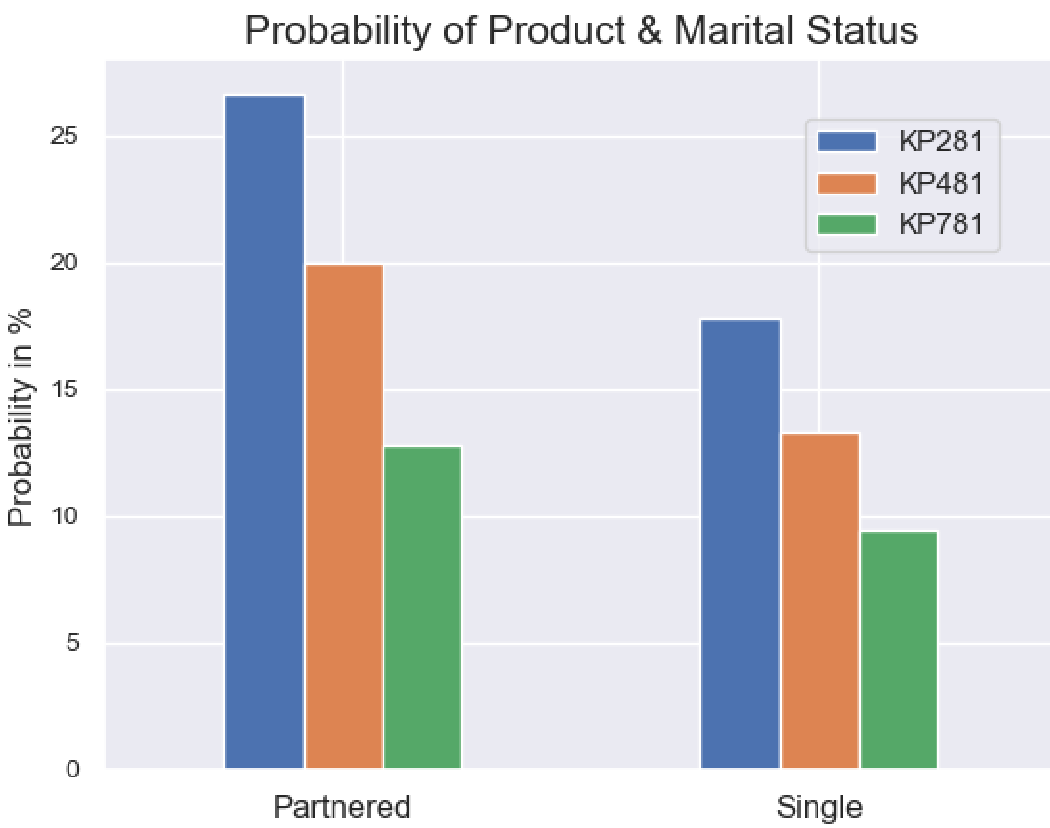
Descriptive Plot

```
[ ]: plt.figure(figsize=(15,5)).suptitle("Aerofit MaritalStatus␣
      ↪Dashboard",fontsize=14)

     plt.subplot(1, 3, 1)
     plt.pie(aerofit['MaritalStatus'].value_counts().values,labels =␣
      ↪aerofit['MaritalStatus'].value_counts().index,radius = 1.3,autopct = '%1.
      ↪2f%%',) # type: ignore

     plt.subplot(1, 3, 2)
     sns.countplot(aerofit, x='MaritalStatus')
     plt.ylabel('', fontsize=12)
     plt.xlabel('Marital Status', fontsize=11)
     plt.xticks(fontsize=11)
     plt.yticks(rotation= 0, fontsize=11)

     plt.subplot(1, 3, 3)
     sns.countplot(aerofit, x='MaritalStatus', hue='Product')
     plt.ylabel('Count', fontsize=12)
     plt.xlabel('Marital Status', fontsize=11)
     plt.xticks(fontsize=11)
     plt.yticks(rotation= 0, fontsize=11)
     plt.legend(borderaxespad=0, ncol=1)

     plt.show()
```

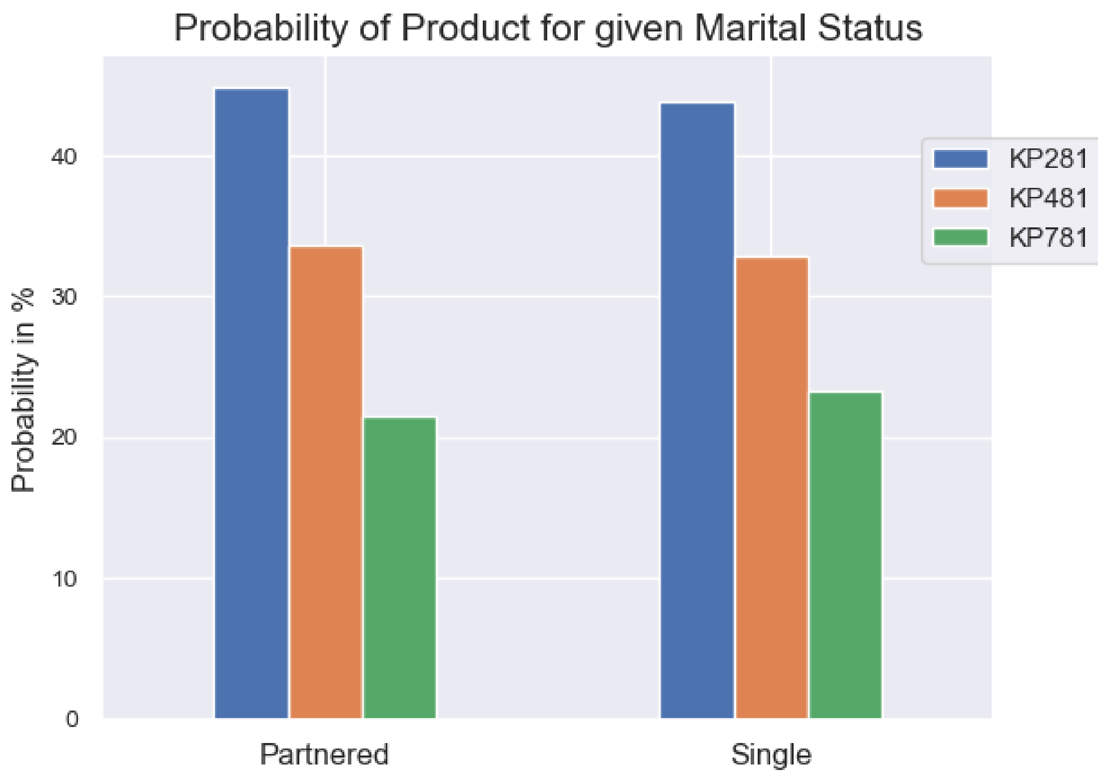


Probability Plot

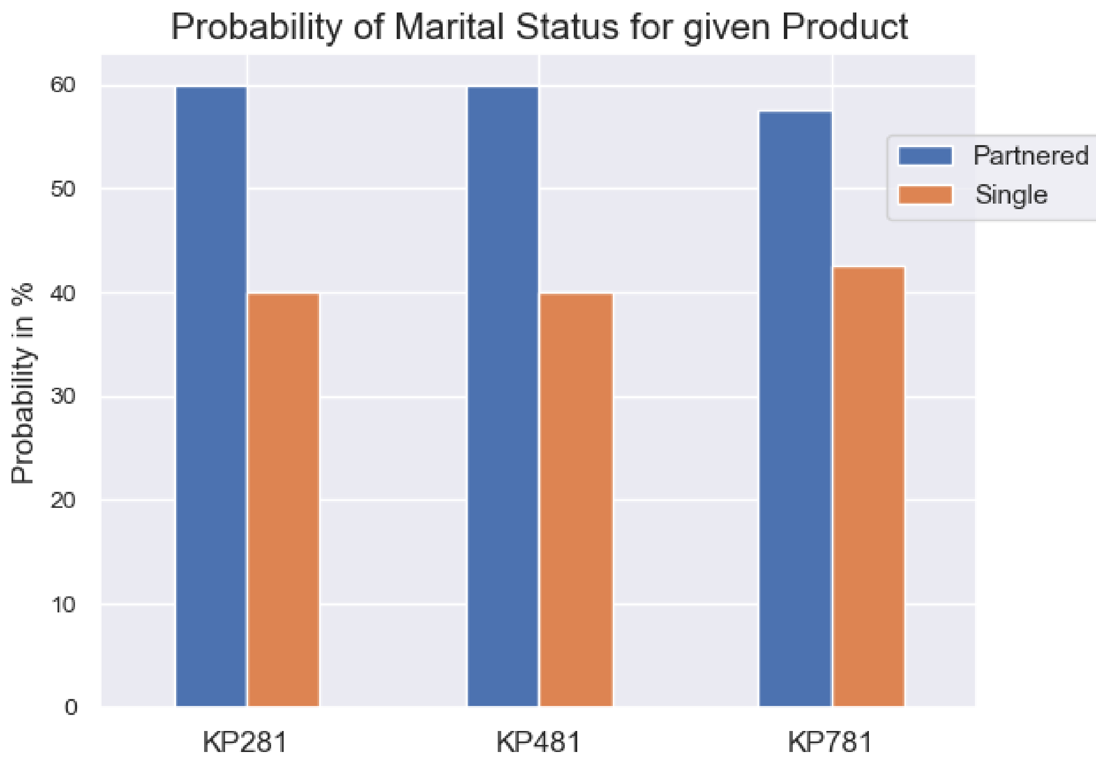
[ ]:
```
(pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'], normalize=True)*100).
 ↪plot(kind='bar')
plt.title('Probability of Product & Marital Status', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(borderaxespad=2, ncol=1)
plt.show()
```



[ ]:
```
(pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'],␣
 ↪normalize="index")*100).plot(kind='bar')
plt.title('Probability of Product for given Marital Status', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=3)
plt.show()
```

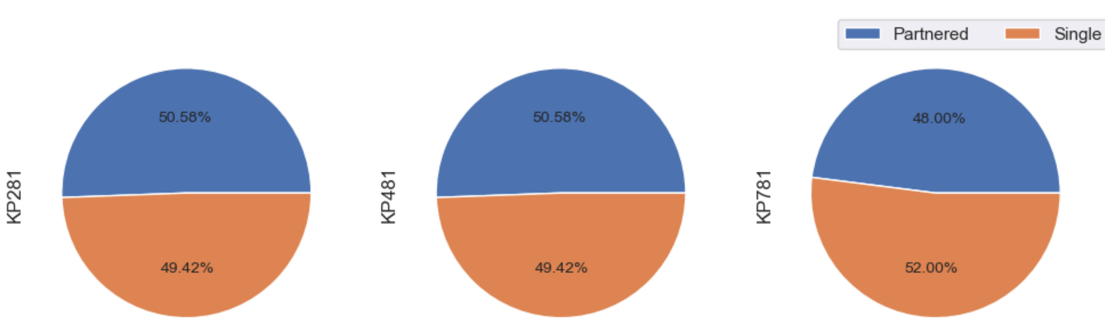


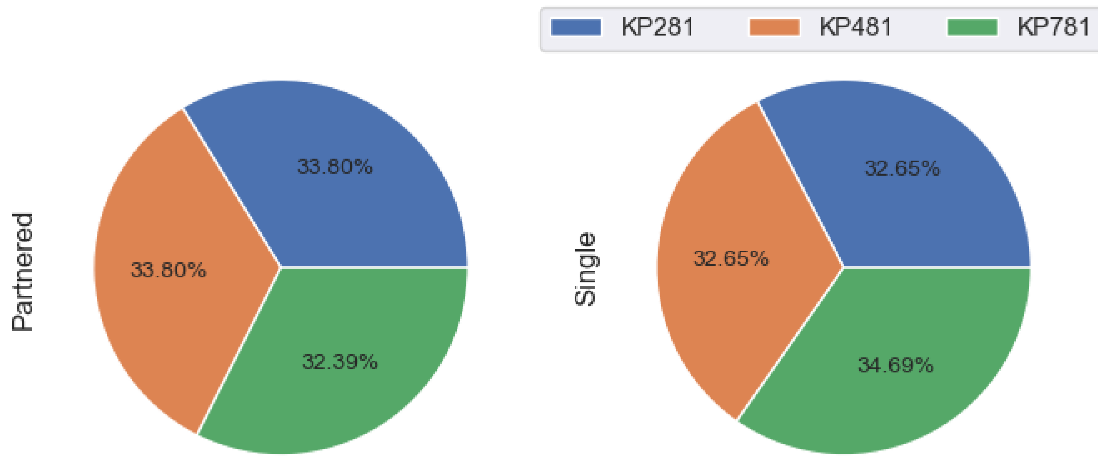

```
[ ]: (pd.crosstab(aerofit['Product'], aerofit['MaritalStatus'],␣
      ↪normalize="index")*100).plot(kind='bar')
     plt.title('Probability of Marital Status for given Product', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=10)
     plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=3)
     plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'], normalize="index").
     ↪plot(kind='pie', subplots=True, figsize=(12,4), labeldistance=None,␣
     ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=3)
     plt.show()
     pd.crosstab(aerofit['Product'], aerofit['MaritalStatus'], normalize="index").
     ↪plot(kind='pie', subplots=True, figsize=(8,4), labeldistance=None,␣
     ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=3)
     plt.show()
```





Insight * There are 107 `Partnered` which is equivalent to 59.44%. * There are 73 `Single` which is equivalent to 40.56%.

1.3.4 Age

Age value Count

```
[ ]: aerofit['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],
       dtype=int64)
```

```
[ ]: aerofit['Age'].value_counts()[:5]
```

```
[ ]: 25    25
     23    18
     24    12
     26    12
     28     9
     Name: Age, dtype: int64
```

```
[ ]: aerofit['Age'].value_counts(normalize=True)[:5]*100
```

```
[ ]: 25    13.888889
     23    10.000000
     24     6.666667
```

```
26     6.666667
28     5.000000
Name: Age, dtype: float64
```

Age Group Value Count

[ ]:
```
aerofit['age_group'].unique()
```

[ ]:
```
['15-20', '20-25', '25-30', '30-35', '35-40', '40-45', '45-50']
Categories (8, object): ['0-15' < '15-20' < '20-25' < '25-30' < '30-35' <
'35-40' < '40-45' < '45-50']
```

[ ]:
```
aerofit['age_group'].value_counts()[:5]
```

[ ]:
```
20-25    69
25-30    41
30-35    32
35-40    16
15-20    10
Name: age_group, dtype: int64
```

[ ]:
```
aerofit['age_group'].value_counts(normalize=True)[:5]*100
```

[ ]:
```
20-25    38.333333
25-30    22.777778
30-35    17.777778
35-40     8.888889
15-20     5.555556
Name: age_group, dtype: float64
```

Statitical Analysis

[ ]:
```
aerofit['Age'].describe()
```

[ ]:
```
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
```

[ ]:
```
aerofit['age_group'].describe()
```

[ ]:
```
count       180
unique        7
top       20-25
```

```
freq          69
Name: age_group, dtype: object
```

[ ]:
```
aerofit['Age'].mean()
```

[ ]:
```
28.788888888888888
```

[ ]:
```
aerofit['Age'].median()
```

[ ]:
```
26.0
```

[ ]:
```
aerofit['Age'].mode()[0]
```

[ ]:
```
25
```

[ ]:
```
aerofit.groupby('Product')["Age"].describe()
```

[ ]:
```
         count   mean       std   min    25%   50%    75%   max
Product
KP281     80.0  28.55  7.221452  18.0  23.00  26.0  33.00  50.0
KP481     60.0  28.90  6.645248  19.0  24.00  26.0  33.25  48.0
KP781     40.0  29.10  6.971738  22.0  24.75  27.0  30.25  48.0
```

[ ]:
```
aerofit.groupby('Product')["age_group"].describe()
```

[ ]:
```
        count unique    top freq
Product
KP281      80      7  20-25   28
KP481      60      7  20-25   24
KP781      40      6  20-25   17
```

Check for Outliers

[ ]:
```
check_outlier(aerofit, 'Age')['upper']
```

[ ]:
```
{'list': 78     47
 79     50
 139    48
 178    47
 179    48
 Name: Age, dtype: int64,
 'length': 5}
```

[ ]:
```
check_outlier(aerofit, 'Age')['lower']
```

[ ]:
```
{'list': Series([], Name: Age, dtype: int64), 'length': 0}
```

Find Probability

Probability of a `Product` & `Age Group` across all Combination *"Product   Age Group"*

[ ]:
```
pd.crosstab(aerofit['age_group'], aerofit['Product'], normalize=True,␣
↪margins=True)*100
```

[ ]:

Product age_group	KP281	KP481	KP781	All
15-20	3.333333	2.222222	0.000000	5.555556
20-25	15.555556	13.333333	9.444444	38.333333
25-30	11.666667	3.888889	7.222222	22.777778
30-35	6.111111	9.444444	2.222222	17.777778
35-40	4.444444	3.333333	1.111111	8.888889
40-45	1.666667	0.555556	1.111111	3.333333
45-50	1.666667	0.555556	1.111111	3.333333
All	44.444444	33.333333	22.222222	100.000000

Probability of `Product's` for given `Age Group` *"Product / Age Group"*

[ ]:
```
pd.crosstab(aerofit['age_group'], aerofit['Product'], normalize='index',␣
↪margins=True)*100
```

[ ]:

Product age_group	KP281	KP481	KP781
15-20	60.000000	40.000000	0.000000
20-25	40.579710	34.782609	24.637681
25-30	51.219512	17.073171	31.707317
30-35	34.375000	53.125000	12.500000
35-40	50.000000	37.500000	12.500000
40-45	50.000000	16.666667	33.333333
45-50	50.000000	16.666667	33.333333
All	44.444444	33.333333	22.222222

Probability of `Age Group` for given `Product` *"Age Group / Product"*

[ ]:
```
pd.crosstab(aerofit['age_group'], aerofit['Product'], normalize='columns',␣
↪margins=True)*100
```

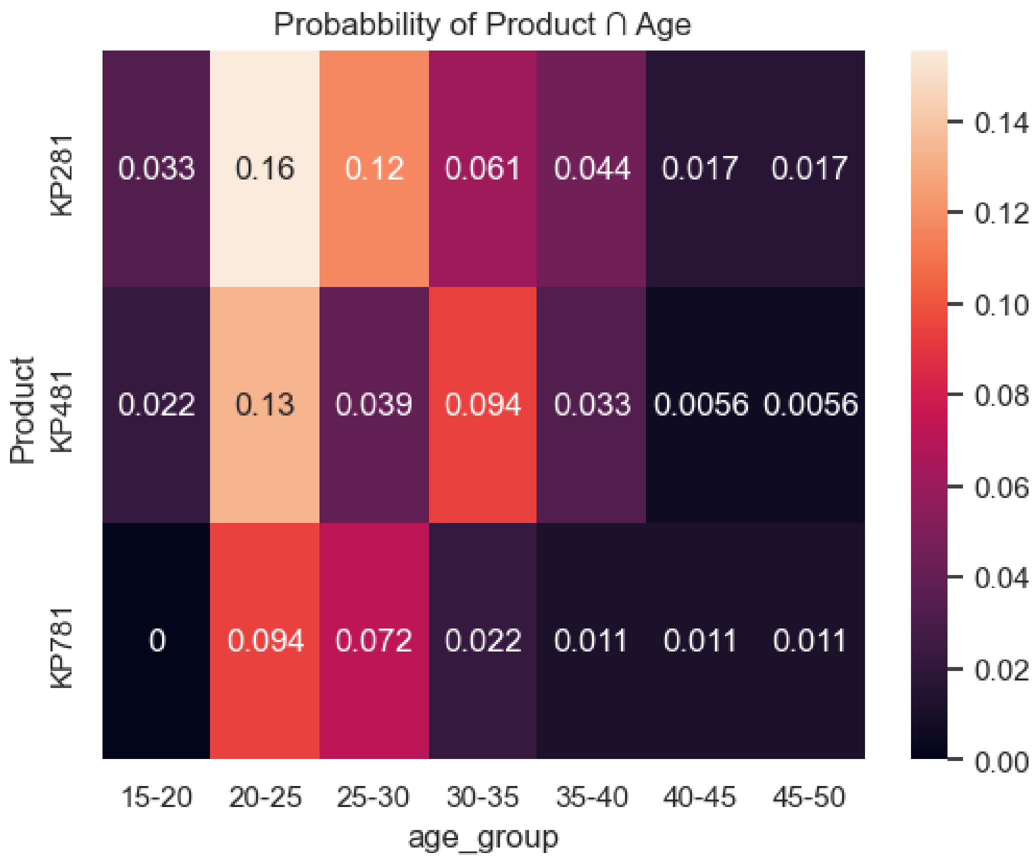
[ ]:

Product age_group	KP281	KP481	KP781	All
15-20	7.50	6.666667	0.0	5.555556
20-25	35.00	40.000000	42.5	38.333333
25-30	26.25	11.666667	32.5	22.777778
30-35	13.75	28.333333	10.0	17.777778
35-40	10.00	10.000000	5.0	8.888889
40-45	3.75	1.666667	5.0	3.333333
45-50	3.75	1.666667	5.0	3.333333

Plot the Graph

`Heat Map`

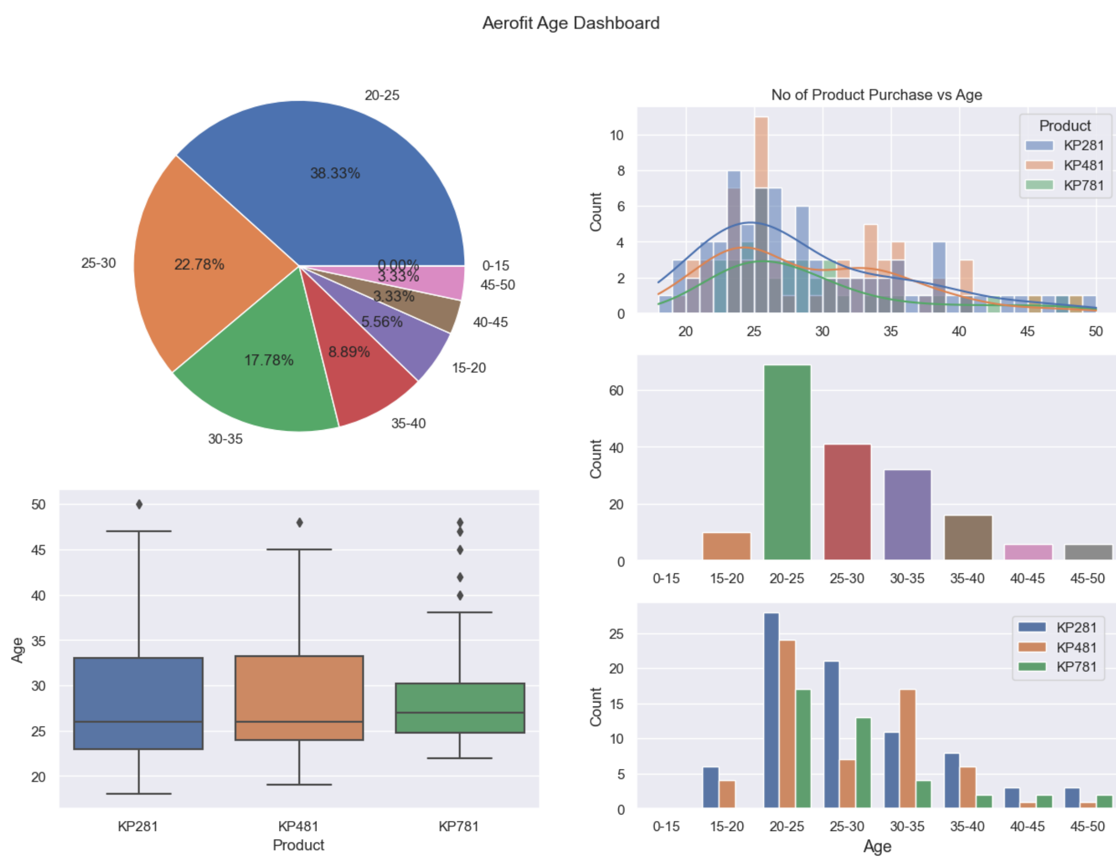
[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['age_group'],
 ↪normalize='all'),annot=True)
plt.title('Probabbility of Product   Age', fontsize=12)
plt.show()
```



Descriptive Plot

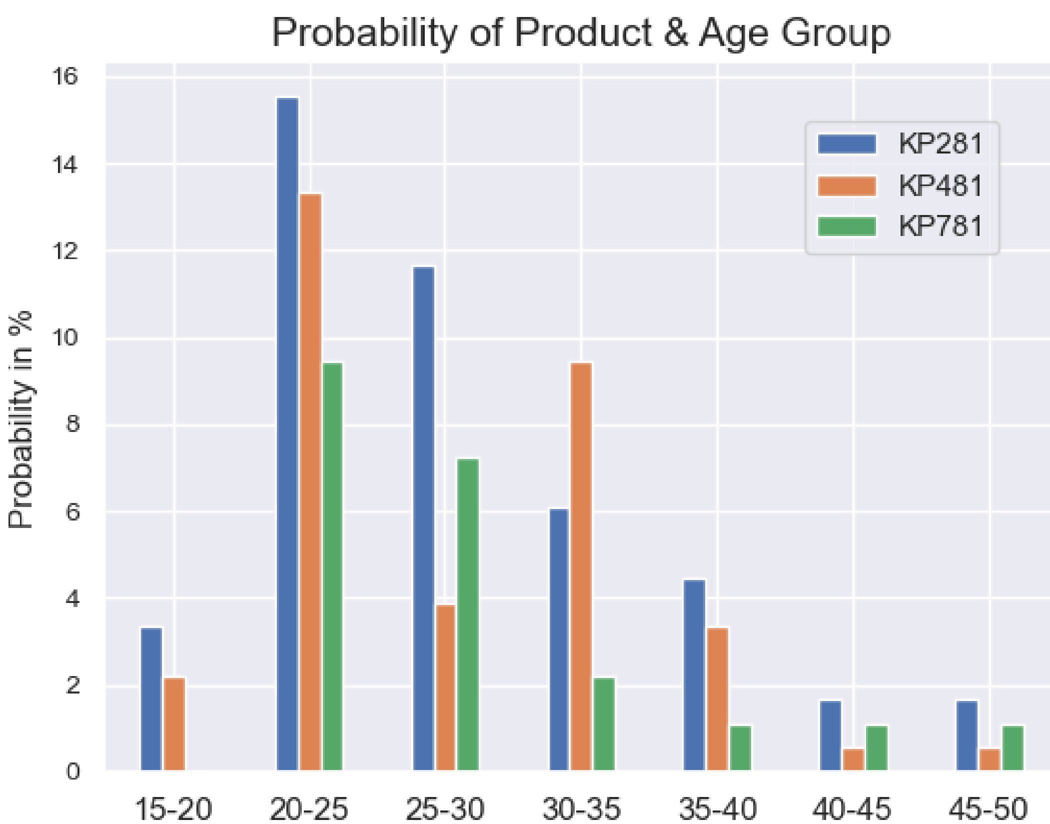
[ ]:
```
plt.figure(figsize=(15,10)).suptitle("Aerofit Age Dashboard",fontsize=14)

plt.subplot(2, 2, 1)
plt.pie(aerofit['age_group'].value_counts().values,labels =
 ↪aerofit['age_group'].value_counts().index,radius = 1.3,autopct = '%1.2f%%')
 ↪# type: ignore

plt.subplot(2, 2, 3)
sns.boxplot(aerofit, y="Age", x='Product')

plt.subplot(3, 2, 2)
sns.histplot(aerofit, x='Age', binwidth=1, kde=True, hue='Product')
plt.title('No of Product Purchase vs Age', fontsize=12)
```

```
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 4)
sns.countplot(aerofit, x='age_group')
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 6)
sns.countplot(aerofit, x='age_group', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Age', fontsize=13)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=1, ncol=1)

plt.show()
```



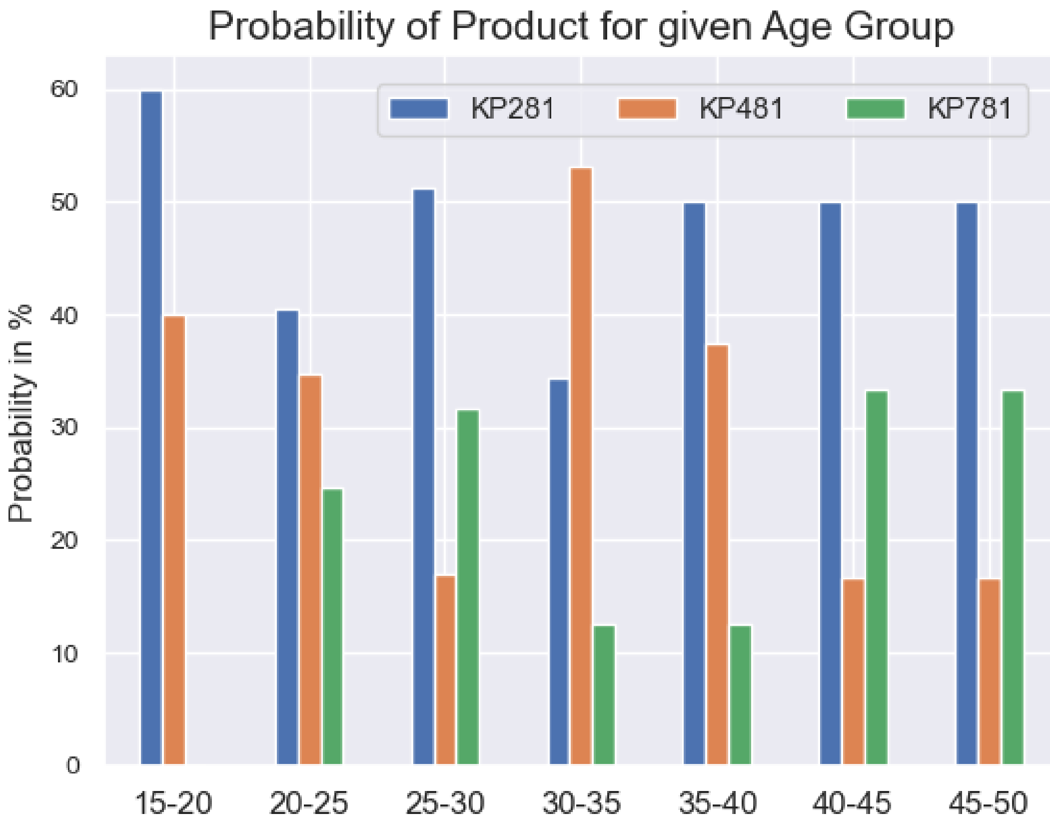
Probability Plot

[ ]:
```
(pd.crosstab(aerofit['age_group'], aerofit['Product'], normalize=True)*100).
 ↪plot(kind='bar')
plt.title('Probability of Product & Age Group', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(borderaxespad=2, ncol=1)
plt.show()
```

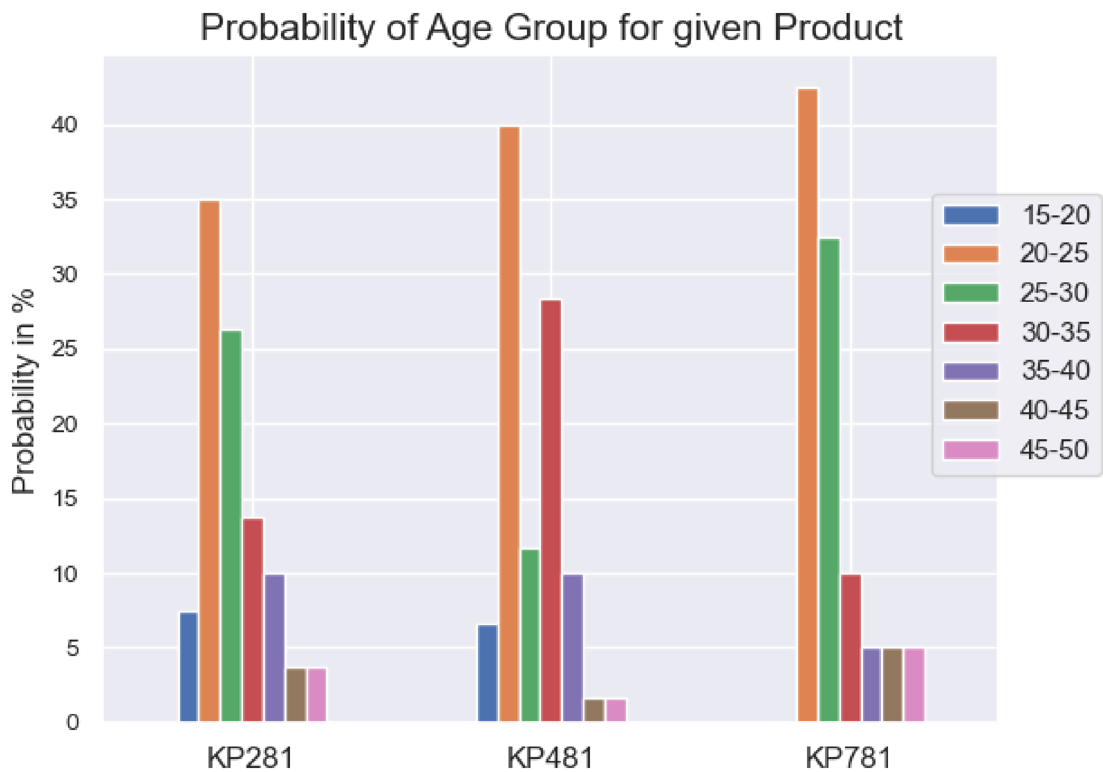


[ ]:
```
(pd.crosstab(aerofit['age_group'], aerofit['Product'], normalize="index")*100).
 ↪plot(kind='bar')
plt.title('Probability of Product for given Age Group', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
```

```
plt.legend(borderaxespad=1, ncol=3)
plt.show()
```

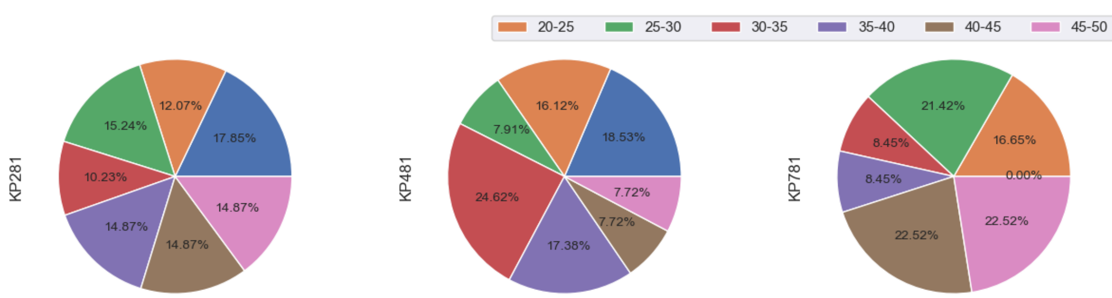


[ ]:
```
(pd.crosstab(aerofit['Product'], aerofit['age_group'], normalize="index")*100).
 ↪plot(kind='bar')
plt.title('Probability of Age Group for given Product', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=5)

plt.show()
```



Population Plot

[ ]:
```
pd.crosstab(aerofit['age_group'], aerofit['Product'], normalize="index").
    plot(kind='pie', subplots=True, figsize=(15,4), labeldistance=None,
    fontsize=10, legend=None, autopct = '%1.2f%%')
plt.legend(borderaxespad=-1, ncol=6)
plt.show()
```



1.3.5 Income

Income value Count

```
[ ]: aerofit['Income'].unique()
```

```
[ ]: 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,
         65220,  62535,  48658,  54781,  48556,  58516,  53536,  61006,
         57271,  52291,  49801,  62251,  64741,  70966,  75946,  74701,
         69721,  83416,  88396,  90886,  92131,  77191,  52290,  85906,
        103336,  99601,  89641,  95866, 104581,  95508], dtype=int64)
```

```
[ ]: aerofit['Income'].value_counts()[:5]
```

```
[ ]: 45480    14
     52302     9
     46617     8
     54576     8
     53439     8
     Name: Income, dtype: int64
```

```
[ ]: aerofit['Income'].value_counts(normalize=True)[:5]*100
```

```
[ ]: 45480    7.777778
     52302    5.000000
     46617    4.444444
     54576    4.444444
     53439    4.444444
     Name: Income, dtype: float64
```

Income Group Value Count

```
[ ]: aerofit['income_group'].unique()
```

```
[ ]: ['25K-35K', '35K-45K', '45K-55K', '65K-75K', '55K-65K', '75K-85K', '85K-95K',
     '95K-105K']
     Categories (9, object): ['0-25K' < '25K-35K' < '35K-45K' < '45K-55K' …
     '65K-75K' < '75K-85K' < '85K-95K' < '95K-105K']
```

```
[ ]: aerofit['income_group'].value_counts()[:5]
```

```
[ ]: 45K-55K    77
     35K-45K    35
     55K-65K    26
     25K-35K    14
     85K-95K    11
     Name: income_group, dtype: int64
```

```
[ ]: aerofit['income_group'].value_counts(normalize=True)[:5]*100
```

```
45K-55K    42.777778
35K-45K    19.444444
55K-65K    14.444444
25K-35K     7.777778
85K-95K     6.111111
Name: income_group, dtype: float64
```

Statitical Analysis

```python
aerofit['Income'].describe()
```

```
count       180.000000
mean      53719.577778
std       16506.684226
min       29562.000000
25%       44058.750000
50%       50596.500000
75%       58668.000000
max      104581.000000
Name: Income, dtype: float64
```

```python
aerofit['income_group'].describe()
```

```
count         180
unique          8
top       45K-55K
freq           77
Name: income_group, dtype: object
```

```python
aerofit['Income'].mean()
```

```
53719.57777777778
```

```python
aerofit['Income'].median()
```

```
50596.5
```

```python
aerofit['Income'].mode()[0]
```

```
45480
```

```python
aerofit.groupby('Product')["Income"].describe()
```

```
         count       mean           std      min       25%      50%      75%  \
Product
KP281     80.0  46418.025   9075.783190  29562.0  38658.00  46617.0  53439.0
KP481     60.0  48973.650   8653.989388  31836.0  44911.50  49459.5  53439.0
KP781     40.0  75441.575  18505.836720  48556.0  58204.75  76568.5  90886.0
```

```
              max
Product
KP281     68220.0
KP481     67083.0
KP781    104581.0
```

[ ]:
```
aerofit.groupby('Product')["income_group"].describe()
```

[ ]:
```
        count unique      top freq
Product
KP281      80      5  45K-55K   35
KP481      60      5  45K-55K   33
KP781      40      6  85K-95K   11
```

Check for Outliers

[ ]:
```
check_outlier(aerofit, 'Income')['upper']
```

[ ]:
```
{'list': 159     83416
 160     88396
 161     90886
 162     92131
 164     88396
 166     85906
 167     90886
 168    103336
 169     99601
 170     89641
 171     95866
 172     92131
 173     92131
 174    104581
 175     83416
 176     89641
 177     90886
 178    104581
 179     95508
 Name: Income, dtype: int64,
 'length': 19}
```

[ ]:
```
check_outlier(aerofit, 'Income')['lower']
```

[ ]:
```
{'list': Series([], Name: Income, dtype: int64), 'length': 0}
```

Find Probability

Probability of a `Product` & `Income Group` across all Combination *"Product Income Group"*

```
[ ]: pd.crosstab(aerofit['income_group'], aerofit['Product'], normalize=True,␣
     ↪margins=True)*100
```

```
[ ]: Product           KP281      KP481      KP781         All
     income_group
     25K-35K        4.444444   3.333333   0.000000    7.777778
     35K-45K       14.444444   5.000000   0.000000   19.444444
     45K-55K       19.444444  18.333333   5.000000   42.777778
     55K-65K        5.000000   5.555556   3.888889   14.444444
     65K-75K        1.111111   1.111111   1.666667    3.888889
     75K-85K        0.000000   0.000000   2.222222    2.222222
     85K-95K        0.000000   0.000000   6.111111    6.111111
     95K-105K       0.000000   0.000000   3.333333    3.333333
     All           44.444444  33.333333  22.222222  100.000000
```

Probability of `Product's` for given `Income Group` *"Product | Income Group"*

```
[ ]: pd.crosstab(aerofit['income_group'], aerofit['Product'], normalize='index',␣
     ↪margins=True)*100
```

```
[ ]: Product           KP281      KP481       KP781
     income_group
     25K-35K       57.142857  42.857143    0.000000
     35K-45K       74.285714  25.714286    0.000000
     45K-55K       45.454545  42.857143   11.688312
     55K-65K       34.615385  38.461538   26.923077
     65K-75K       28.571429  28.571429   42.857143
     75K-85K        0.000000   0.000000  100.000000
     85K-95K        0.000000   0.000000  100.000000
     95K-105K       0.000000   0.000000  100.000000
     All           44.444444  33.333333   22.222222
```

Probability of `Income Group` for given `Product` *"Income Group | Product"*

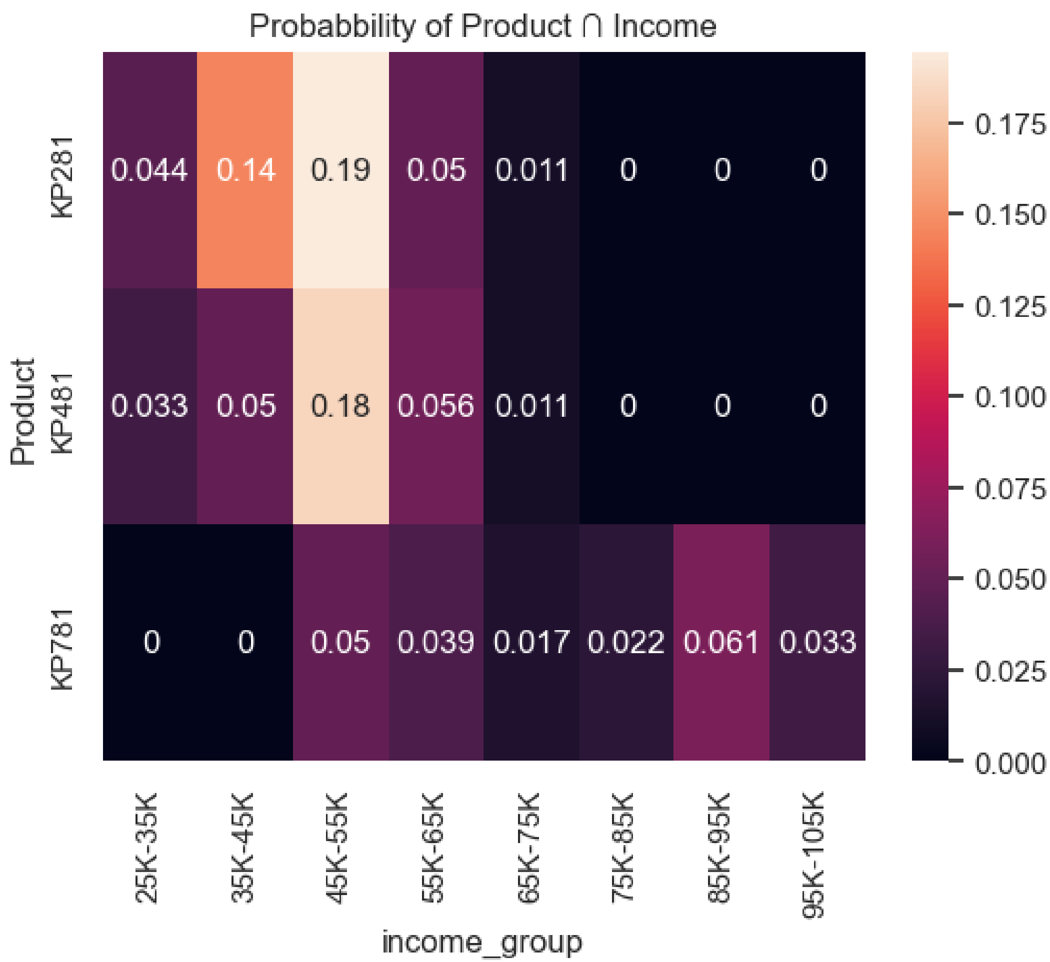
```
[ ]: pd.crosstab(aerofit['income_group'], aerofit['Product'], normalize='columns',␣
     ↪margins=True)*100
```

```
[ ]: Product       KP281      KP481  KP781        All
     income_group
     25K-35K       10.00  10.000000    0.0   7.777778
     35K-45K       32.50  15.000000    0.0  19.444444
     45K-55K       43.75  55.000000   22.5  42.777778
     55K-65K       11.25  16.666667   17.5  14.444444
     65K-75K        2.50   3.333333    7.5   3.888889
     75K-85K        0.00   0.000000   10.0   2.222222
     85K-95K        0.00   0.000000   27.5   6.111111
     95K-105K       0.00   0.000000   15.0   3.333333
```

Plot the Graph

Heat Map

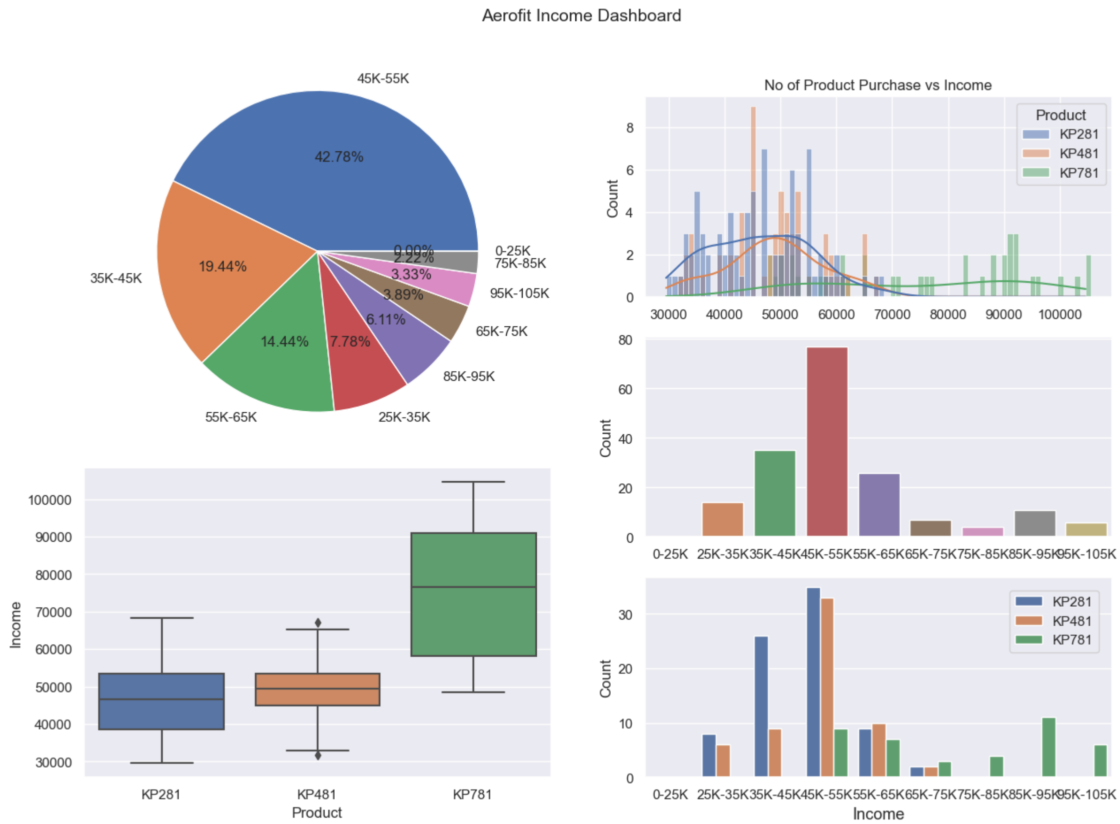
```
[ ]: sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['income_group'],␣
       ↪normalize='all'),annot=True)
     plt.title('Probabbility of Product  Income', fontsize=12)
     plt.show()
```



Descriptive Plot

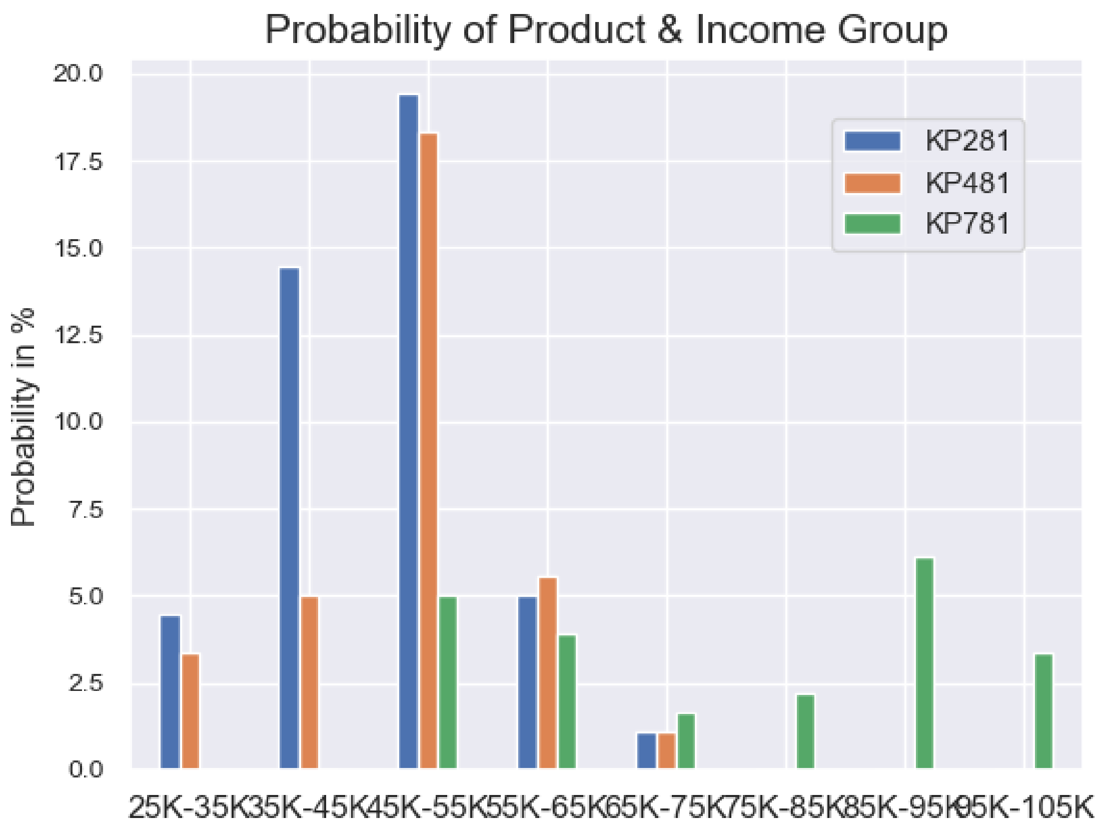
```
[ ]: plt.figure(figsize=(15,10)).suptitle("Aerofit Income Dashboard",fontsize=14)

     plt.subplot(2, 2, 1)
     plt.pie(aerofit['income_group'].value_counts().values,labels =␣
       ↪aerofit['income_group'].value_counts().index,radius = 1.3,autopct = '%1.
       ↪2f%%') # type: ignore

     plt.subplot(2, 2, 3)
     sns.boxplot(aerofit, y="Income", x='Product')
```

```
plt.subplot(3, 2, 2)
sns.histplot(aerofit, x='Income', binwidth=1000, kde=True, hue='Product')
plt.title('No of Product Purchase vs Income', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 4)
sns.countplot(aerofit, x='income_group')
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 6)
sns.countplot(aerofit, x='income_group', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Income', fontsize=13)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=1, ncol=1)

plt.show()
```

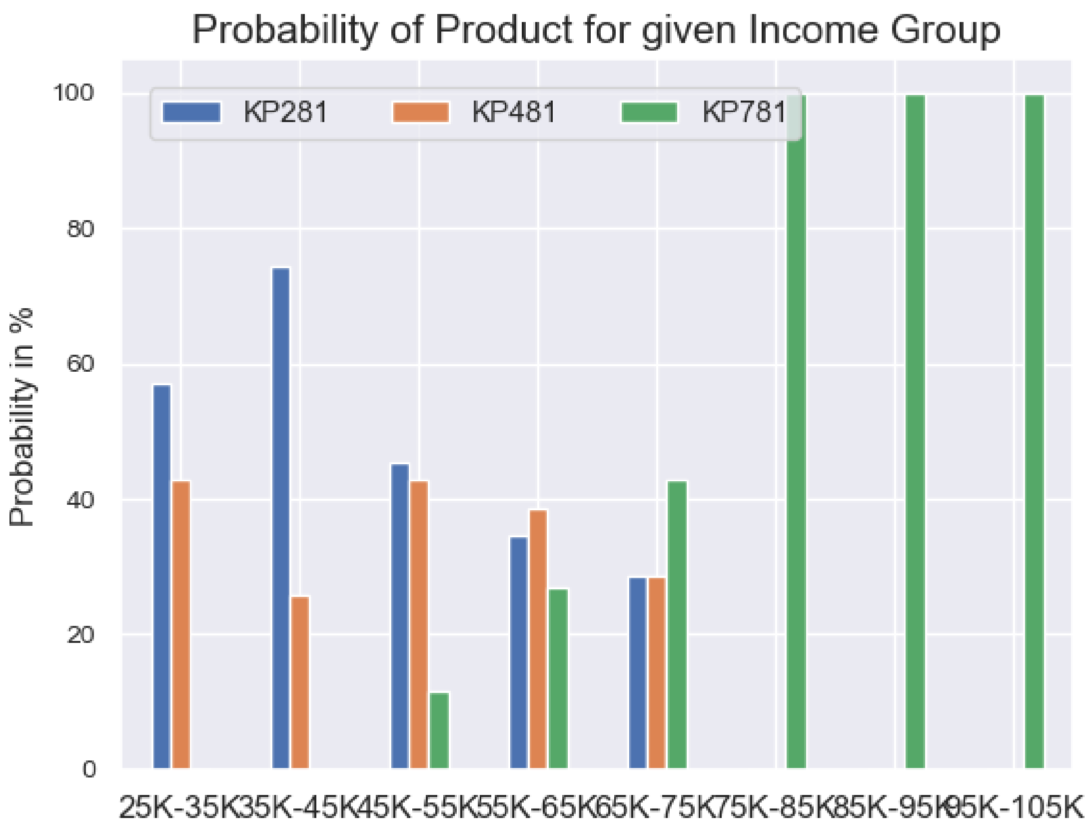


Probability Plot

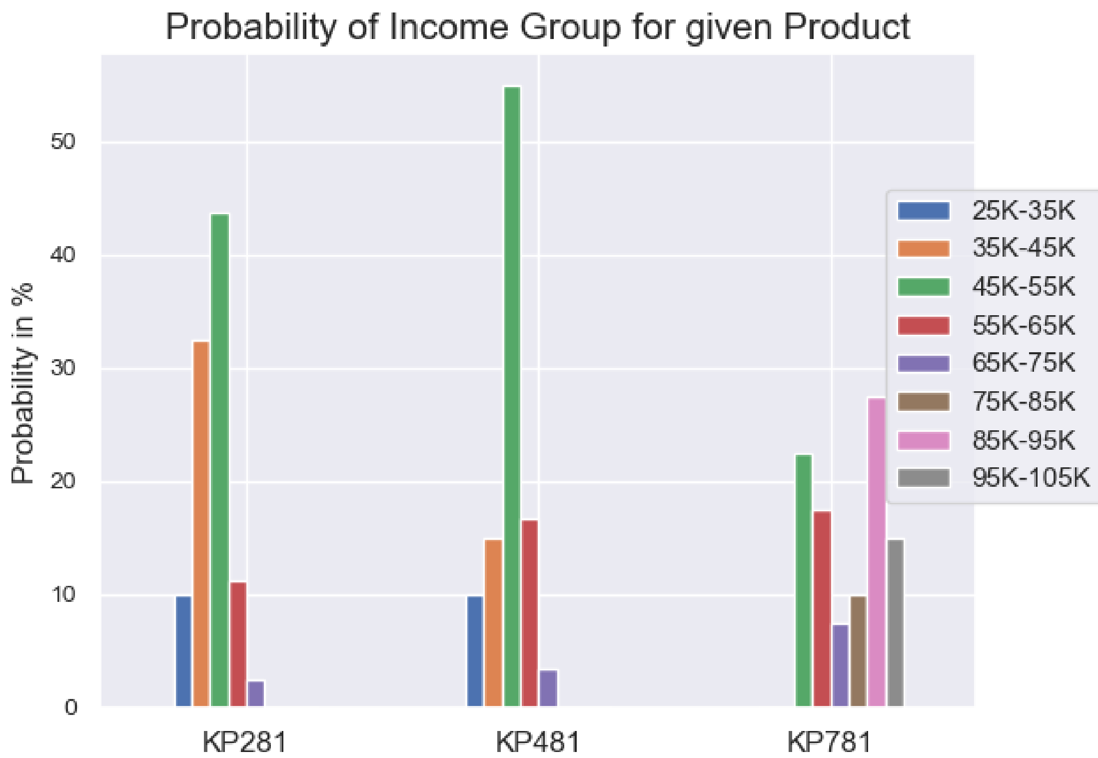
```
[ ]: (pd.crosstab(aerofit['income_group'], aerofit['Product'], normalize=True)*100).
      ↪plot(kind='bar')
     plt.title('Probability of Product & Income Group', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=10)
     plt.legend(borderaxespad=2, ncol=1)
     plt.show()
```




```
[ ]: (pd.crosstab(aerofit['income_group'], aerofit['Product'],␣
     ↪normalize="index")*100).plot(kind='bar')
     plt.title('Probability of Product for given Income Group', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=10)
     plt.legend(borderaxespad=1, ncol=3)
     plt.show()
```

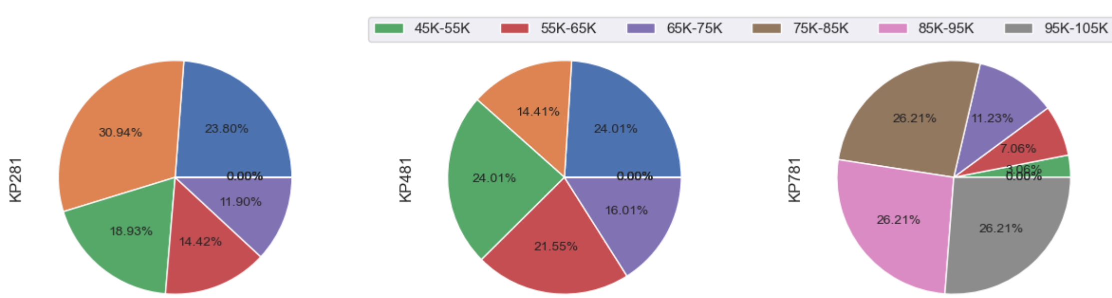


[ ]:
```
(pd.crosstab(aerofit['Product'], aerofit['income_group'],␣
↪normalize="index")*100).plot(kind='bar')
plt.title('Probability of Income Group for given Product', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=5)

plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['income_group'], aerofit['Product'], normalize="index").
     ↪plot(kind='pie', subplots=True, figsize=(15,4), labeldistance=None,␣
     ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=6)
     plt.show()
```



1.3.6 Miles

Miles value Count

[ ]:
```
aerofit['Miles'].unique()
```

[ ]:
```
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)
```

[ ]:
```
aerofit['Miles'].value_counts()[:5]
```

[ ]:
```
85     27
95     12
66     10
75     10
47      9
Name: Miles, dtype: int64
```

[ ]:
```
aerofit['Miles'].value_counts(normalize=True)[:5]*100
```

[ ]:
```
85     15.000000
95      6.666667
66      5.555556
75      5.555556
47      5.000000
Name: Miles, dtype: float64
```

Miles Group Value Count

[ ]:
```
aerofit['miles_group'].unique()
```

[ ]:
```
['110-140', '50-80', '80-110', '20-50', '140-170', …, '200-230', '230-260',
'290-320', '260-290', '350-380']
Length: 11
Categories (13, object): ['0-20' < '20-50' < '50-80' < '80-110' … '260-290' <
'290-320' < '320-350' < '350-380']
```

[ ]:
```
aerofit['miles_group'].value_counts()[:5]
```

[ ]:
```
80-110     66
50-80      43
110-140    20
20-50      17
140-170    15
Name: miles_group, dtype: int64
```

[ ]:
```
aerofit['miles_group'].value_counts(normalize=True)[:5]*100
```

[ ]:
```
80-110     36.666667
50-80      23.888889
110-140    11.111111
20-50       9.444444
```

```
140-170     8.333333
Name: miles_group, dtype: float64
```

Statitical Analysis

[ ]:
```
aerofit['Miles'].describe()
```

[ ]:
```
count    180.000000
mean     103.194444
std       51.863605
min       21.000000
25%       66.000000
50%       94.000000
75%      114.750000
max      360.000000
Name: Miles, dtype: float64
```

[ ]:
```
aerofit['miles_group'].describe()
```

[ ]:
```
count        180
unique        11
top       80-110
freq          66
Name: miles_group, dtype: object
```

[ ]:
```
aerofit['Miles'].mean()
```

[ ]:
```
103.19444444444444
```

[ ]:
```
aerofit['Miles'].median()
```

[ ]:
```
94.0
```

[ ]:
```
aerofit['Miles'].mode()[0]
```

[ ]:
```
85
```

[ ]:
```
aerofit.groupby('Product')["Miles"].describe()
```

[ ]:

Product	count	mean	std	min	25%	50%	75%	max
KP281	80.0	82.787500	28.874102	38.0	66.0	85.0	94.0	188.0
KP481	60.0	87.933333	33.263135	21.0	64.0	85.0	106.0	212.0
KP781	40.0	166.900000	60.066544	80.0	120.0	160.0	200.0	360.0

[ ]:
```
aerofit.groupby('Product')["miles_group"].describe()
```

[ ]:
```
        count unique      top freq
Product
```

```
KP281        80       6    80-110    27
KP481        60       6    80-110    31
KP781        40       9   170-200    12
```

Check for Outliers

```
[ ]: check_outlier(aerofit, 'Miles')['upper']
```

```
[ ]: {'list': 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,
      'length': 13}
```

```
[ ]: check_outlier(aerofit, 'Miles')['lower']
```

```
[ ]: {'list': Series([], Name: Miles, dtype: int64), 'length': 0}
```

Find Probability

Probability of a Product & Miles Group across all Combination *"Product Miles Group"*

```
[ ]: pd.crosstab(aerofit['miles_group'], aerofit['Product'], normalize=True,␣
      ↪margins=True)*100
```

```
[ ]: Product          KP281      KP481      KP781         All
     miles_group
     20-50         6.666667   2.777778   0.000000    9.444444
     50-80        14.444444   8.888889   0.555556   23.888889
     80-110       15.000000  17.222222   4.444444   36.666667
     110-140       6.111111   2.777778   2.222222   11.111111
     140-170       1.666667   1.111111   5.555556    8.333333
     170-200       0.555556   0.000000   6.666667    7.222222
     200-230       0.000000   0.555556   0.000000    0.555556
     230-260       0.000000   0.000000   1.111111    1.111111
     260-290       0.000000   0.000000   0.555556    0.555556
     290-320       0.000000   0.000000   0.555556    0.555556
     350-380       0.000000   0.000000   0.555556    0.555556
     All          44.444444  33.333333  22.222222  100.000000
```

Probability of `Product's` for given `Miles Group` *"Product | Miles Group"*

```
[ ]: pd.crosstab(aerofit['miles_group'], aerofit['Product'], normalize='index',␣
     ↪margins=True)*100
```

```
[ ]: Product           KP281       KP481       KP781
     miles_group
     20-50         70.588235   29.411765    0.000000
     50-80         60.465116   37.209302    2.325581
     80-110        40.909091   46.969697   12.121212
     110-140       55.000000   25.000000   20.000000
     140-170       20.000000   13.333333   66.666667
     170-200        7.692308    0.000000   92.307692
     200-230        0.000000  100.000000    0.000000
     230-260        0.000000    0.000000  100.000000
     260-290        0.000000    0.000000  100.000000
     290-320        0.000000    0.000000  100.000000
     350-380        0.000000    0.000000  100.000000
     All           44.444444   33.333333   22.222222
```

Probability of `Miles Group` for given `Product` *"Miles Group | Product"*

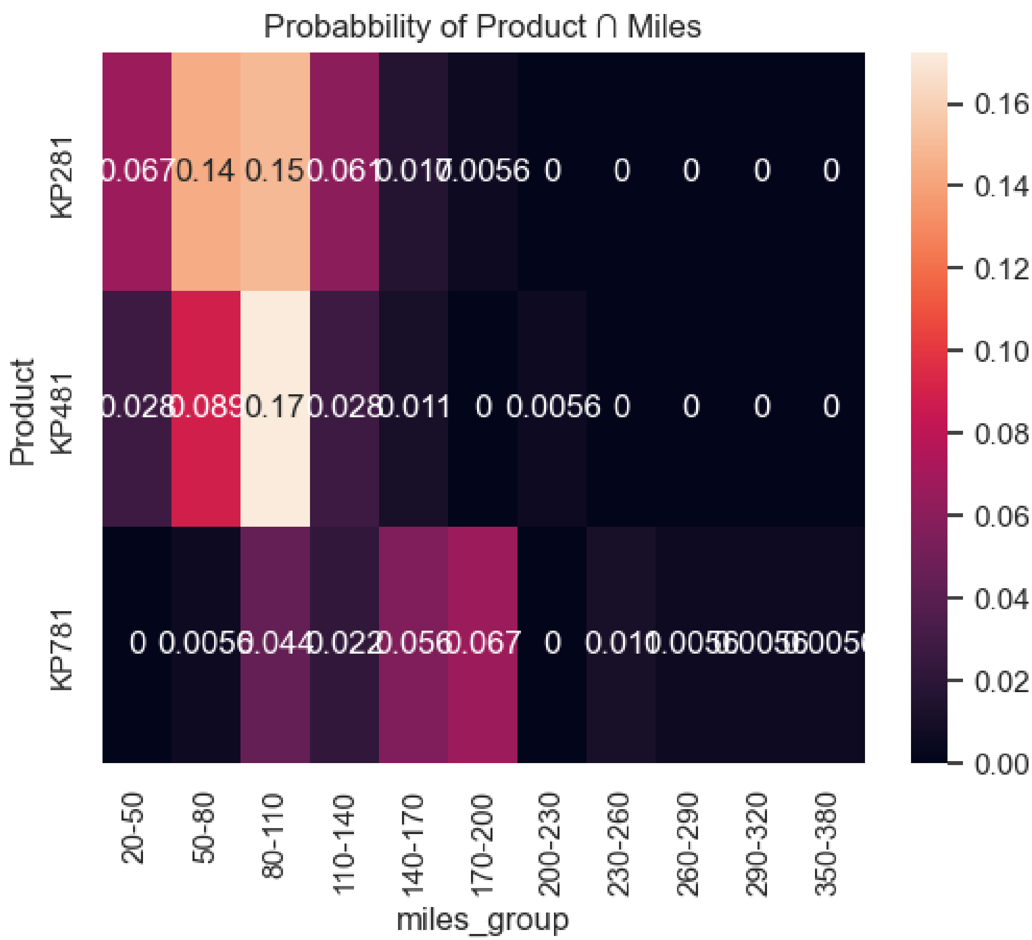
```
[ ]: pd.crosstab(aerofit['miles_group'], aerofit['Product'], normalize='columns',␣
     ↪margins=True)*100
```

```
[ ]: Product       KP281      KP481  KP781        All
     miles_group
     20-50         15.00   8.333333    0.0   9.444444
     50-80         32.50  26.666667    2.5  23.888889
     80-110        33.75  51.666667   20.0  36.666667
     110-140       13.75   8.333333   10.0  11.111111
     140-170        3.75   3.333333   25.0   8.333333
     170-200        1.25   0.000000   30.0   7.222222
     200-230        0.00   1.666667    0.0   0.555556
     230-260        0.00   0.000000    5.0   1.111111
     260-290        0.00   0.000000    2.5   0.555556
     290-320        0.00   0.000000    2.5   0.555556
     350-380        0.00   0.000000    2.5   0.555556
```

Plot the Graph

Heat Map

```
[ ]: sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['miles_group'],␣
     ↪normalize='all'),annot=True)
     plt.title('Probabbility of Product  Miles', fontsize=12)
     plt.show()
```



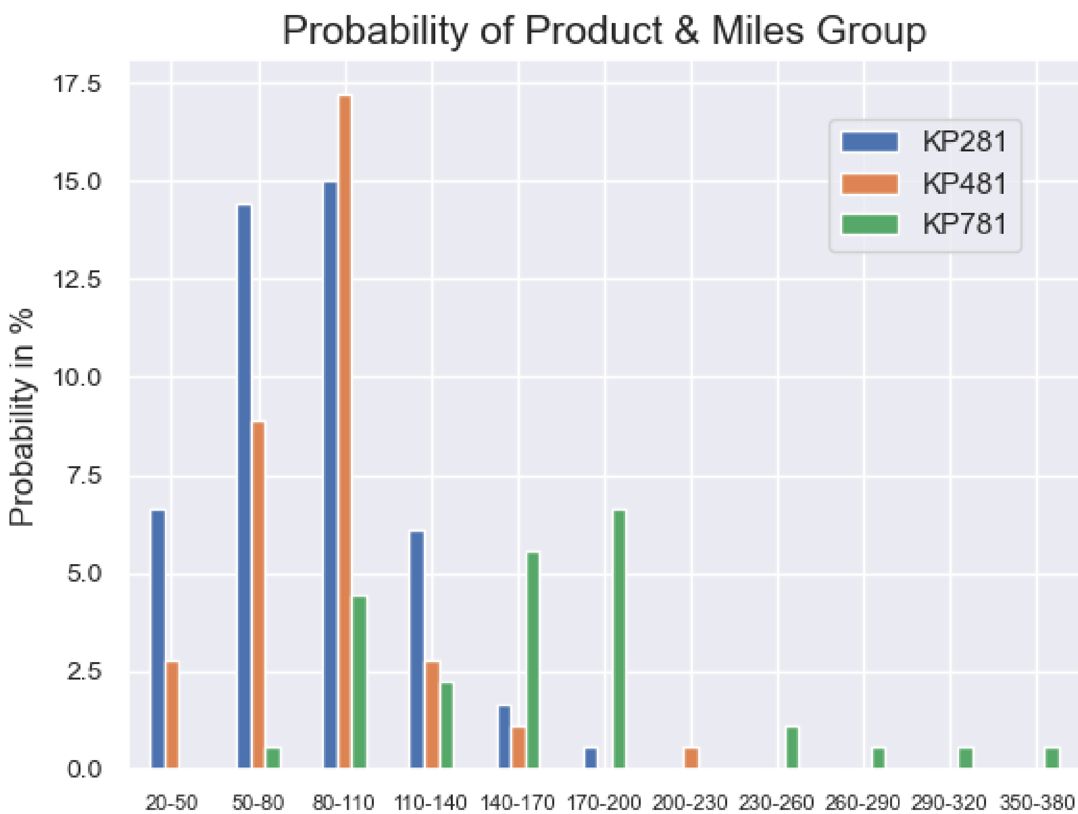
Descriptive Plot

```
[ ]: plt.figure(figsize=(15,10)).suptitle("Aerofit Miles Dashboard",fontsize=14)

plt.subplot(2, 2, 1)
plt.pie(aerofit['miles_group'].value_counts().values,labels = aerofit['miles_group'].value_counts().index,radius = 1.3,autopct = '%1.2f%%') # type: ignore

plt.subplot(2, 2, 3)
sns.boxplot(aerofit, y="Miles", x='Product')

plt.subplot(3, 2, 2)
sns.histplot(aerofit, x='Miles', binwidth=10, kde=True, hue='Product')
plt.title('No of Product Purchase vs Miles', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
```

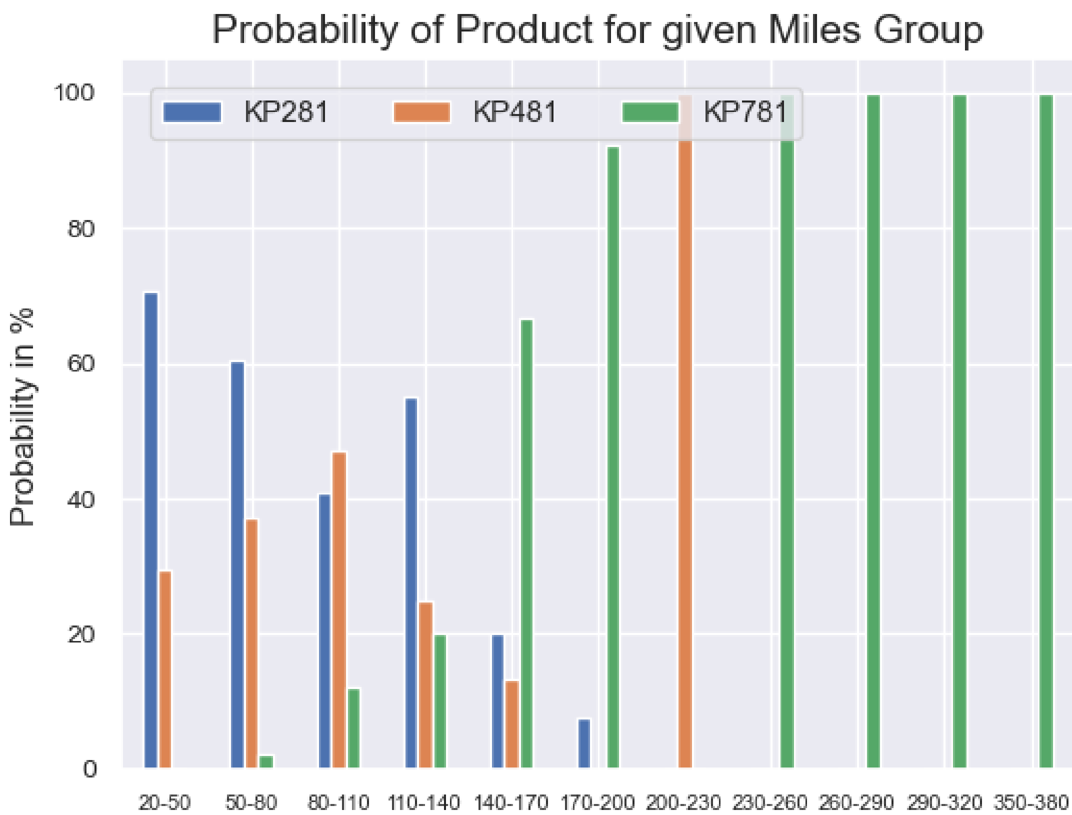
```
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 4)
sns.countplot(aerofit, x='miles_group')
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=8)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 6)
sns.countplot(aerofit, x='miles_group', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Miles', fontsize=13)
plt.xticks(fontsize=8)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=1, ncol=1)

plt.show()
```

`Probability` Plot

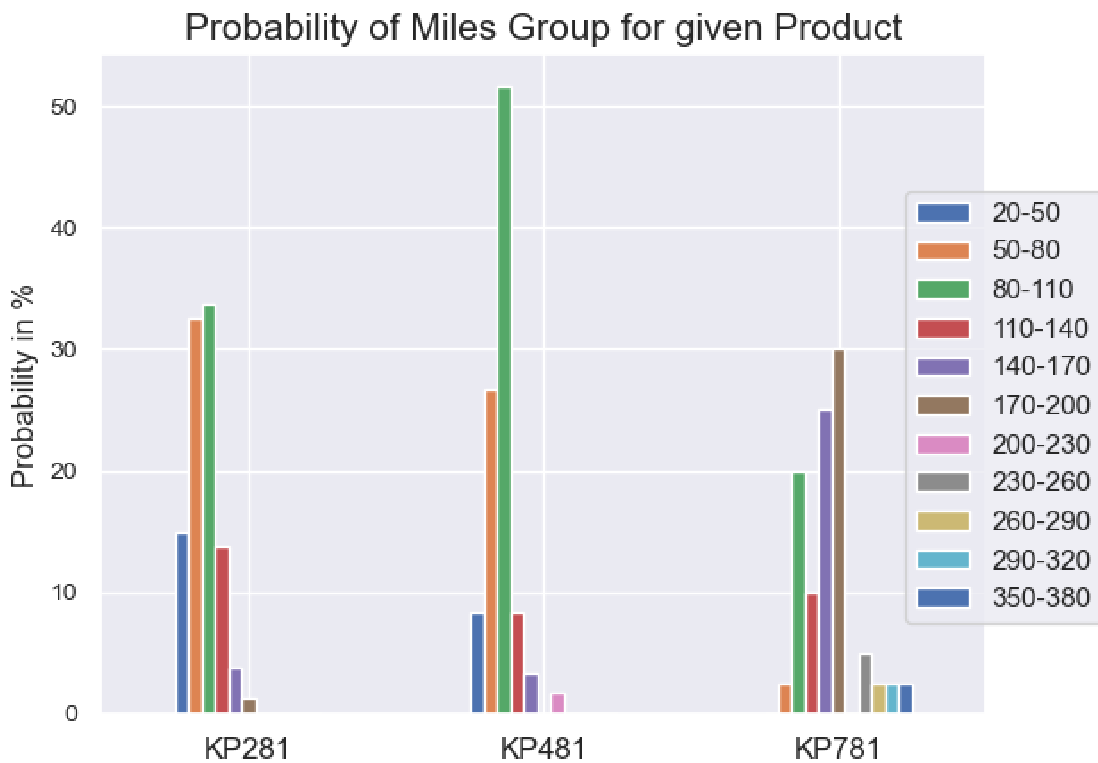
[ ]:
```
(pd.crosstab(aerofit['miles_group'], aerofit['Product'], normalize=True)*100).
 ↪plot(kind='bar')
plt.title('Probability of Product & Miles Group', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=8)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(borderaxespad=2, ncol=1)
plt.show()
```



[ ]:
```
(pd.crosstab(aerofit['miles_group'], aerofit['Product'],␣
 ↪normalize="index")*100).plot(kind='bar')
plt.title('Probability of Product for given Miles Group', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=8)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(borderaxespad=1, ncol=3)
plt.show()
```

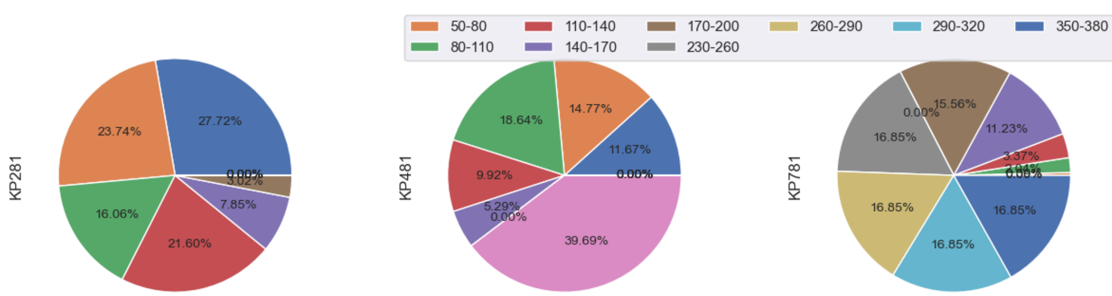


[ ]:
```
(pd.crosstab(aerofit['Product'], aerofit['miles_group'],␣
 ↪normalize="index")*100).plot(kind='bar')
plt.title('Probability of Miles Group for given Product', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=10)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=5)

plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['miles_group'], aerofit['Product'], normalize="index").
       ↪plot(kind='pie', subplots=True, figsize=(15,4), labeldistance=None,␣
       ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=6)
     plt.show()
```



1.3.7 Education

[ ]:
```
aerofit['Education'].unique()
```

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

[ ]:
```
aerofit['Education'].value_counts()
```

[ ]:
```
16    85
14    55
18    23
15     5
13     5
12     3
21     3
20     1
Name: Education, dtype: int64
```

[ ]:
```
aerofit['Education'].value_counts(normalize=True)*100
```

[ ]:
```
16    47.222222
14    30.555556
18    12.777778
15     2.777778
13     2.777778
12     1.666667
21     1.666667
20     0.555556
Name: Education, dtype: float64
```

Statitical Analysis

[ ]:
```
aerofit['Education'].describe()
```

[ ]:
```
count    180.000000
mean      15.572222
std        1.617055
min       12.000000
25%       14.000000
50%       16.000000
75%       16.000000
max       21.000000
Name: Education, dtype: float64
```

[ ]:
```
aerofit['Education'].mean()
```

[ ]:
```
15.572222222222223
```

[ ]:
```
aerofit['Education'].median()
```

[ ]: 16.0

[ ]:
```
aerofit['Education'].mode()[0]
```

[ ]: 16

[ ]:
```
aerofit.groupby('Product')["Education"].describe()
```

[ ]:

Product	count	mean	std	min	25%	50%	75%	max
KP281	80.0	15.037500	1.216383	12.0	14.0	16.0	16.0	18.0
KP481	60.0	15.116667	1.222552	12.0	14.0	16.0	16.0	18.0
KP781	40.0	17.325000	1.639066	14.0	16.0	18.0	18.0	21.0

Check for Outliers

[ ]:
```
check_outlier(aerofit, 'Education')['upper']
```

[ ]:
```
{'list': 156    20
 157    21
 161    21
 175    21
 Name: Education, dtype: int64,
 'length': 4}
```

[ ]:
```
check_outlier(aerofit, 'Education')['lower']
```

[ ]:
```
{'list': Series([], Name: Education, dtype: int64), 'length': 0}
```

Find Probability

Probability of a `Product` & `Education` across all Combination *"Product Education"*

[ ]:
```
pd.crosstab(aerofit['Education'], aerofit['Product'], normalize=True,
    margins=True)*100
```

[ ]:

Product Education	KP281	KP481	KP781	All
12	1.111111	0.555556	0.000000	1.666667
13	1.666667	1.111111	0.000000	2.777778
14	16.666667	12.777778	1.111111	30.555556
15	2.222222	0.555556	0.000000	2.777778
16	21.666667	17.222222	8.333333	47.222222
18	1.111111	1.111111	10.555556	12.777778
20	0.000000	0.000000	0.555556	0.555556
21	0.000000	0.000000	1.666667	1.666667
All	44.444444	33.333333	22.222222	100.000000

Probability of `Product's` for given `Education` *"Product | Education"*

```
[ ]: pd.crosstab(aerofit['Education'], aerofit['Product'], normalize='index',␣
     ↪margins=True)*100
```

```
[ ]: Product        KP281      KP481       KP781
     Education
     12         66.666667  33.333333    0.000000
     13         60.000000  40.000000    0.000000
     14         54.545455  41.818182    3.636364
     15         80.000000  20.000000    0.000000
     16         45.882353  36.470588   17.647059
     18          8.695652   8.695652   82.608696
     20          0.000000   0.000000  100.000000
     21          0.000000   0.000000  100.000000
     All        44.444444  33.333333   22.222222
```

Probability of `Education` for given `Product` *"Education | Product"*

```
[ ]: pd.crosstab(aerofit['Education'], aerofit['Product'], normalize='columns',␣
     ↪margins=True)*100
```

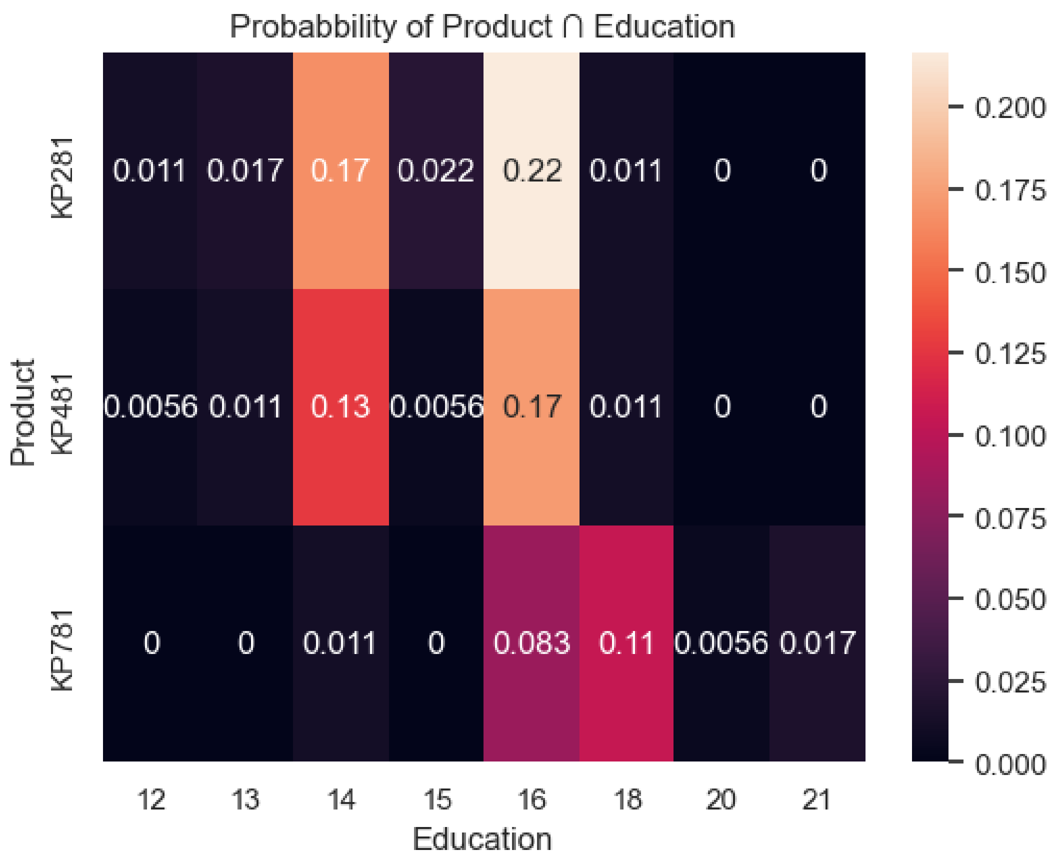
```
[ ]: Product    KP281      KP481  KP781        All
     Education
     12          2.50   1.666667    0.0   1.666667
     13          3.75   3.333333    0.0   2.777778
     14         37.50  38.333333    5.0  30.555556
     15          5.00   1.666667    0.0   2.777778
     16         48.75  51.666667   37.5  47.222222
     18          2.50   3.333333   47.5  12.777778
     20          0.00   0.000000    2.5   0.555556
     21          0.00   0.000000    7.5   1.666667
```

Plot the Graph

Heat Map

```
[ ]: sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['Education'],␣
     ↪normalize='all'),annot=True)
     plt.title('Probabbility of Product   Education', fontsize=12)
```

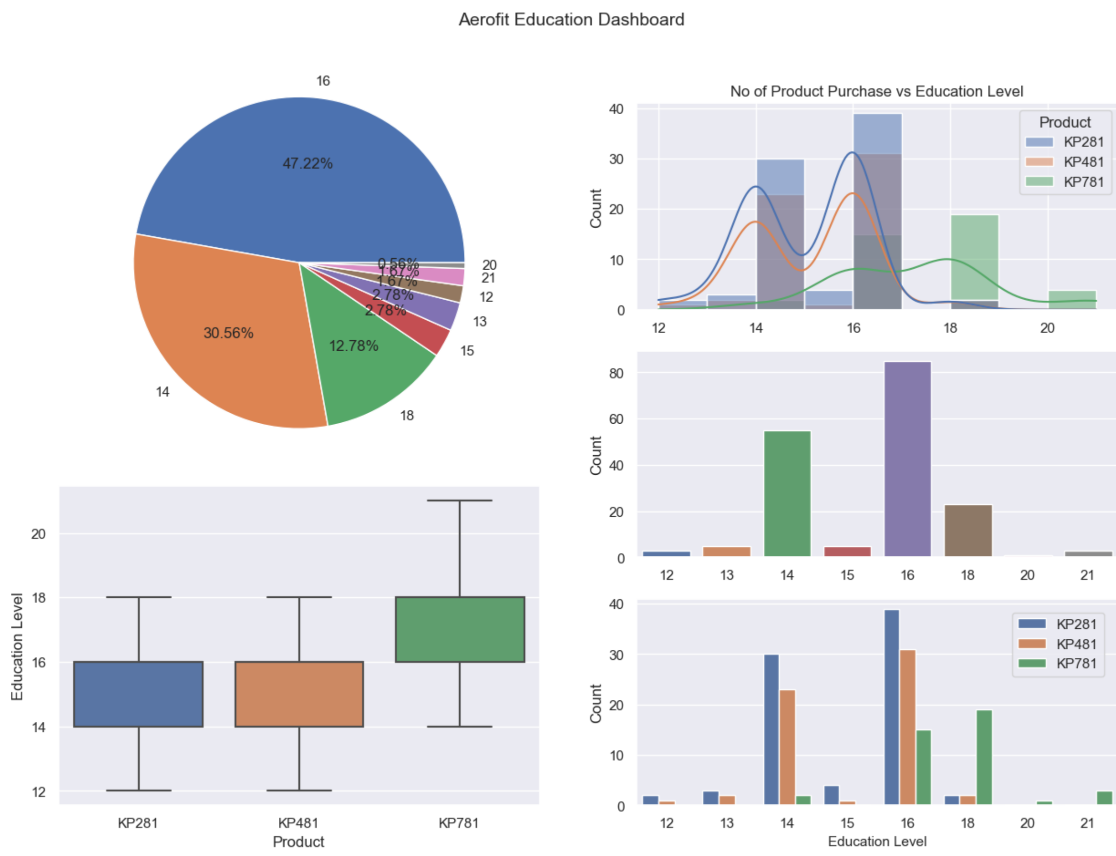
```
[ ]: Text(0.5, 1.0, 'Probabbility of Product   Education')
```



Descriptive Plot

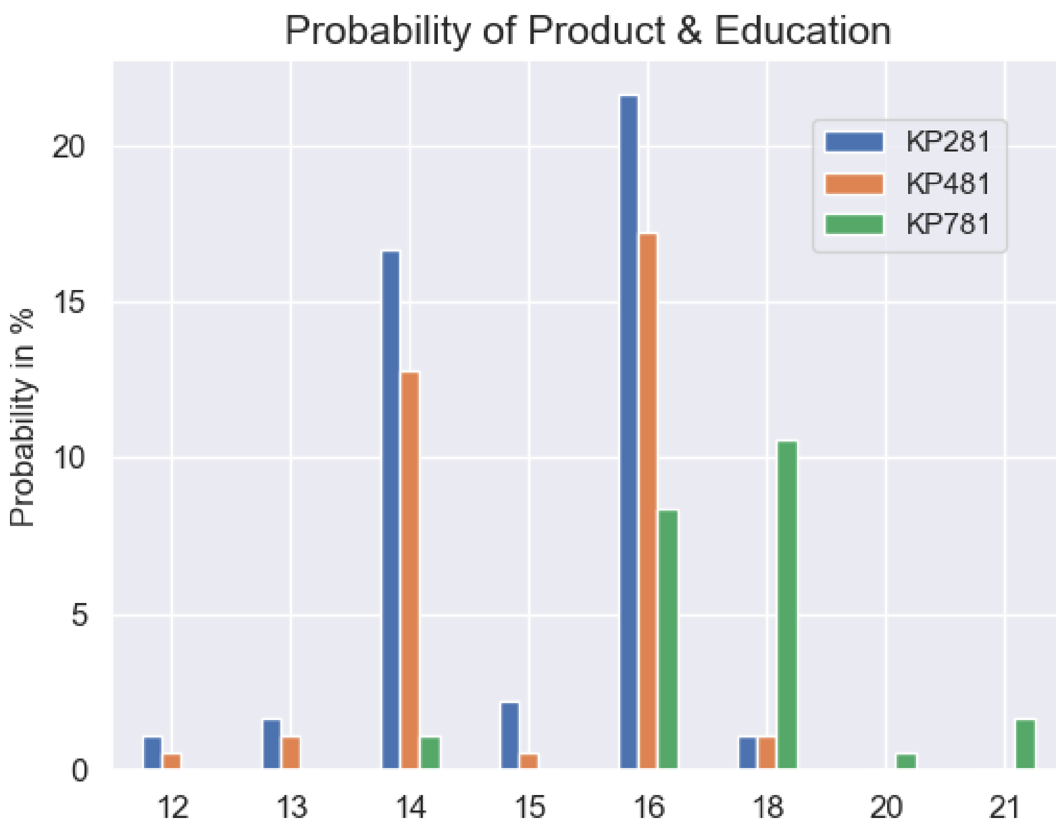
[ ]:
```
plt.figure(figsize=(15,10)).suptitle("Aerofit Education Dashboard",fontsize=14)

plt.subplot(2, 2, 1)
plt.pie(aerofit['Education'].value_counts().values,labels =␣
↪aerofit['Education'].value_counts().index,radius = 1.3,autopct = '%1.2f%%')␣
↪# type: ignore

plt.subplot(2, 2, 3)
sns.boxplot(aerofit, y="Education", x='Product')
plt.ylabel('Education Level', fontsize=12)

plt.subplot(3, 2, 2)
sns.histplot(aerofit, x='Education', binwidth=1, kde=True, hue="Product")
plt.title('No of Product Purchase vs Education Level', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
```

```
plt.subplot(3, 2, 4)
sns.countplot(aerofit, x='Education')
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 6)
sns.countplot(aerofit, x='Education', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Education Level', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=1, ncol=1)

plt.show()
```

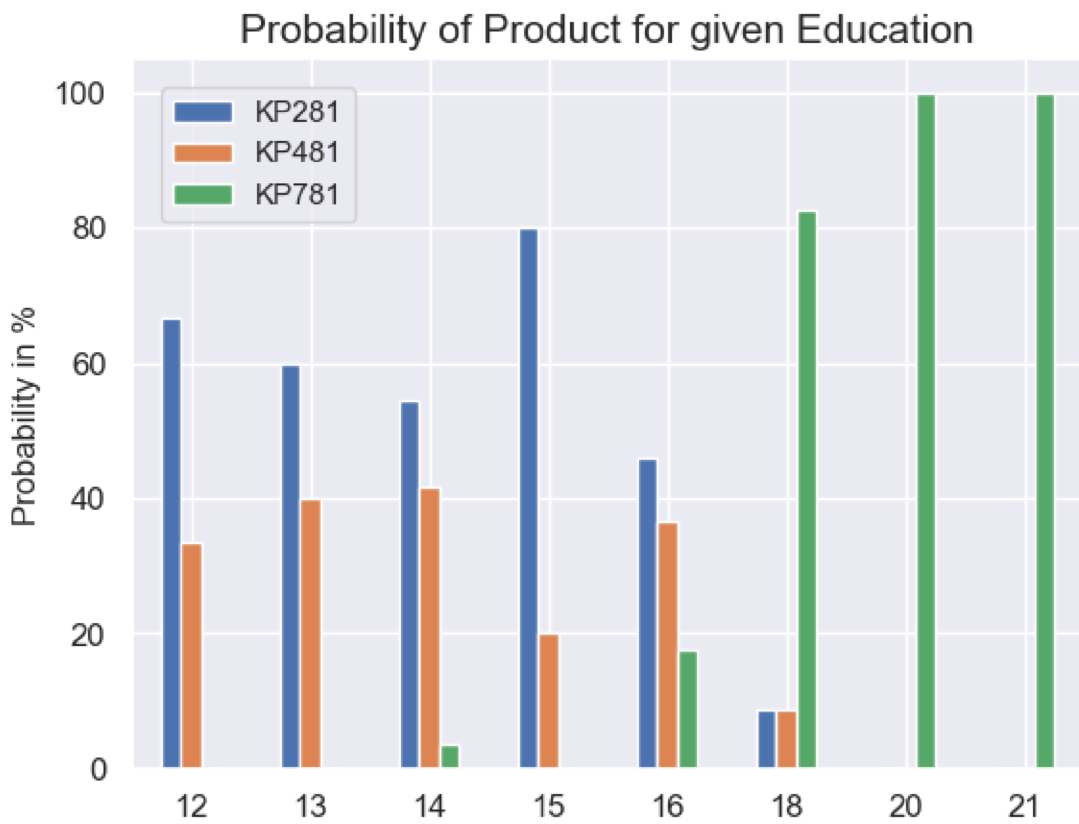


Probability Plot

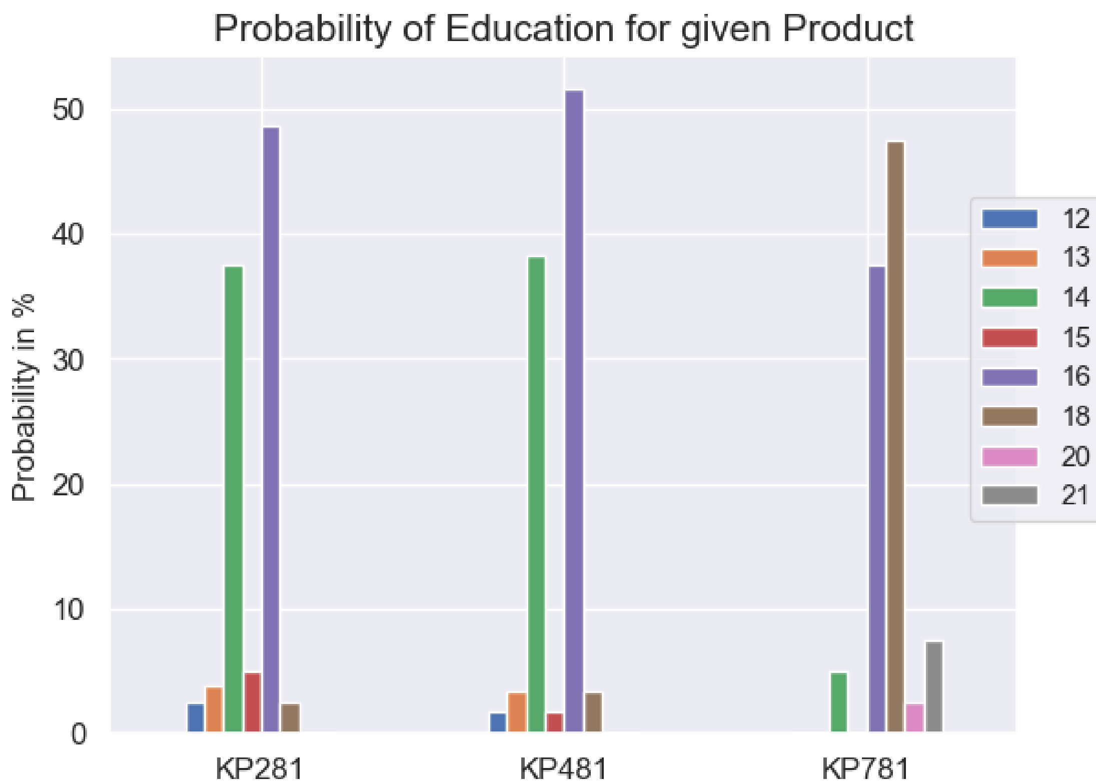
[ ]:
```
(pd.crosstab(aerofit['Education'], aerofit['Product'], normalize=True)*100).
  ↪plot(kind='bar')
plt.title('Probability of Product & Education', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(borderaxespad=2, ncol=1)
plt.show()
```



[ ]:
```
(pd.crosstab(aerofit['Education'], aerofit['Product'], normalize="index")*100).
  ↪plot(kind='bar')
plt.title('Probability of Product for given Education', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(borderaxespad=1, ncol=1)
plt.show()
```

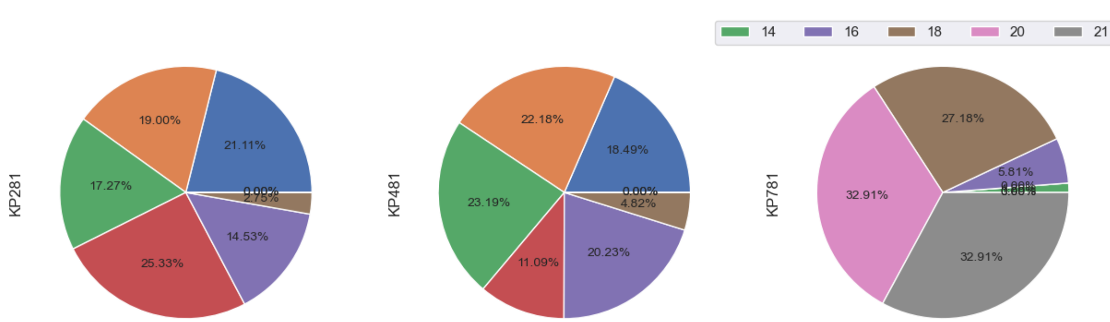


[ ]:
```
(pd.crosstab(aerofit['Product'], aerofit['Education'], normalize="index")*100).
  ↪plot(kind='bar')
plt.title('Probability of Education for given Product', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=5)

plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['Education'], aerofit['Product'], normalize="index").
      ↪plot(kind='pie', subplots=True, figsize=(15,5), labeldistance=None,␣
      ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=5)
     plt.show()
```



1.3.8 Fitness

[ ]:
```
aerofit['Fitness'].unique()
```

[ ]:
```
array([4, 3, 2, 1, 5], dtype=int64)
```

[ ]:
```
aerofit['Fitness'].value_counts()
```

[ ]:
```
3    97
5    31
2    26
4    24
1     2
Name: Fitness, dtype: int64
```

[ ]:
```
aerofit['Fitness'].value_counts(normalize=True)*100
```

[ ]:
```
3    53.888889
5    17.222222
2    14.444444
4    13.333333
1     1.111111
Name: Fitness, dtype: float64
```

Statitical Analysis

[ ]:
```
aerofit['Fitness'].describe()
```

[ ]:
```
count    180.000000
mean       3.311111
std        0.958869
min        1.000000
25%        3.000000
50%        3.000000
75%        4.000000
max        5.000000
Name: Fitness, dtype: float64
```

[ ]:
```
aerofit['Fitness'].mean()
```

[ ]:
```
3.311111111111111
```

[ ]:
```
aerofit['Fitness'].median()
```

[ ]:
```
3.0
```

[ ]:
```
aerofit['Fitness'].mode()[0]
```

[ ]:
```
3
```

```
[ ]: aerofit.groupby('Product')["Fitness"].describe()
```

```
[ ]:          count    mean       std  min  25%  50%  75%  max
     Product
     KP281     80.0  2.9625  0.664540  1.0  3.0  3.0  3.0  5.0
     KP481     60.0  2.9000  0.629770  1.0  3.0  3.0  3.0  4.0
     KP781     40.0  4.6250  0.667467  3.0  4.0  5.0  5.0  5.0
```

Check for Outliers

```
[ ]: check_outlier(aerofit, 'Fitness')['upper']
```

```
[ ]: {'list': Series([], Name: Fitness, dtype: int64), 'length': 0}
```

```
[ ]: check_outlier(aerofit, 'Fitness')['lower']
```

```
[ ]: {'list': 14     1
      117    1
      Name: Fitness, dtype: int64,
      'length': 2}
```

Find Probability

Probability of a Product & Fitness across all Combination *"Product Fitness"*

```
[ ]: pd.crosstab(aerofit['Fitness'], aerofit['Product'], normalize=True,␣
      ↪margins=True)*100
```

```
[ ]: Product      KP281      KP481      KP781         All
     Fitness
     1         0.555556   0.555556   0.000000    1.111111
     2         7.777778   6.666667   0.000000   14.444444
     3        30.000000  21.666667   2.222222   53.888889
     4         5.000000   4.444444   3.888889   13.333333
     5         1.111111   0.000000  16.111111   17.222222
     All      44.444444  33.333333  22.222222  100.000000
```

Probability of Product's for given Fitness *"Product | Fitness"*

```
[ ]: pd.crosstab(aerofit['Fitness'], aerofit['Product'], normalize='index',␣
      ↪margins=True)*100
```

```
[ ]: Product      KP281      KP481      KP781
     Fitness
     1        50.000000  50.000000   0.000000
     2        53.846154  46.153846   0.000000
     3        55.670103  40.206186   4.123711
     4        37.500000  33.333333  29.166667
     5         6.451613   0.000000  93.548387
     All      44.444444  33.333333  22.222222
```

Probability of Fitness for given Product *"Fitness | Product"*

[ ]:
```
pd.crosstab(aerofit['Fitness'], aerofit['Product'], normalize='columns',␣
  ↪margins=True)*100
```

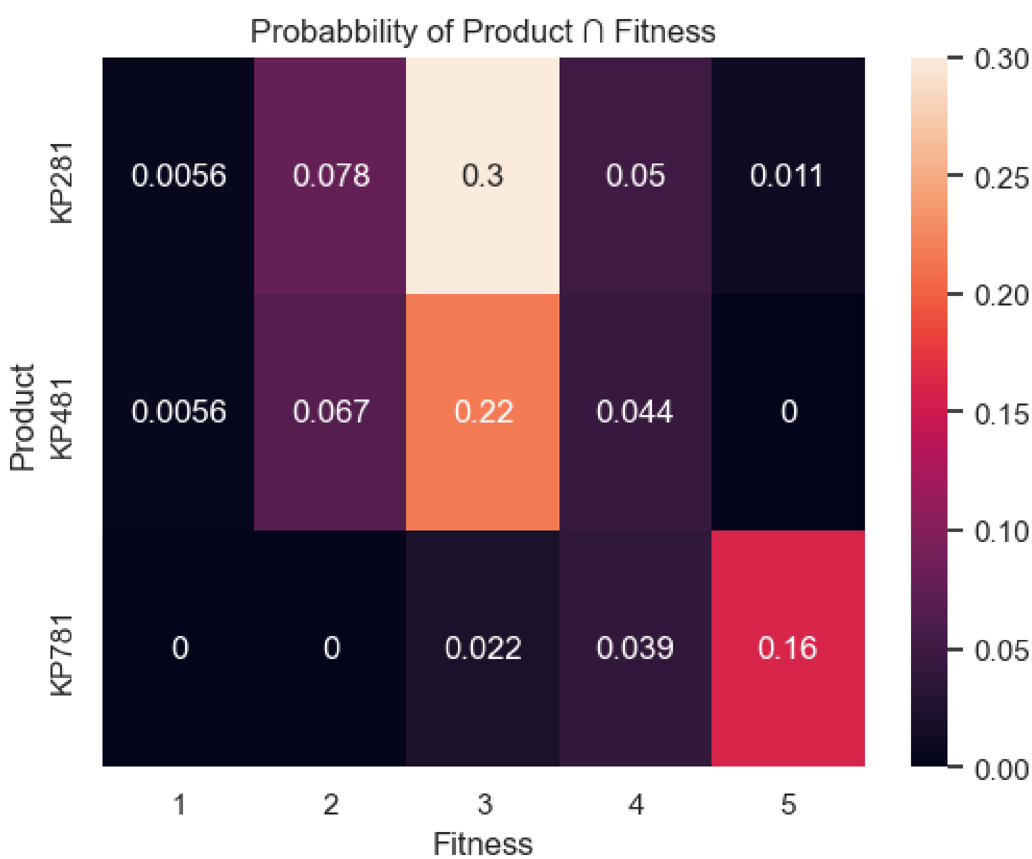
[ ]:
```
Product  KP281      KP481  KP781        All
Fitness
1         1.25   1.666667    0.0   1.111111
2        17.50  20.000000    0.0  14.444444
3        67.50  65.000000   10.0  53.888889
4        11.25  13.333333   17.5  13.333333
5         2.50   0.000000   72.5  17.222222
```

Plot the Graph

Heat Map

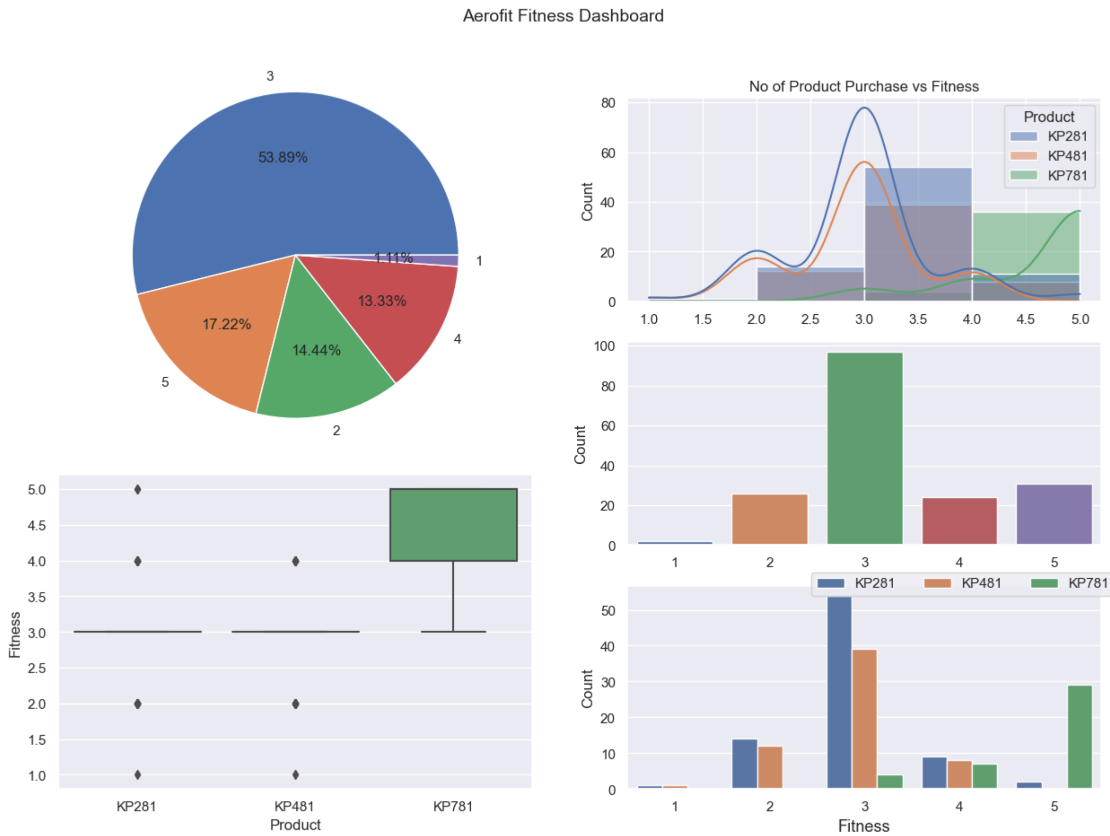
[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['Fitness'],␣
  ↪normalize='all'),annot=True)
plt.title('Probabbility of Product  Fitness', fontsize=12)
```

[ ]:
```
Text(0.5, 1.0, 'Probabbility of Product  Fitness')
```



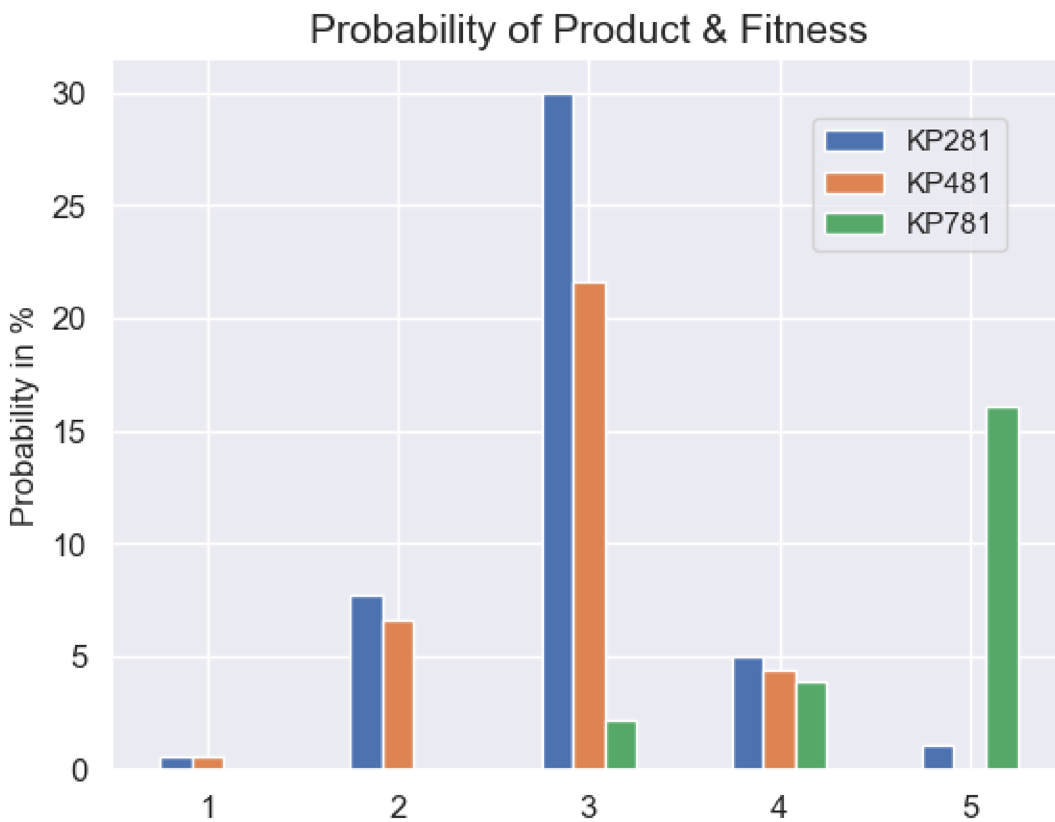
Descriptive Plot

[ ]:
```
plt.figure(figsize=(15,10)).suptitle("Aerofit Fitness Dashboard",fontsize=14)

plt.subplot(2, 2, 1)
plt.pie(aerofit['Fitness'].value_counts().values,labels = aerofit['Fitness'].
 ↪value_counts().index,radius = 1.3,autopct = '%1.2f%%') # type: ignore

plt.subplot(2, 2, 3)
sns.boxplot(aerofit, y="Fitness", x='Product')

plt.subplot(3, 2, 2)
sns.histplot(aerofit, x='Fitness', binwidth=1, kde=True, hue="Product")
plt.title('No of Product Purchase vs Fitness', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 4)
sns.countplot(aerofit, x='Fitness')
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 6)
sns.countplot(aerofit, x='Fitness', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Fitness', fontsize=13)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=-1, ncol=3)
plt.show()
```

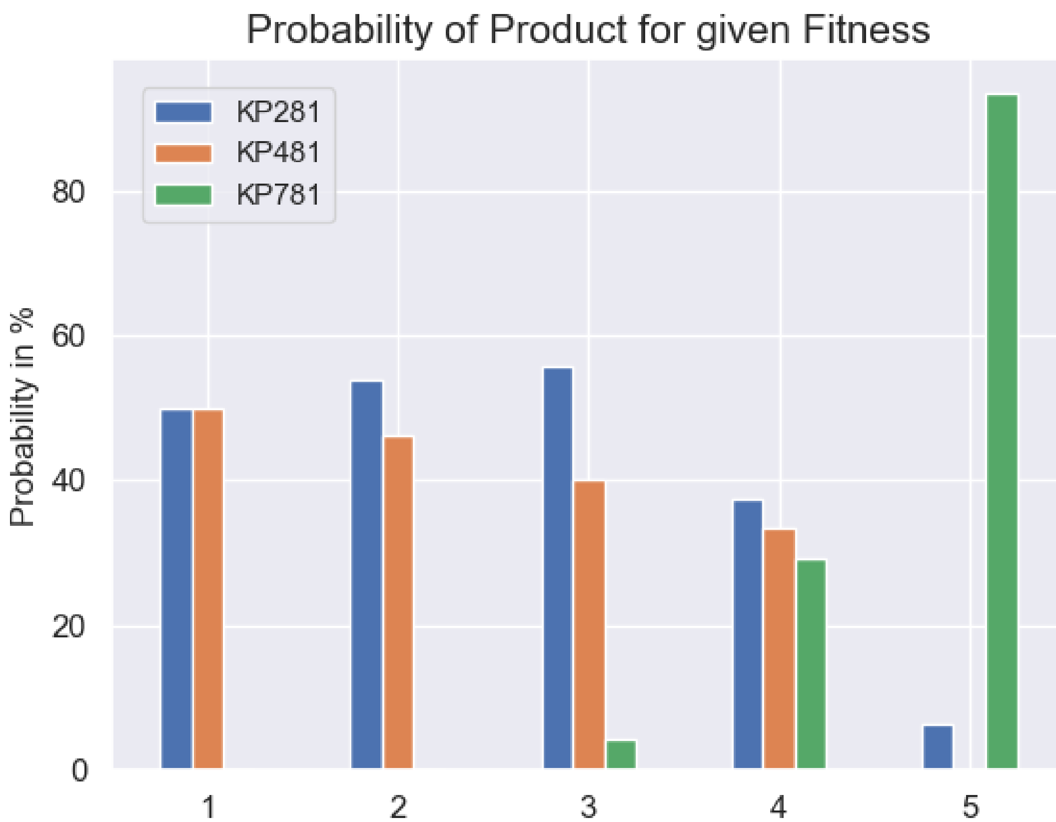


Probability Plot

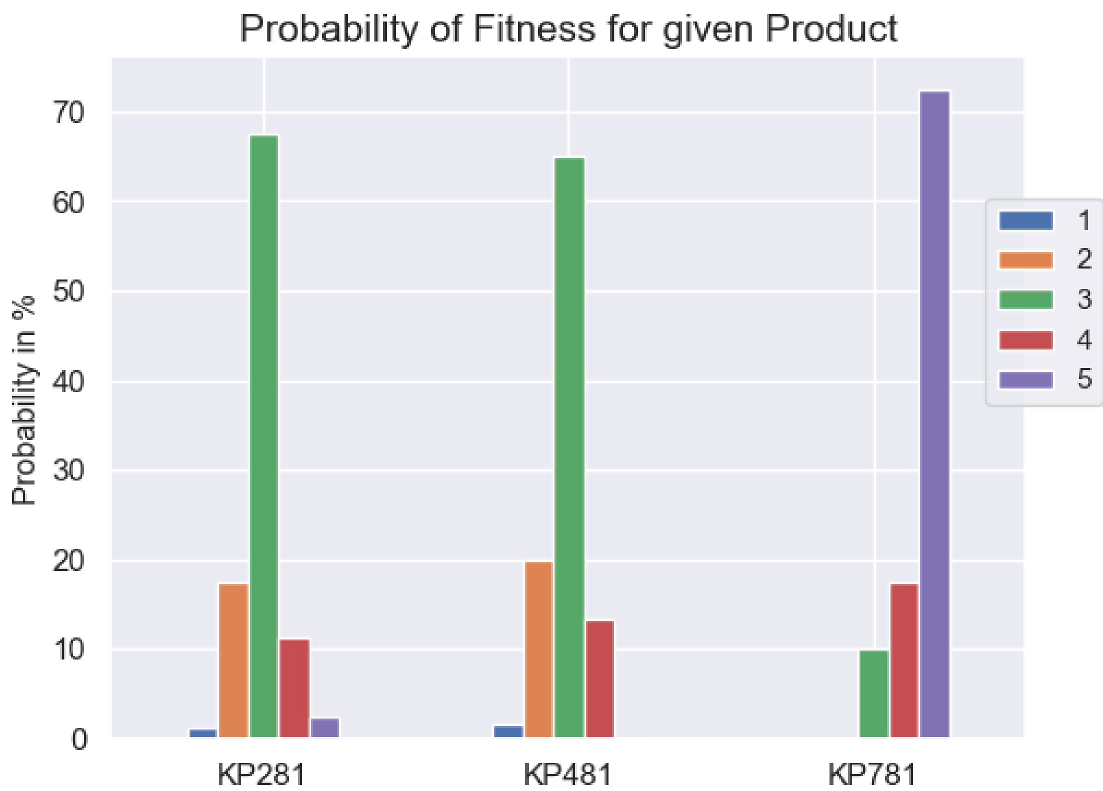
```
[ ]: (pd.crosstab(aerofit['Fitness'], aerofit['Product'], normalize=True)*100).
      ↪plot(kind='bar')
     plt.title('Probability of Product & Fitness', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=12)
     plt.legend(borderaxespad=2, ncol=1)
     plt.show()
```




```
[ ]: (pd.crosstab(aerofit['Fitness'], aerofit['Product'], normalize="index")*100).
      ↪plot(kind='bar')
     plt.title('Probability of Product for given Fitness', fontsize=15)
     plt.ylabel('Probability in %', fontsize=12)
     plt.xlabel('', fontsize=12)
     plt.xticks(rotation= 360, fontsize=12)
     plt.yticks(rotation= 0, fontsize=12)
     plt.legend(borderaxespad=1, ncol=1)
     plt.show()
```

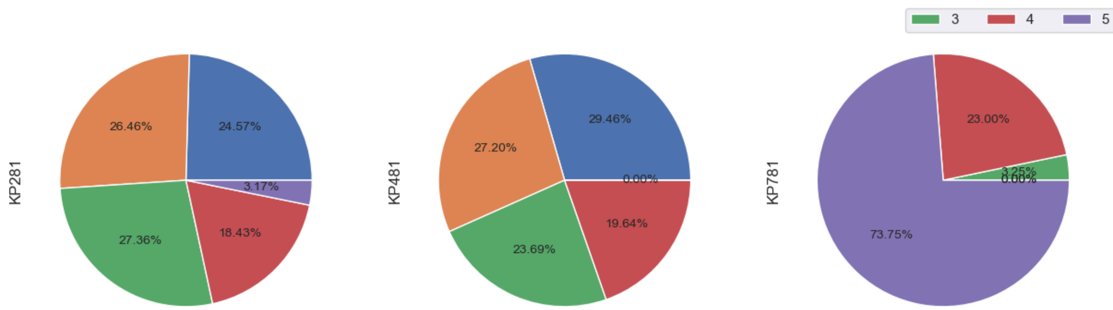


[ ]:
```
(pd.crosstab(aerofit['Product'], aerofit['Fitness'], normalize="index")*100).
 ↪plot(kind='bar')
plt.title('Probability of Fitness for given Product', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=5)

plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['Fitness'], aerofit['Product'], normalize="index").
      ↪plot(kind='pie', subplots=True, figsize=(15,5), labeldistance=None,␣
      ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=5)
     plt.show()
```



1.3.9 Usage

[ ]:
```
aerofit['Usage'].unique()
```

[ ]:
```
array([3, 2, 4, 5, 6, 7], dtype=int64)
```

[ ]:
```
aerofit['Usage'].value_counts()
```

[ ]:
```
3    69
4    52
2    33
5    17
6     7
7     2
Name: Usage, dtype: int64
```

[ ]:
```
aerofit['Usage'].value_counts(normalize=True)*100
```

[ ]:
```
3    38.333333
4    28.888889
2    18.333333
5     9.444444
6     3.888889
7     1.111111
Name: Usage, dtype: float64
```

Statitical Analysis

[ ]:
```
aerofit['Usage'].describe()
```

[ ]:
```
count    180.000000
mean       3.455556
std        1.084797
min        2.000000
25%        3.000000
50%        3.000000
75%        4.000000
max        7.000000
Name: Usage, dtype: float64
```

[ ]:
```
aerofit['Usage'].mean()
```

[ ]:
```
3.4555555555555557
```

[ ]:
```
aerofit['Usage'].median()
```

[ ]:
```
3.0
```

[ ]:
```
aerofit['Usage'].mode()[0]
```

[ ]: 3

[ ]:
```
aerofit.groupby('Product')["Usage"].describe()
```

[ ]:

	count	mean	std	min	25%	50%	75%	max
Product								
KP281	80.0	3.087500	0.782624	2.0	3.0	3.0	4.00	5.0
KP481	60.0	3.066667	0.799717	2.0	3.0	3.0	3.25	5.0
KP781	40.0	4.775000	0.946993	3.0	4.0	5.0	5.00	7.0

Check for Outliers

[ ]:
```
check_outlier(aerofit, 'Usage')['upper']
```

[ ]:
```
{'list': 154    6
 155    6
 162    6
 163    7
 164    6
 166    7
 167    6
 170    6
 175    6
 Name: Usage, dtype: int64,
 'length': 9}
```

[ ]:
```
check_outlier(aerofit, 'Usage')['lower']
```

[ ]:
```
{'list': Series([], Name: Usage, dtype: int64), 'length': 0}
```

Find Probability

Probability of a Product & Usage across all Combination *"Product   Usage"*

[ ]:
```
pd.crosstab(aerofit['Usage'], aerofit['Product'], normalize=True,␣
 ↪margins=True)*100
```

[ ]:

Product	KP281	KP481	KP781	All
Usage				
2	10.555556	7.777778	0.000000	18.333333
3	20.555556	17.222222	0.555556	38.333333
4	12.222222	6.666667	10.000000	28.888889
5	1.111111	1.666667	6.666667	9.444444
6	0.000000	0.000000	3.888889	3.888889
7	0.000000	0.000000	1.111111	1.111111
All	44.444444	33.333333	22.222222	100.000000

Probability of Product's for given Usage *"Product | Usage"*

[ ]:
```
pd.crosstab(aerofit['Usage'], aerofit['Product'], normalize='index',␣
↪margins=True)*100
```

[ ]:

Product Usage	KP281	KP481	KP781
2	57.575758	42.424242	0.000000
3	53.623188	44.927536	1.449275
4	42.307692	23.076923	34.615385
5	11.764706	17.647059	70.588235
6	0.000000	0.000000	100.000000
7	0.000000	0.000000	100.000000
All	44.444444	33.333333	22.222222

Probability of Usage for given Product *"Fitness | Product"*

[ ]:
```
pd.crosstab(aerofit['Usage'], aerofit['Product'], normalize='columns',␣
↪margins=True)*100
```

[ ]:

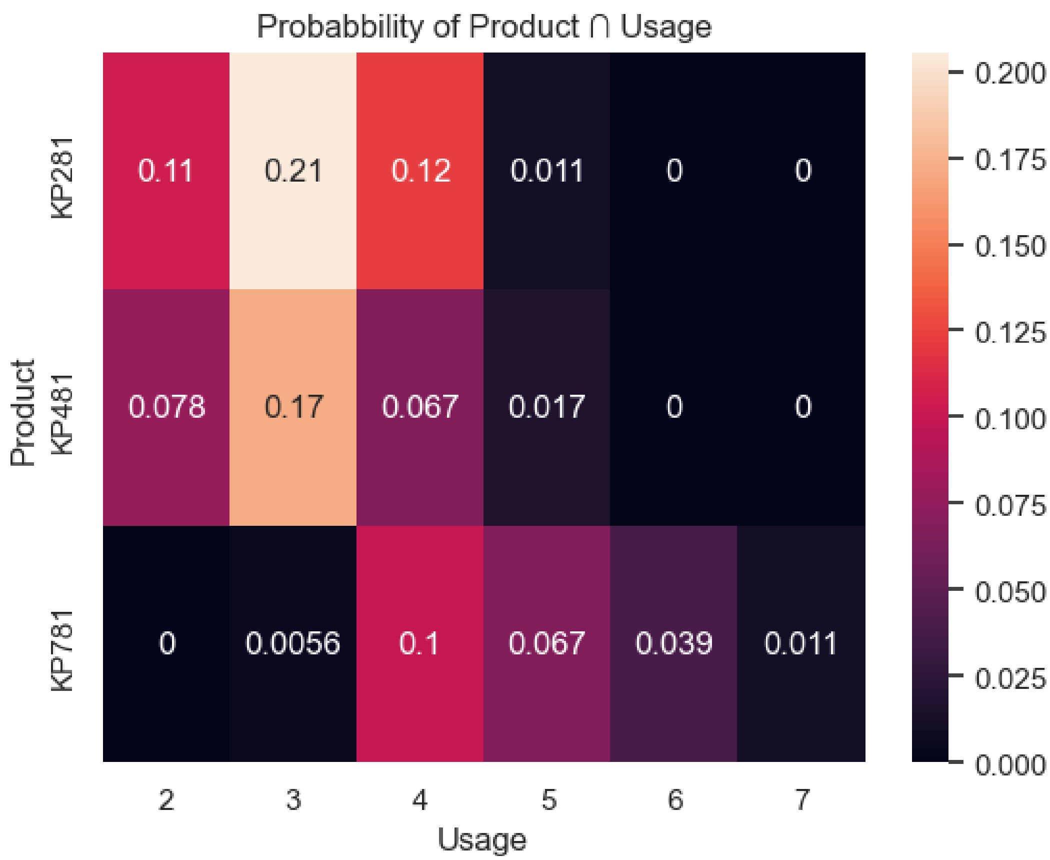
Product Usage	KP281	KP481	KP781	All
2	23.75	23.333333	0.0	18.333333
3	46.25	51.666667	2.5	38.333333
4	27.50	20.000000	45.0	28.888889
5	2.50	5.000000	30.0	9.444444
6	0.00	0.000000	17.5	3.888889
7	0.00	0.000000	5.0	1.111111

Plot the Graph

Heat Map

[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['Usage'],␣
↪normalize='all'),annot=True)
plt.title('Probabbility of Product  Usage', fontsize=12)
```

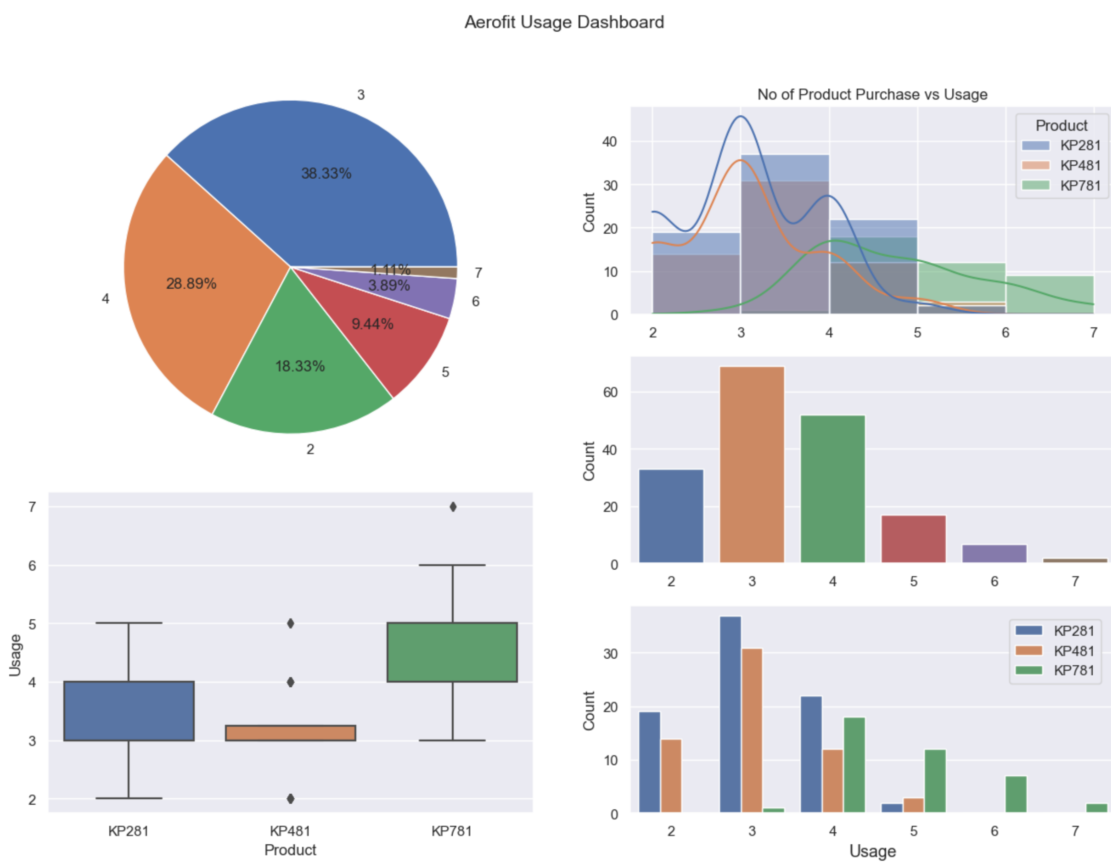
[ ]:
```
Text(0.5, 1.0, 'Probabbility of Product  Usage')
```



Descriptive Plot

[ ]:
```
plt.figure(figsize=(15,10)).suptitle("Aerofit Usage Dashboard",fontsize=14)

plt.subplot(2, 2, 1)
plt.pie(aerofit['Usage'].value_counts().values,labels = aerofit['Usage'].
↪value_counts().index,radius = 1.3,autopct = '%1.2f%%') # type: ignore

plt.subplot(2, 2, 3)
sns.boxplot(aerofit, y="Usage", x='Product')

plt.subplot(3, 2, 2)
sns.histplot(aerofit, x='Usage', binwidth=1, kde=True, hue="Product")
plt.title('No of Product Purchase vs Usage', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 4)
```

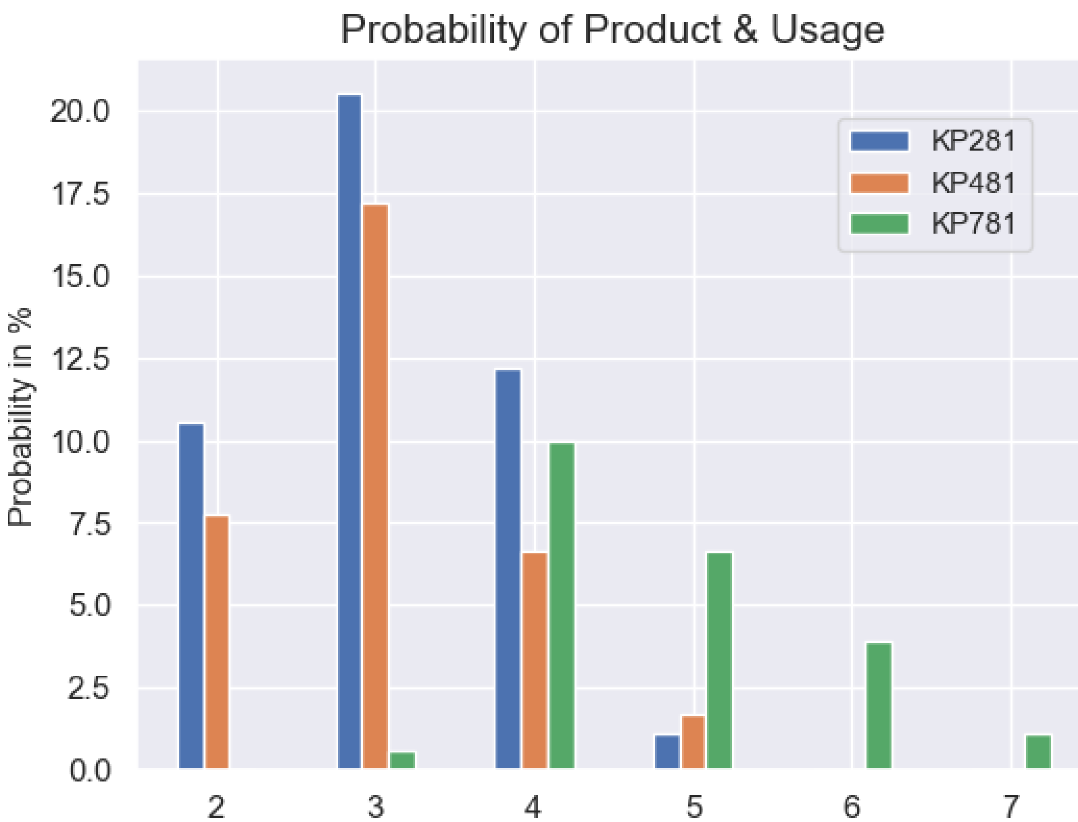
```
sns.countplot(aerofit, x='Usage')
plt.ylabel('Count', fontsize=12)
plt.xlabel('', fontsize=11)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)

plt.subplot(3, 2, 6)
sns.countplot(aerofit, x='Usage', hue='Product')
plt.ylabel('Count', fontsize=12)
plt.xlabel('Usage', fontsize=13)
plt.xticks(fontsize=11)
plt.yticks(rotation= 0, fontsize=11)
plt.legend(borderaxespad=1, ncol=1)

plt.show()
```



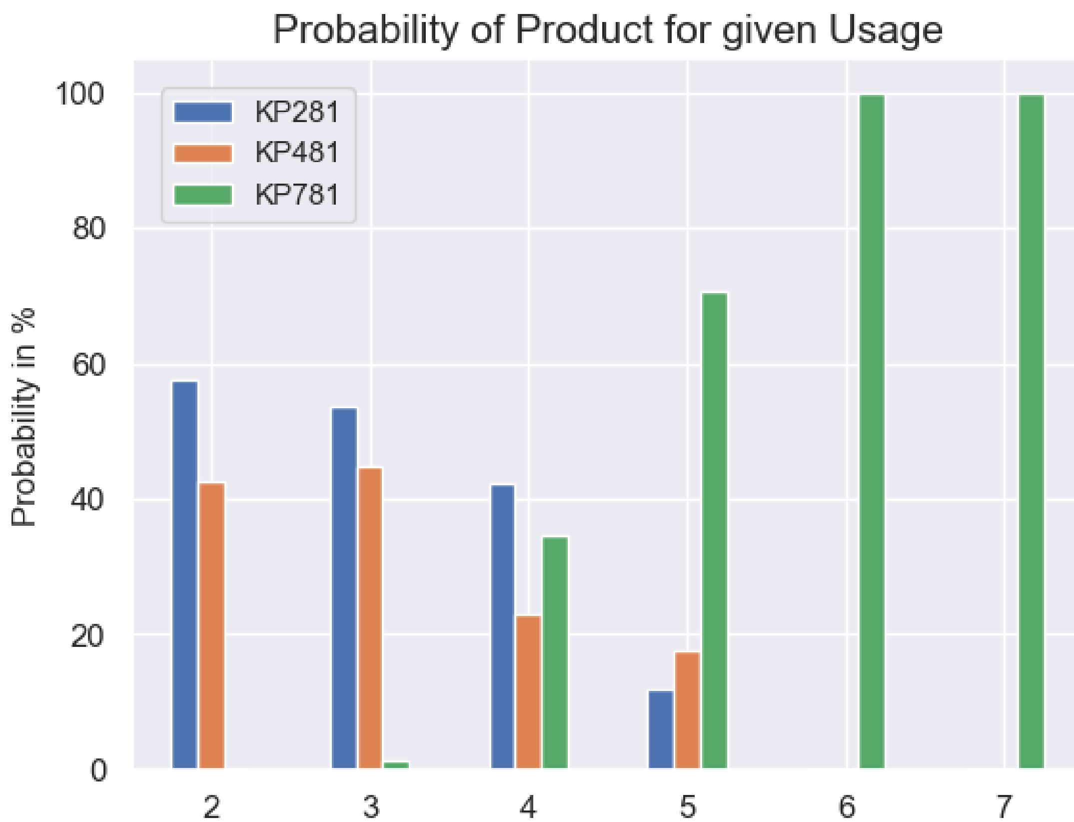
Probability Plot

```
[ ]: (pd.crosstab(aerofit['Usage'], aerofit['Product'], normalize=True)*100).
      ↪plot(kind='bar')
```

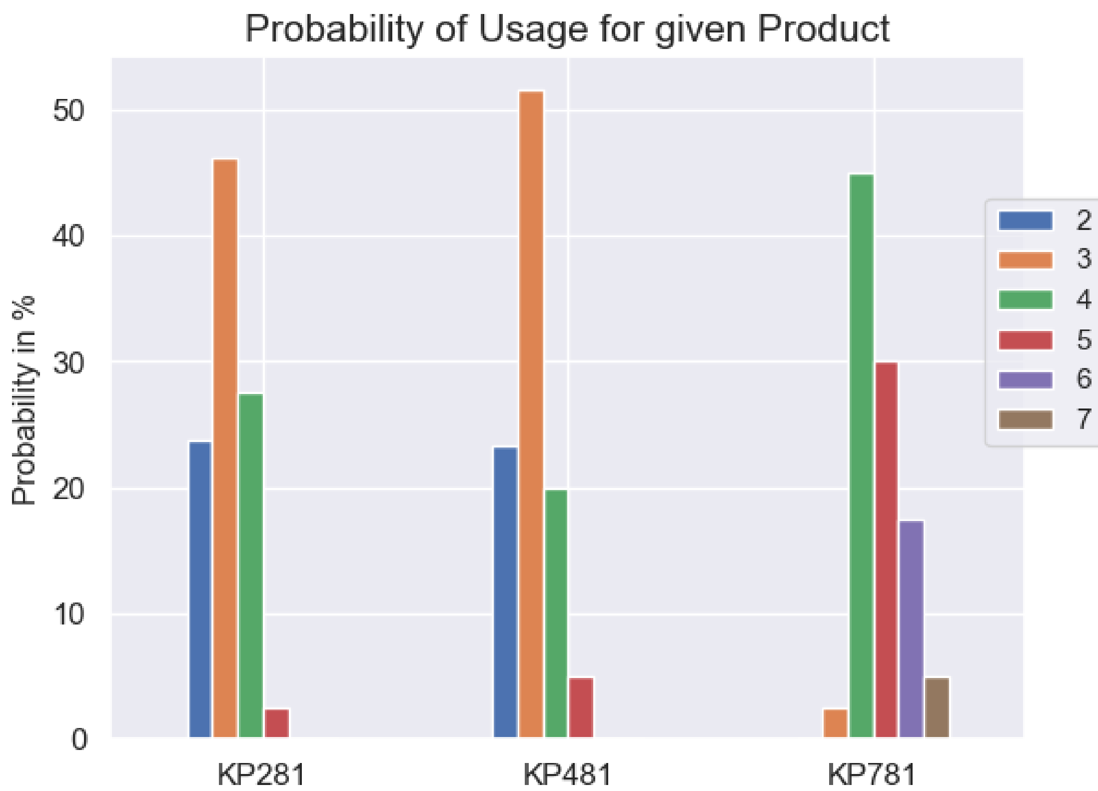
```
plt.title('Probability of Product & Usage', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(borderaxespad=2, ncol=1)
plt.show()
```




```
[ ]: (pd.crosstab(aerofit['Usage'], aerofit['Product'], normalize="index")*100).
      ↪plot(kind='bar')
plt.title('Probability of Product for given Usage', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(borderaxespad=1, ncol=1)
plt.show()
```

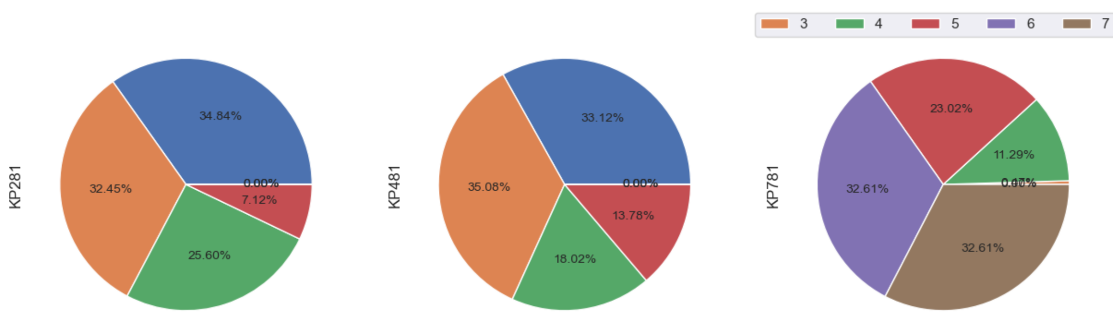


[ ]:
```
(pd.crosstab(aerofit['Product'], aerofit['Usage'], normalize="index")*100).
 ↪plot(kind='bar')
plt.title('Probability of Usage for given Product', fontsize=15)
plt.ylabel('Probability in %', fontsize=12)
plt.xlabel('', fontsize=12)
plt.xticks(rotation= 360, fontsize=12)
plt.yticks(rotation= 0, fontsize=12)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper center', borderaxespad=5)

plt.show()
```



Population Plot

```
[ ]: pd.crosstab(aerofit['Usage'], aerofit['Product'], normalize="index").
       ↪plot(kind='pie', subplots=True, figsize=(15,5), labeldistance=None,␣
       ↪fontsize=10, legend=None, autopct = '%1.2f%%')
     plt.legend(borderaxespad=-1, ncol=5)
     plt.show()
```



1.4 Customer Profile of Different Product

[ ]:
```
KP281 = aerofit.copy().loc[aerofit['Product']=='KP281']
KP481 = aerofit.copy().loc[aerofit['Product']=='KP481']
KP781 = aerofit.copy().loc[aerofit['Product']=='KP781']
```

1.4.1 Cummulative Profile

[ ]:
```
plt.figure(figsize=(20,15)).suptitle("Aerofit Customer Profile",fontsize=14)

plt.subplot(2, 2, 1)
sns.heatmap(aerofit[['Age', 'Income', 'Miles', 'Education', 'Fitness',␣
↪'Usage']].corr(), annot=True)
plt.yticks(rotation= 0, fontsize=11)
plt.xticks(fontsize=11)

plt.subplot(4, 3, 3)
sns.countplot(aerofit, x='Gender', hue="Product")
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 6)
sns.countplot(aerofit, x='MaritalStatus', hue="Product")
plt.ylabel("Count", fontsize=11)

plt.subplot(4, 3, 7)
sns.histplot(aerofit, x="Age", binwidth=3, kde=True, hue="Product",␣
↪element="step")
plt.subplot(4, 3, 8)
sns.histplot(aerofit, x="Income", binwidth=1500, kde=True, hue="Product",␣
↪element="step")
plt.subplot(4, 3, 9)
sns.histplot(aerofit, x="Miles", binwidth=20, kde=True, hue="Product",␣
↪element="step")

plt.subplot(4, 3, 10)
sns.histplot(aerofit, x="Education", binwidth=1, kde=True, hue="Product",␣
↪element="step")
plt.subplot(4, 3, 11)
sns.countplot(aerofit, x='Fitness', hue="Product")
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 12)
sns.countplot(aerofit, x='Usage', hue="Product")
plt.ylabel("Count", fontsize=11)

plt.show()
```

1.4.2 Profile of *KP281*

[ ]:
```
KP281[['Gender', 'MaritalStatus', 'Fitness', 'Usage', 'Age']].
↪value_counts(normalize=True)[:5]*100
```

[ ]:
```
Gender   MaritalStatus  Fitness  Usage  Age
Female   Partnered      2        2      25     2.5
Male     Partnered      3        3      38     2.5
Female   Single         3        4      24     2.5
         Partnered      3        2      28     2.5
Male     Single         3        4      23     2.5
dtype: float64
```

Statitical Analysis

[ ]:
```
KP281[['Gender', 'MaritalStatus', 'age_group', 'income_group', 'miles_group',␣
↪'education_group', 'fitness_group', 'usage_group' ]].describe()
```

[ ]:
```
        Gender MaritalStatus age_group income_group miles_group  \
count       80            80        80           80          80
unique       2             2         7            5           6
top     Female     Partnered     20-25      45K-55K      80-110
freq        40            48        28           35          27

        education_group  fitness_group  usage_group
count                80             80           80
unique                6              5            4
top                  16              3            3
freq                 39             54           37
```

[ ]:
```
KP281[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].describe()
```

[ ]:

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

[ ]:
```
KP281[['Age', 'Income', 'Miles', 'Education', 'Usage', 'Fitness']].median()
```

[ ]:
```
Age             26.0
Income       46617.0
Miles           85.0
Education       16.0
Usage            3.0
Fitness          3.0
dtype: float64
```

Find Probability

[ ]:
```
pd.crosstab([KP281.income_group], [KP281.age_group], normalize=True,␣
↪margins=True)*100
```

[ ]:

age_group income_group	15-20	20-25	25-30	30-35	35-40	40-45	45-50	All
25K-35K	6.25	3.75	0.00	0.00	0.00	0.00	0.00	10.00
35K-45K	1.25	25.00	3.75	0.00	2.50	0.00	0.00	32.50
45K-55K	0.00	6.25	21.25	10.00	3.75	2.50	0.00	43.75
55K-65K	0.00	0.00	0.00	2.50	3.75	1.25	3.75	11.25
65K-75K	0.00	0.00	1.25	1.25	0.00	0.00	0.00	2.50
All	7.50	35.00	26.25	13.75	10.00	3.75	3.75	100.00

```
[ ]: pd.crosstab([KP281.Fitness, KP281.Gender, KP281.MaritalStatus], [KP281.
     ↪miles_group], normalize=True, margins=True)*100
```

```
[ ]: miles_group                   20-50  50-80  80-110  110-140  140-170  170-200  \
     Fitness Gender MaritalStatus
     1       Male   Partnered       1.25   0.00    0.00     0.00     0.00     0.00
     2       Female Partnered       6.25   2.50    0.00     0.00     0.00     0.00
                    Single          2.50   1.25    0.00     0.00     0.00     0.00
             Male   Partnered       5.00   0.00    0.00     0.00     0.00     0.00
     3       Female Partnered       0.00  12.50    8.75     1.25     0.00     0.00
                    Single          0.00   5.00    3.75     1.25     0.00     0.00
             Male   Partnered       0.00   7.50    8.75     0.00     0.00     0.00
                    Single          0.00   2.50   12.50     3.75     0.00     0.00
     4       Female Partnered       0.00   0.00    0.00     1.25     0.00     0.00
                    Single          0.00   1.25    0.00     1.25     0.00     0.00
             Male   Partnered       0.00   0.00    0.00     2.50     1.25     0.00
                    Single          0.00   0.00    0.00     2.50     1.25     0.00
     5       Female Partnered       0.00   0.00    0.00     0.00     0.00     1.25
             Male   Single          0.00   0.00    0.00     0.00     1.25     0.00
     All                           15.00  32.50   33.75    13.75     3.75     1.25

     miles_group                      All
     Fitness Gender MaritalStatus
     1       Male   Partnered        1.25
     2       Female Partnered        8.75
                    Single           3.75
             Male   Partnered        5.00
     3       Female Partnered       22.50
                    Single          10.00
             Male   Partnered       16.25
                    Single          18.75
     4       Female Partnered        1.25
                    Single           2.50
             Male   Partnered        3.75
                    Single           3.75
     5       Female Partnered        1.25
             Male   Single           1.25
     All                           100.00
```

```
[ ]: pd.crosstab([KP281.Fitness, KP281.Gender, KP281.MaritalStatus], [KP281.
     ↪age_group], normalize=True, margins=True)*100
```

```
[ ]: age_group                     15-20  20-25  25-30  30-35  35-40  40-45  45-50  \
     Fitness Gender MaritalStatus
     1       Male   Partnered       0.00   1.25   0.00   0.00   0.00   0.00   0.00
     2       Female Partnered       0.00   5.00   2.50   0.00   0.00   0.00   1.25
                    Single          0.00   0.00   0.00   3.75   0.00   0.00   0.00
```

```
        Male   Partnered       1.25   1.25   1.25   1.25   0.00   0.00   0.00
3       Female Partnered       2.50   5.00   8.75   2.50   2.50   0.00   1.25
               Single          0.00   7.50   1.25   1.25   0.00   0.00   0.00
        Male   Partnered       0.00   3.75   2.50   2.50   3.75   2.50   1.25
               Single          2.50   7.50   6.25   0.00   2.50   0.00   0.00
4       Female Partnered       0.00   0.00   1.25   0.00   0.00   0.00   0.00
               Single          0.00   0.00   0.00   1.25   0.00   1.25   0.00
        Male   Partnered       0.00   0.00   2.50   0.00   1.25   0.00   0.00
               Single          1.25   2.50   0.00   0.00   0.00   0.00   0.00
5       Female Partnered       0.00   1.25   0.00   0.00   0.00   0.00   0.00
        Male   Single          0.00   0.00   0.00   1.25   0.00   0.00   0.00
All                            7.50  35.00  26.25  13.75  10.00   3.75   3.75

age_group                        All
Fitness Gender MaritalStatus
1       Male   Partnered        1.25
2       Female Partnered        8.75
               Single           3.75
        Male   Partnered        5.00
3       Female Partnered       22.50
               Single          10.00
        Male   Partnered       16.25
               Single          18.75
4       Female Partnered        1.25
               Single           2.50
        Male   Partnered        3.75
               Single           3.75
5       Female Partnered        1.25
        Male   Single           1.25
All                           100.00
```

[ ]:
```
pd.crosstab([KP281.Fitness, KP281.Gender, KP281.MaritalStatus], [KP281.
 ↪income_group], normalize=True, margins=True)*100
```

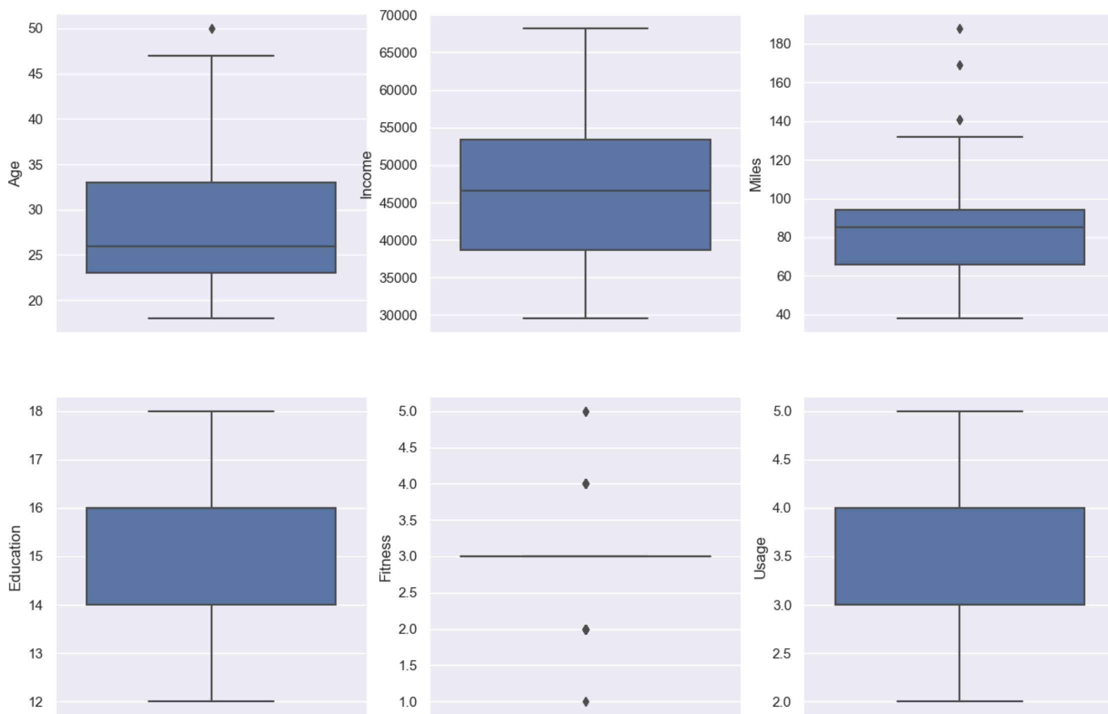
[ ]:
```
income_group                  25K-35K  35K-45K  45K-55K  55K-65K  65K-75K  \
Fitness Gender MaritalStatus
1       Male   Partnered         0.00     1.25     0.00     0.00     0.00
2       Female Partnered         1.25     2.50     3.75     1.25     0.00
               Single            0.00     0.00     2.50     1.25     0.00
        Male   Partnered         0.00     2.50     2.50     0.00     0.00
3       Female Partnered         2.50     5.00    12.50     2.50     0.00
               Single            1.25     6.25     1.25     0.00     1.25
        Male   Partnered         0.00     2.50     8.75     3.75     1.25
               Single            3.75     6.25     8.75     0.00     0.00
4       Female Partnered         0.00     1.25     0.00     0.00     0.00
               Single            0.00     0.00     1.25     1.25     0.00
        Male   Partnered         0.00     1.25     1.25     1.25     0.00
```

```
                Single          1.25      2.50      0.00      0.00      0.00
5       Female  Partnered       0.00      1.25      0.00      0.00      0.00
        Male    Single          0.00      0.00      1.25      0.00      0.00
All                            10.00     32.50     43.75     11.25      2.50

income_group                   All
Fitness Gender MaritalStatus
1       Male   Partnered       1.25
2       Female Partnered       8.75
               Single          3.75
        Male   Partnered       5.00
3       Female Partnered      22.50
               Single         10.00
        Male   Partnered      16.25
               Single         18.75
4       Female Partnered       1.25
               Single          2.50
        Male   Partnered       3.75
               Single          3.75
5       Female Partnered       1.25
        Male   Single          1.25
All                          100.00
```

Check for Outliers

[ ]:
```
plt.figure(figsize=(15,10)).suptitle("KP281 Outliers",fontsize=14)

plt.subplot(2, 3, 1)
sns.boxplot(KP281, y="Age")
plt.subplot(2, 3, 2)
sns.boxplot(KP281, y="Income")

plt.subplot(2, 3, 3)
sns.boxplot(KP281, y="Miles")
plt.subplot(2, 3, 4)
sns.boxplot(KP281, y="Education")

plt.subplot(2, 3, 5)
sns.boxplot(KP281, y='Fitness')
plt.subplot(2, 3, 6)
sns.boxplot(KP281, y='Usage')

plt.show()
```

KP281 Outliers

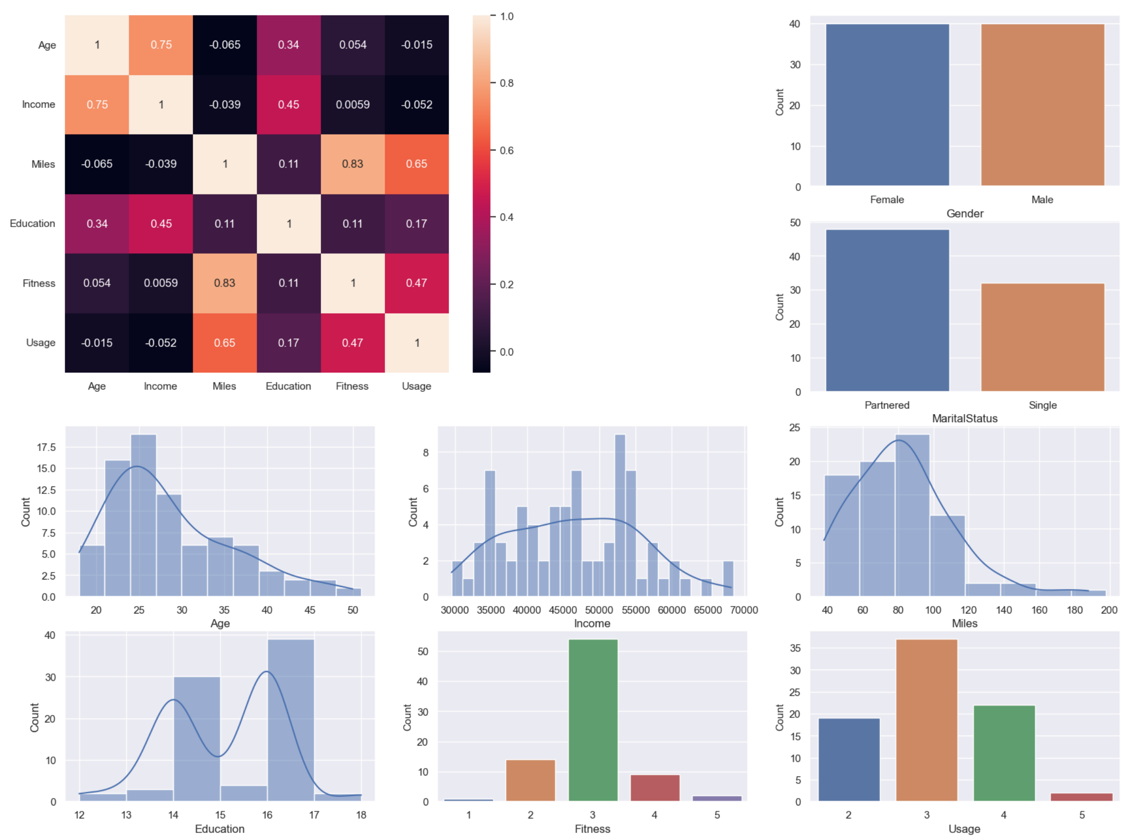


Plot the Graph

[ ]:
```
plt.figure(figsize=(20,15)).suptitle("KP281 Customer Profile",fontsize=14)

plt.subplot(2, 2, 1)
sns.heatmap(KP281[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].
    ↪corr(), annot=True)
plt.yticks(rotation= 0, fontsize=11)
plt.xticks(fontsize=11)

plt.subplot(4, 3, 3)
sns.countplot(KP281, x='Gender')
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 6)
sns.countplot(KP281, x='MaritalStatus')
plt.ylabel("Count", fontsize=11)

plt.subplot(4, 3, 7)
sns.histplot(KP281, x="Age", binwidth=3, kde=True)
plt.subplot(4, 3, 8)
sns.histplot(KP281, x="Income", binwidth=1500, kde=True)
plt.subplot(4, 3, 9)
```

```
sns.histplot(KP281, x="Miles", binwidth=20, kde=True)

plt.subplot(4, 3, 10)
sns.histplot(KP281, x="Education", binwidth=1, kde=True)
plt.subplot(4, 3, 11)
sns.countplot(KP281, x='Fitness')
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 12)
sns.countplot(KP281, x='Usage')
plt.ylabel("Count", fontsize=11)

plt.show()
```

KP281 Customer Profile



Insight * There are highest number of customer have covered `70 miles`.

1.4.3 Profile of *KP481*

```
[ ]: KP481[['Gender', 'MaritalStatus', 'Fitness', 'Usage', 'Age']].
      ↪value_counts(normalize=True)[:5]*100
```

```
[ ]: Gender  MaritalStatus  Fitness  Usage  Age
     Male    Partnered      3        3      23     5.000000
                            2        2      21     3.333333
     Female  Partnered      2        3      23     1.666667
     Male    Partnered      2        2      45     1.666667
                                     3      35     1.666667
     dtype: float64
```

Statitical Analysis

```
[ ]: KP481[['Gender', 'MaritalStatus', 'age_group', 'income_group', 'miles_group',␣
      ↪'education_group', 'fitness_group', 'usage_group' ]].describe()
```

```
[ ]:        Gender MaritalStatus age_group income_group miles_group  \
     count      60            60        60           60          60
     unique      2             2         7            5           6
     top      Male     Partnered     20-25      45K-55K      80-110
     freq       31            36        24           33          31

            education_group  fitness_group  usage_group
     count               60             60           60
     unique               6              4            4
     top                 16              3            3
     freq                31             39           31
```

```
[ ]: KP481[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].describe()
```

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

```
[ ]: KP481[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].median()
```

```
[ ]: Age             26.0
     Income       49459.5
     Miles           85.0
     Education       16.0
     Fitness          3.0
```

```
Usage              3.0
dtype: float64
```

Find Probability

```
[ ]: pd.crosstab([KP481.income_group], [KP481.age_group], normalize=True,␣
     ↪margins=True)*100
```

```
[ ]: age_group        15-20      20-25      25-30      30-35      35-40     40-45  \
     income_group
     25K-35K       5.000000   5.000000   0.000000   0.000000   0.000000  0.000000
     35K-45K       1.666667  13.333333   0.000000   0.000000   0.000000  0.000000
     45K-55K       0.000000  21.666667  10.000000  20.000000   1.666667  1.666667
     55K-65K       0.000000   0.000000   1.666667   5.000000   8.333333  0.000000
     65K-75K       0.000000   0.000000   0.000000   3.333333   0.000000  0.000000
     All           6.666667  40.000000  11.666667  28.333333  10.000000  1.666667

     age_group        45-50         All
     income_group
     25K-35K       0.000000   10.000000
     35K-45K       0.000000   15.000000
     45K-55K       0.000000   55.000000
     55K-65K       1.666667   16.666667
     65K-75K       0.000000    3.333333
     All           1.666667  100.000000
```

```
[ ]: pd.crosstab([KP481.Fitness, KP481.Gender, KP481.MaritalStatus], [KP481.
     ↪miles_group], normalize=True, margins=True)*100
```

```
[ ]: miles_group                      20-50      50-80     80-110    110-140  \
     Fitness Gender MaritalStatus
     1       Female Single         1.666667   0.000000   0.000000   0.000000
     2       Female Partnered      0.000000   3.333333   0.000000   0.000000
                    Single         1.666667   3.333333   1.666667   0.000000
             Male   Partnered      5.000000   3.333333   0.000000   0.000000
                    Single         0.000000   1.666667   0.000000   0.000000
     3       Female Partnered      0.000000   1.666667  18.333333   0.000000
                    Single         0.000000   3.333333   6.666667   0.000000
             Male   Partnered      0.000000   5.000000  13.333333   1.666667
                    Single         0.000000   3.333333   6.666667   3.333333
     4       Female Partnered      0.000000   0.000000   0.000000   0.000000
                    Single         0.000000   1.666667   0.000000   3.333333
             Male   Partnered      0.000000   0.000000   3.333333   0.000000
                    Single         0.000000   0.000000   1.666667   0.000000
     All                           8.333333  26.666667  51.666667   8.333333

     miles_group                    140-170    200-230          All
     Fitness Gender MaritalStatus
```

```
1       Female Single        0.000000  0.000000    1.666667
2       Female Partnered     0.000000  0.000000    3.333333
               Single        0.000000  0.000000    6.666667
        Male   Partnered     0.000000  0.000000    8.333333
               Single        0.000000  0.000000    1.666667
3       Female Partnered     0.000000  0.000000   20.000000
               Single        0.000000  0.000000   10.000000
        Male   Partnered     1.666667  0.000000   21.666667
               Single        0.000000  0.000000   13.333333
4       Female Partnered     0.000000  1.666667    1.666667
               Single        0.000000  0.000000    5.000000
        Male   Partnered     1.666667  0.000000    5.000000
               Single        0.000000  0.000000    1.666667
All                          3.333333  1.666667  100.000000
```

[ ]:
```
pd.crosstab([KP481.Fitness, KP481.Gender, KP481.MaritalStatus], [KP481.
 ↪age_group], normalize=True, margins=True)*100
```

[ ]:
```
age_group                        15-20      20-25      25-30      30-35  \
Fitness Gender MaritalStatus
1       Female Single         0.000000   0.000000   0.000000   1.666667
2       Female Partnered      0.000000   1.666667   0.000000   1.666667
               Single         0.000000   5.000000   0.000000   1.666667
        Male   Partnered      0.000000   5.000000   0.000000   1.666667
               Single         0.000000   0.000000   1.666667   0.000000
3       Female Partnered      1.666667   3.333333   3.333333   6.666667
               Single         0.000000   5.000000   3.333333   0.000000
        Male   Partnered      0.000000  10.000000   0.000000   6.666667
               Single         5.000000   3.333333   1.666667   3.333333
4       Female Partnered      0.000000   1.666667   0.000000   0.000000
               Single         0.000000   1.666667   1.666667   1.666667
        Male   Partnered      0.000000   1.666667   0.000000   3.333333
               Single         0.000000   1.666667   0.000000   0.000000
All                           6.666667  40.000000  11.666667  28.333333

age_group                        35-40     40-45     45-50         All
Fitness Gender MaritalStatus
1       Female Single         0.000000  0.000000  0.000000    1.666667
2       Female Partnered      0.000000  0.000000  0.000000    3.333333
               Single         0.000000  0.000000  0.000000    6.666667
        Male   Partnered      0.000000  1.666667  0.000000    8.333333
               Single         0.000000  0.000000  0.000000    1.666667
3       Female Partnered      5.000000  0.000000  0.000000   20.000000
               Single         1.666667  0.000000  0.000000   10.000000
        Male   Partnered      3.333333  0.000000  1.666667   21.666667
               Single         0.000000  0.000000  0.000000   13.333333
4       Female Partnered      0.000000  0.000000  0.000000    1.666667
```

```
            Single          0.000000  0.000000  0.000000    5.000000
       Male Partnered       0.000000  0.000000  0.000000    5.000000
            Single          0.000000  0.000000  0.000000    1.666667
All                        10.000000  1.666667  1.666667  100.000000
```

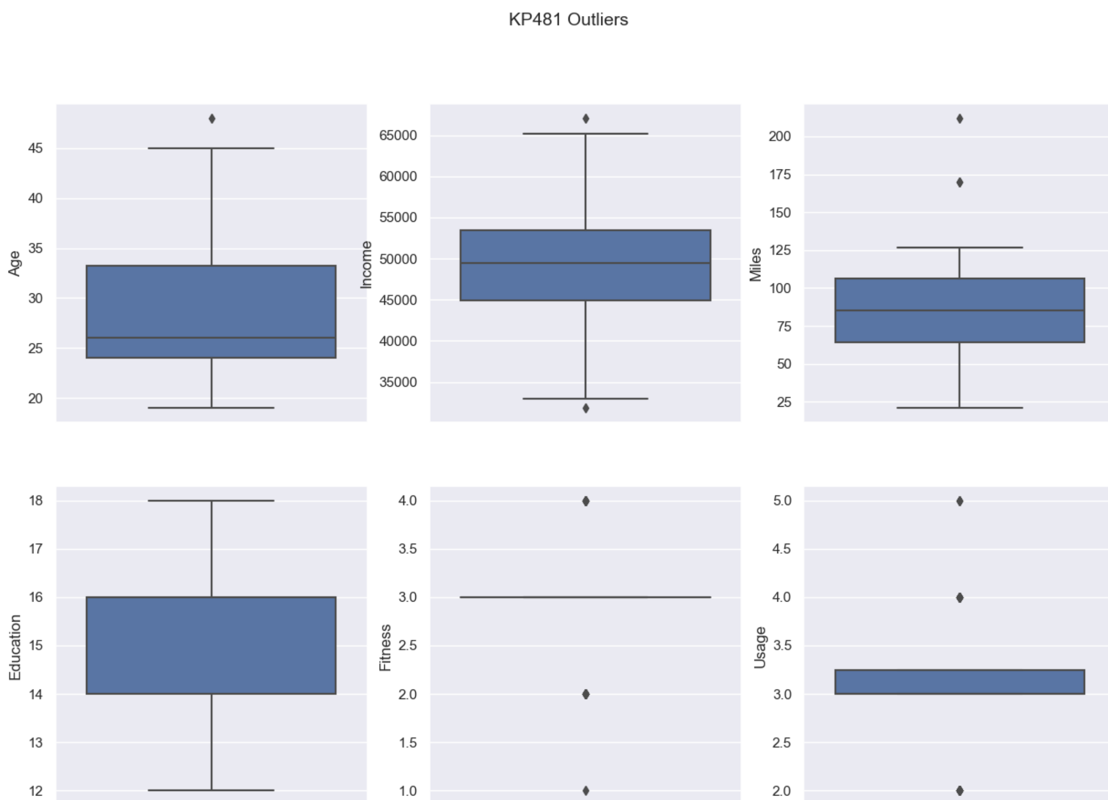
[ ]:
```python
pd.crosstab([KP481.Fitness, KP481.Gender, KP481.MaritalStatus], [KP481.
↪income_group], normalize=True, margins=True)*100
```

[ ]:
```
income_group                 25K-35K    35K-45K    45K-55K    55K-65K  \
Fitness Gender MaritalStatus
1       Female Single       0.000000   0.000000   0.000000   0.000000
2       Female Partnered    0.000000   1.666667   1.666667   0.000000
               Single       0.000000   3.333333   3.333333   0.000000
        Male   Partnered    3.333333   0.000000   5.000000   0.000000
               Single       0.000000   0.000000   1.666667   0.000000
3       Female Partnered    1.666667   0.000000  13.333333   5.000000
               Single       0.000000   1.666667   5.000000   3.333333
        Male   Partnered    0.000000   3.333333  13.333333   5.000000
               Single       3.333333   1.666667   5.000000   1.666667
4       Female Partnered    1.666667   0.000000   0.000000   0.000000
               Single       0.000000   1.666667   3.333333   0.000000
        Male   Partnered    0.000000   1.666667   1.666667   1.666667
               Single       0.000000   0.000000   1.666667   0.000000
All                        10.000000  15.000000  55.000000  16.666667

income_group                 65K-75K         All
Fitness Gender MaritalStatus
1       Female Single       1.666667    1.666667
2       Female Partnered    0.000000    3.333333
               Single       0.000000    6.666667
        Male   Partnered    0.000000    8.333333
               Single       0.000000    1.666667
3       Female Partnered    0.000000   20.000000
               Single       0.000000   10.000000
        Male   Partnered    0.000000   21.666667
               Single       1.666667   13.333333
4       Female Partnered    0.000000    1.666667
               Single       0.000000    5.000000
        Male   Partnered    0.000000    5.000000
               Single       0.000000    1.666667
All                         3.333333  100.000000
```

Check for Outliers

[ ]:
```python
plt.figure(figsize=(15,10)).suptitle("KP481 Outliers",fontsize=14)

plt.subplot(2, 3, 1)
sns.boxplot(KP481, y="Age")
```

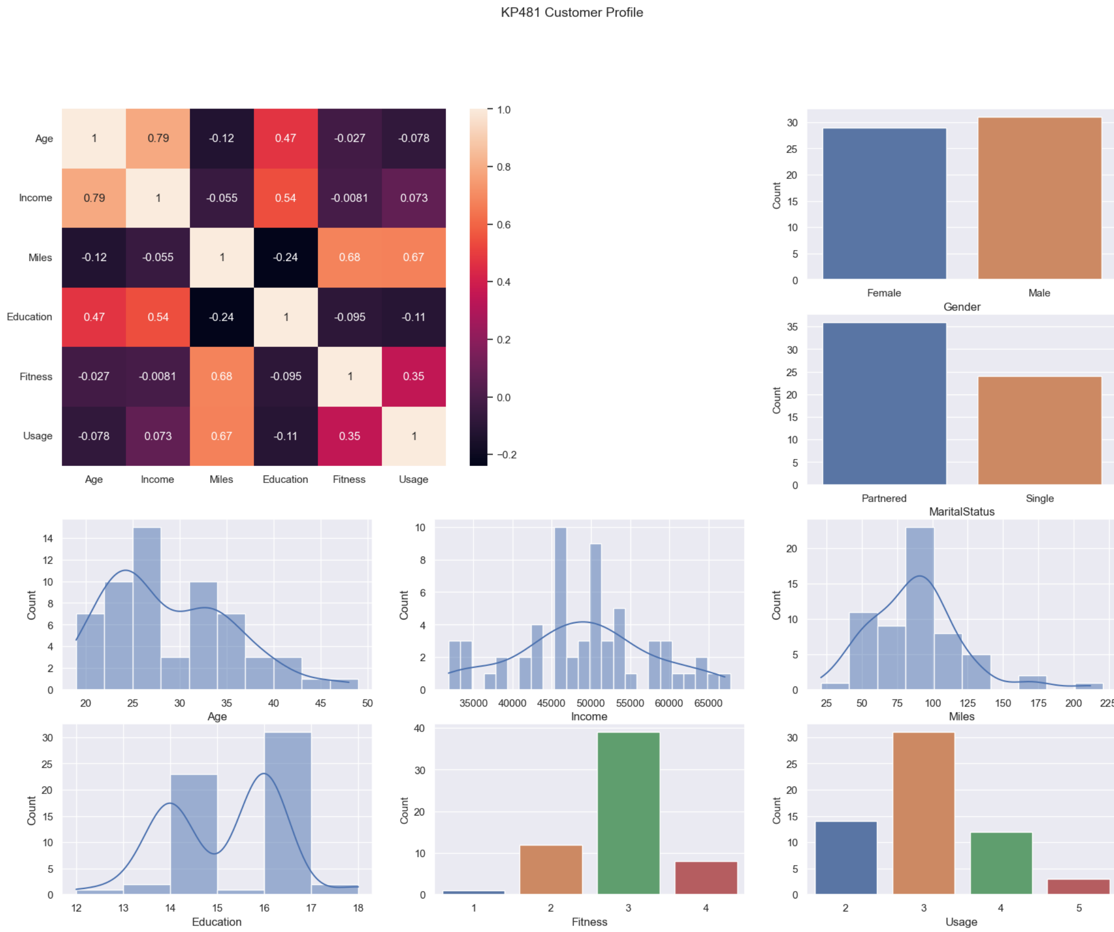
```
plt.subplot(2, 3, 2)
sns.boxplot(KP481, y="Income")

plt.subplot(2, 3, 3)
sns.boxplot(KP481, y="Miles")
plt.subplot(2, 3, 4)
sns.boxplot(KP481, y="Education")

plt.subplot(2, 3, 5)
sns.boxplot(KP481, y='Fitness')
plt.subplot(2, 3, 6)
sns.boxplot(KP481, y='Usage')

plt.show()
```



Plot the Graph

```
[ ]: plt.figure(figsize=(20,15)).suptitle("KP481 Customer Profile",fontsize=14)

plt.subplot(2, 2, 1)
sns.heatmap(KP481[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].
 ↪corr(), annot=True)
```

```
plt.yticks(rotation= 0, fontsize=11)
plt.xticks(fontsize=11)

plt.subplot(4, 3, 3)
sns.countplot(KP481, x='Gender')
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 6)
sns.countplot(KP481, x='MaritalStatus')
plt.ylabel("Count", fontsize=11)

plt.subplot(4, 3, 7)
sns.histplot(KP481, x="Age", binwidth=3, kde=True)
plt.subplot(4, 3, 8)
sns.histplot(KP481, x="Income", binwidth=1500, kde=True)
plt.subplot(4, 3, 9)
sns.histplot(KP481, x="Miles", binwidth=20, kde=True)

plt.subplot(4, 3, 10)
sns.histplot(KP481, x="Education", binwidth=1, kde=True)
plt.subplot(4, 3, 11)
sns.countplot(KP481, x='Fitness')
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 12)
sns.countplot(KP481, x='Usage')
plt.ylabel("Count", fontsize=11)

plt.show()
```



Insight * There are highest number of customer have covered `70 miles`.

1.4.4 Profile of *KP781*

```
[ ]: KP781[['Gender', 'MaritalStatus', 'Fitness', 'Usage', 'Age']].
     ↪value_counts(normalize=True)[:5]*100
```

```
[ ]: Gender  MaritalStatus  Fitness  Usage  Age
     Male    Partnered      5        4      25     5.0
             Single         5        4      23     5.0
     Female  Partnered      5        4      33     2.5
     Male    Single         5        3      22     2.5
             Partnered      5        6      31     2.5
     dtype: float64
```

Statitical Analysis

```
[ ]: KP781[['Gender', 'MaritalStatus', 'age_group', 'income_group', 'miles_group',␣
     ↪'education_group', 'fitness_group', 'usage_group' ]].describe()
```

```
[ ]:        Gender MaritalStatus age_group income_group miles_group  \
     count      40            40        40           40          40
     unique      2             2         6            6           9
     top      Male     Partnered     20-25      85K-95K     170-200
     freq       33            23        17           11          12

            education_group  fitness_group  usage_group
     count                40             40           40
     unique                5              3            5
     top                  18              5            4
     freq                 19             29           18
```

```
[ ]: KP781[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].describe()
```

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

```
[ ]: KP781[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].median()
```

```
[ ]: Age             27.0
     Income       76568.5
     Miles          160.0
     Education       18.0
     Fitness          5.0
     Usage            5.0
     dtype: float64
```

Find Probability

```
[ ]: pd.crosstab([KP781.income_group], [KP781.age_group], normalize=True,␣
     ↪margins=True)*100
```

```
[ ]: age_group     20-25  25-30  30-35  35-40  40-45  45-50   All
     income_group
     45K-55K        20.0    2.5    0.0    0.0    0.0    0.0  22.5
     55K-65K        15.0    2.5    0.0    0.0    0.0    0.0  17.5
     65K-75K         5.0    2.5    0.0    0.0    0.0    0.0   7.5
     75K-85K         2.5    5.0    0.0    2.5    0.0    0.0  10.0
```

```
85K-95K          0.0   15.0   7.5   0.0   5.0   0.0   27.5
95K-105K         0.0    5.0   2.5   2.5   0.0   5.0   15.0
All             42.5   32.5  10.0   5.0   5.0   5.0  100.0
```

[ ]:
```python
pd.crosstab([KP781.Fitness, KP781.Gender, KP781.MaritalStatus], [KP781.
 ↪miles_group], normalize=True, margins=True)*100
```

[ ]:
```
miles_group                  50-80  80-110  110-140  140-170  170-200  \
Fitness Gender MaritalStatus
3       Female Single          0.0     2.5      0.0      0.0      0.0
        Male   Partnered       0.0     2.5      0.0      0.0      0.0
               Single          0.0     5.0      0.0      0.0      0.0
4       Female Single          0.0     2.5      0.0      0.0      0.0
        Male   Partnered       0.0     2.5      0.0      5.0      5.0
               Single          0.0     0.0      0.0      0.0      2.5
5       Female Partnered       0.0     0.0      0.0      0.0      7.5
               Single          0.0     0.0      0.0      0.0      2.5
        Male   Partnered       2.5     0.0      5.0     10.0      5.0
               Single          0.0     5.0      5.0     10.0      7.5
All                            2.5    20.0     10.0     25.0     30.0

miles_group                  230-260  260-290  290-320  350-380    All
Fitness Gender MaritalStatus
3       Female Single            0.0      0.0      0.0      0.0    2.5
        Male   Partnered         0.0      0.0      0.0      0.0    2.5
               Single            0.0      0.0      0.0      0.0    5.0
4       Female Single            0.0      0.0      0.0      0.0    2.5
        Male   Partnered         0.0      0.0      0.0      0.0   12.5
               Single            0.0      0.0      0.0      0.0    2.5
5       Female Partnered         0.0      2.5      0.0      0.0   10.0
               Single            0.0      0.0      0.0      0.0    2.5
        Male   Partnered         5.0      0.0      2.5      2.5   32.5
               Single            0.0      0.0      0.0      0.0   27.5
All                              5.0      2.5      2.5      2.5  100.0
```

[ ]:
```python
pd.crosstab([KP781.Fitness, KP781.Gender, KP781.MaritalStatus], [KP781.
 ↪age_group], normalize=True, margins=True)*100
```

[ ]:
```
age_group                    20-25  25-30  30-35  35-40  40-45  45-50    All
Fitness Gender MaritalStatus
3       Female Single          0.0    2.5    0.0    0.0    0.0    0.0    2.5
        Male   Partnered       2.5    0.0    0.0    0.0    0.0    0.0    2.5
               Single          2.5    2.5    0.0    0.0    0.0    0.0    5.0
4       Female Single          2.5    0.0    0.0    0.0    0.0    0.0    2.5
        Male   Partnered       5.0    7.5    0.0    0.0    0.0    0.0   12.5
               Single          0.0    0.0    0.0    0.0    2.5    0.0    2.5
5       Female Partnered       2.5    5.0    2.5    0.0    0.0    0.0   10.0
```

```
                Single          2.5    0.0    0.0    0.0    0.0    0.0    2.5
        Male    Partnered      10.0   10.0    5.0    2.5    0.0    5.0   32.5
                Single         15.0    5.0    2.5    2.5    2.5    0.0   27.5
All                            42.5   32.5   10.0    5.0    5.0    5.0  100.0
```

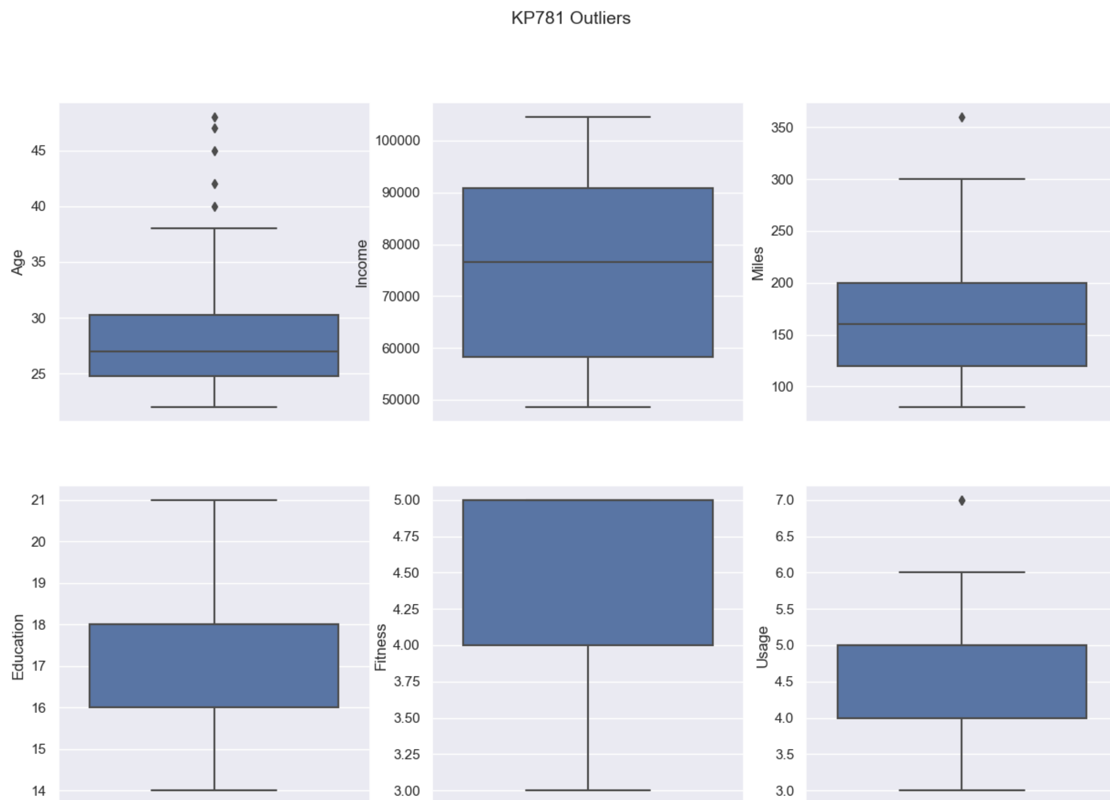
```python
[ ]: pd.crosstab([KP781.Fitness, KP781.Gender, KP781.MaritalStatus], [KP781.
      ↪income_group], normalize=True, margins=True)*100
```

```
[ ]: income_group                   45K-55K  55K-65K  65K-75K  75K-85K  85K-95K  \
Fitness Gender MaritalStatus
3       Female Single                   0.0      0.0      2.5      0.0      0.0
        Male   Partnered                0.0      2.5      0.0      0.0      0.0
               Single                   2.5      0.0      0.0      0.0      2.5
4       Female Single                   2.5      0.0      0.0      0.0      0.0
        Male   Partnered                0.0      5.0      2.5      0.0      2.5
               Single                   0.0      0.0      0.0      0.0      2.5
5       Female Partnered                0.0      2.5      0.0      0.0      5.0
               Single                   2.5      0.0      0.0      0.0      0.0
        Male   Partnered                2.5      2.5      2.5      7.5      7.5
               Single                  12.5      5.0      0.0      2.5      7.5
All                                    22.5     17.5      7.5     10.0     27.5

income_group                   95K-105K    All
Fitness Gender MaritalStatus
3       Female Single                0.0    2.5
        Male   Partnered             0.0    2.5
               Single                0.0    5.0
4       Female Single                0.0    2.5
        Male   Partnered             2.5   12.5
               Single                0.0    2.5
5       Female Partnered             2.5   10.0
               Single                0.0    2.5
        Male   Partnered            10.0   32.5
               Single                0.0   27.5
All                                 15.0  100.0
```

Check for Outliers

```python
[ ]: plt.figure(figsize=(15,10)).suptitle("KP781 Outliers",fontsize=14)

plt.subplot(2, 3, 1)
sns.boxplot(KP781, y="Age")
plt.subplot(2, 3, 2)
sns.boxplot(KP781, y="Income")

plt.subplot(2, 3, 3)
sns.boxplot(KP781, y="Miles")
plt.subplot(2, 3, 4)
```

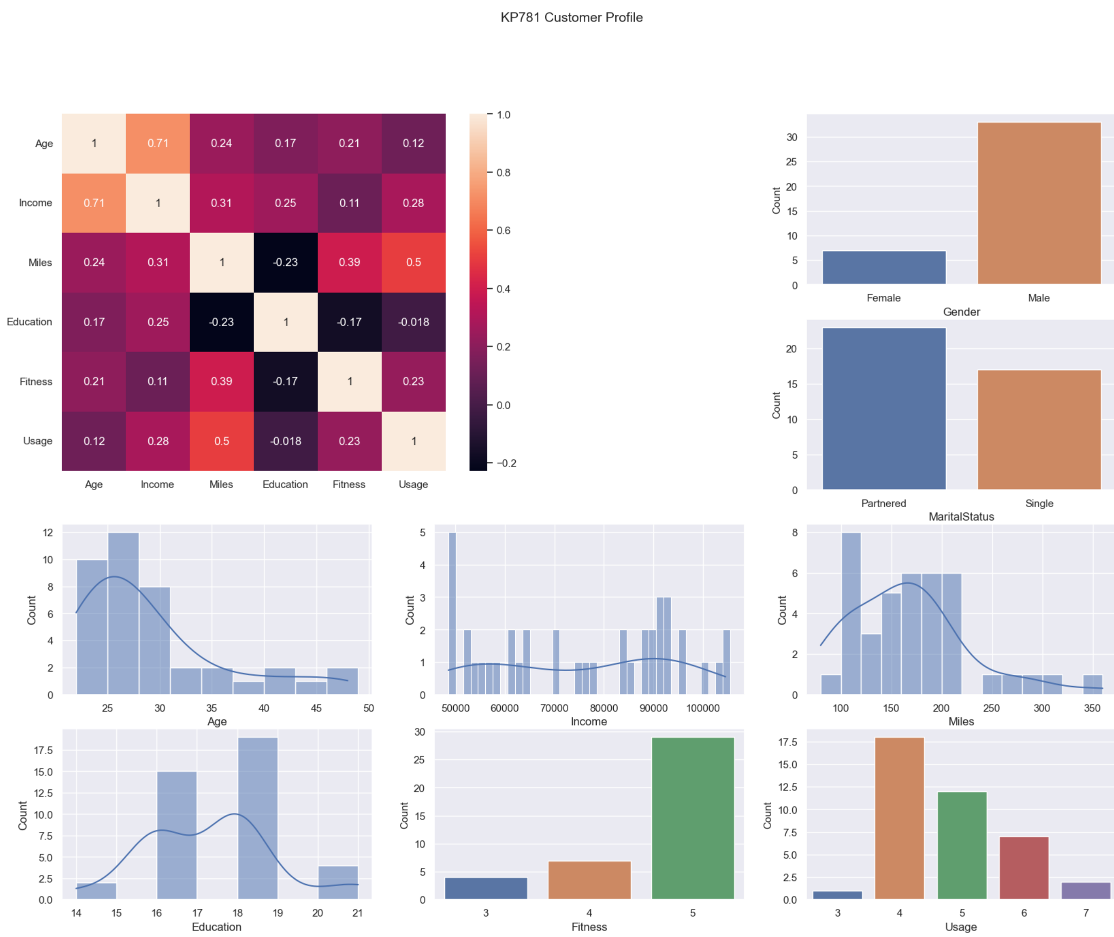
```
sns.boxplot(KP781, y="Education")

plt.subplot(2, 3, 5)
sns.boxplot(KP781, y='Fitness')
plt.subplot(2, 3, 6)
sns.boxplot(KP781, y='Usage')

plt.show()
```



Plot the Graph

```
[ ]: plt.figure(figsize=(20,15)).suptitle("KP781 Customer Profile",fontsize=14)

plt.subplot(2, 2, 1)
sns.heatmap(KP781[['Age', 'Income', 'Miles', 'Education', 'Fitness', 'Usage']].
 ↪corr(), annot=True)
plt.yticks(rotation= 0, fontsize=11)
plt.xticks(fontsize=11)

plt.subplot(4, 3, 3)
sns.countplot(KP781, x='Gender')
plt.ylabel("Count", fontsize=11)
```

```
plt.subplot(4, 3, 6)
sns.countplot(KP781, x='MaritalStatus')
plt.ylabel("Count", fontsize=11)

plt.subplot(4, 3, 7)
sns.histplot(KP781, x="Age", binwidth=3, kde=True)
plt.subplot(4, 3, 8)
sns.histplot(KP781, x="Income", binwidth=1500, kde=True)
plt.subplot(4, 3, 9)
sns.histplot(KP781, x="Miles", binwidth=20, kde=True)

plt.subplot(4, 3, 10)
sns.histplot(KP781, x="Education", binwidth=1, kde=True)
plt.subplot(4, 3, 11)
sns.countplot(KP781, x='Fitness')
plt.ylabel("Count", fontsize=11)
plt.subplot(4, 3, 12)
sns.countplot(KP781, x='Usage')
plt.ylabel("Count", fontsize=11)

plt.show()
```



Insight * There are highest number of customer have covered `70 miles`.

1.5 Questions

1.5.1 Q0. What is the probability of a male customer buying a KP781 treadmill?

[ ]:
```
product_gender = pd.crosstab(aerofit['Gender'], aerofit['Product'],␣
  ↪normalize='index', margins=True)*100
product_gender
```

[ ]:

Product	KP281	KP481	KP781
Gender			
Female	52.631579	38.157895	9.210526
Male	38.461538	29.807692	31.730769
All	44.444444	33.333333	22.222222

[ ]:
```
product_gender['KP781']['Male']
```

[ ]: 31.73076923076923

Insight * There is 31.73% chance a male customer will purchase KP781

1.5.2 Q1. What is the total count of each product present in the dataset?

```
[ ]: Products = aerofit.groupby("Product")["Age"].describe().T
```

```
[ ]: Products[:1]
```

[ ]:

Product	KP281	KP481	KP781
count	80.0	60.0	40.0

```
[ ]: Products[:1]/1.8
```

[ ]:

Product	KP281	KP481	KP781
count	44.444444	33.333333	22.222222

Insight * KP781 40 with 22.22% probability. * KP781 60 with 33.33% probability. * KP781 80 with 44.44% probability.

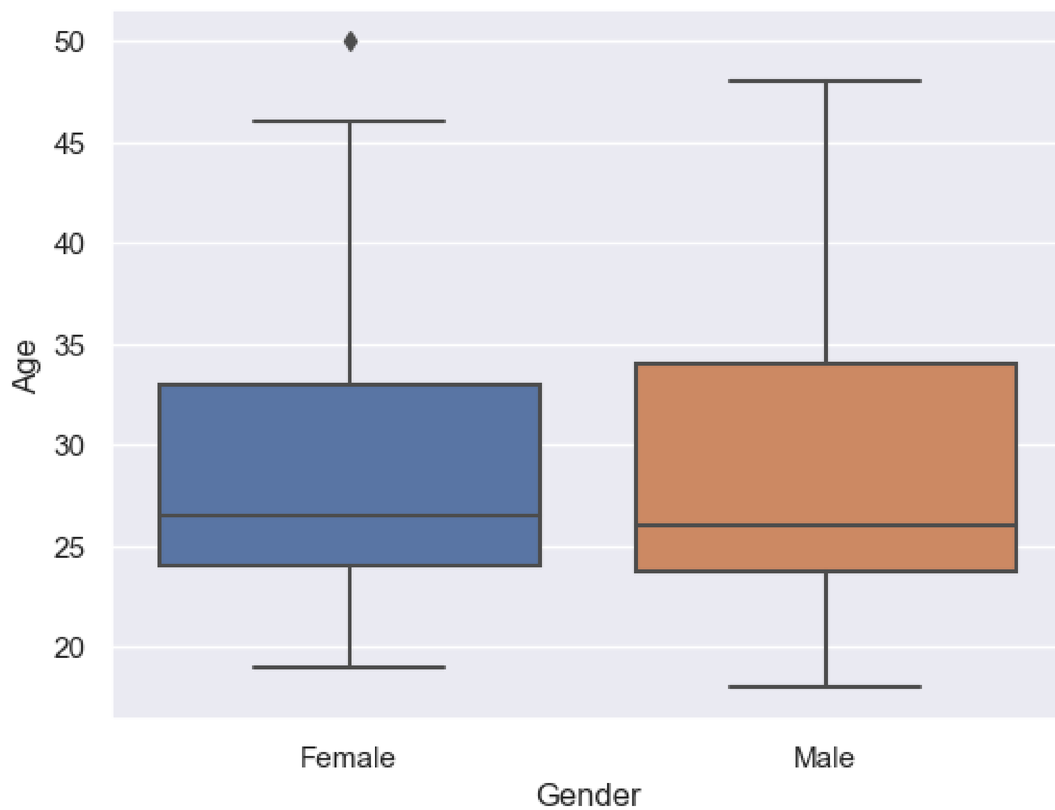
1.5.3 Q2. Describe the Age & Gender distribution of all the customers?

```
[ ]: aerofit.groupby("Gender")["Age"].describe()
```

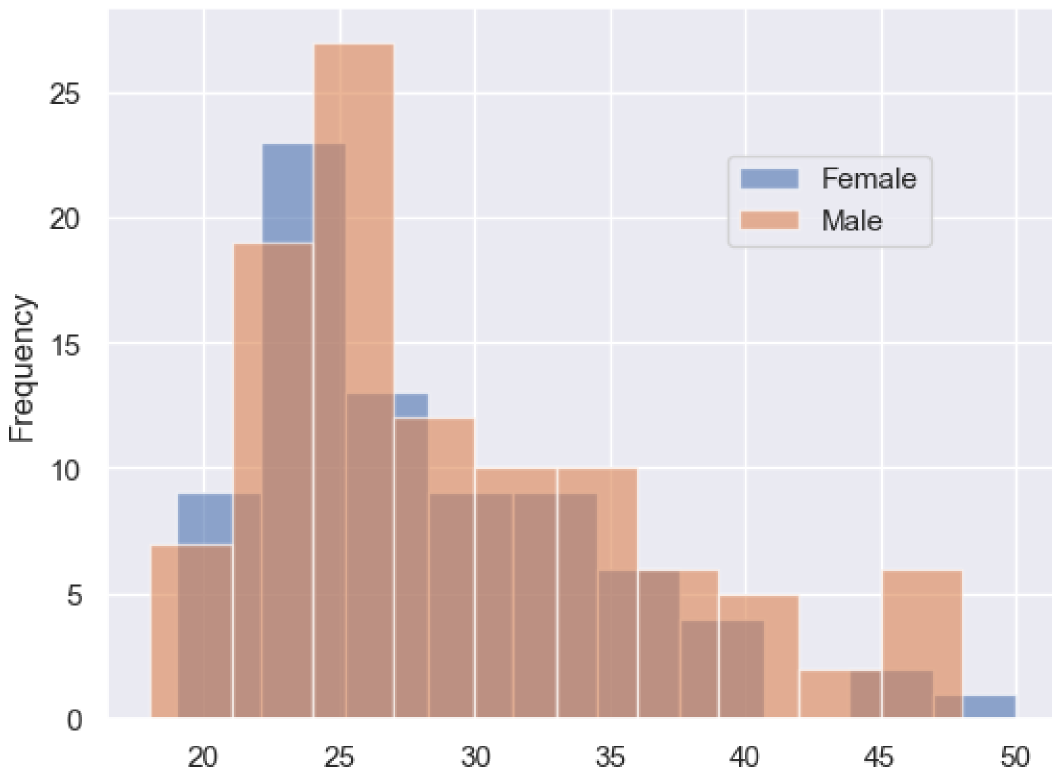
[ ]:

Gender	count	mean	std	min	25%	50%	75%	max
Female	76.0	28.565789	6.342104	19.0	24.00	26.5	33.0	50.0
Male	104.0	28.951923	7.377978	18.0	23.75	26.0	34.0	48.0

```
[ ]: sns.boxplot(aerofit, x='Gender', y='Age')
plt.show()
```



[ ]:
```
aerofit.groupby('Gender').Age.plot(kind='hist', alpha=0.6)
plt.legend(bbox_to_anchor=(1.02, 1), loc='upper right', borderaxespad=5)
plt.show()
```



[ ]:
```
aerofit.groupby('Gender')['Age'].mean()
```

[ ]:
```
Gender
Female    28.565789
Male      28.951923
Name: Age, dtype: float64
```

[ ]:
```
male_age = aerofit.loc[aerofit['Gender']=='Male']['Age']
female_age = aerofit.loc[aerofit['Gender']=='Female']['Age']
```

[ ]:
```
t,p = ttest_ind(male_age, female_age, alternative='greater')
p
```

[ ]:
```
0.3567980420783239
```

Insight * Their is a small differance between mean Age of Male & Female. * also, p-vale of T-Test of the 2 Group come out to be 35% (considering Male age is higher) * when following 95% Confidence Interval. So, we failed to prove that Male age are Higher then Female Age. amoung Customers.

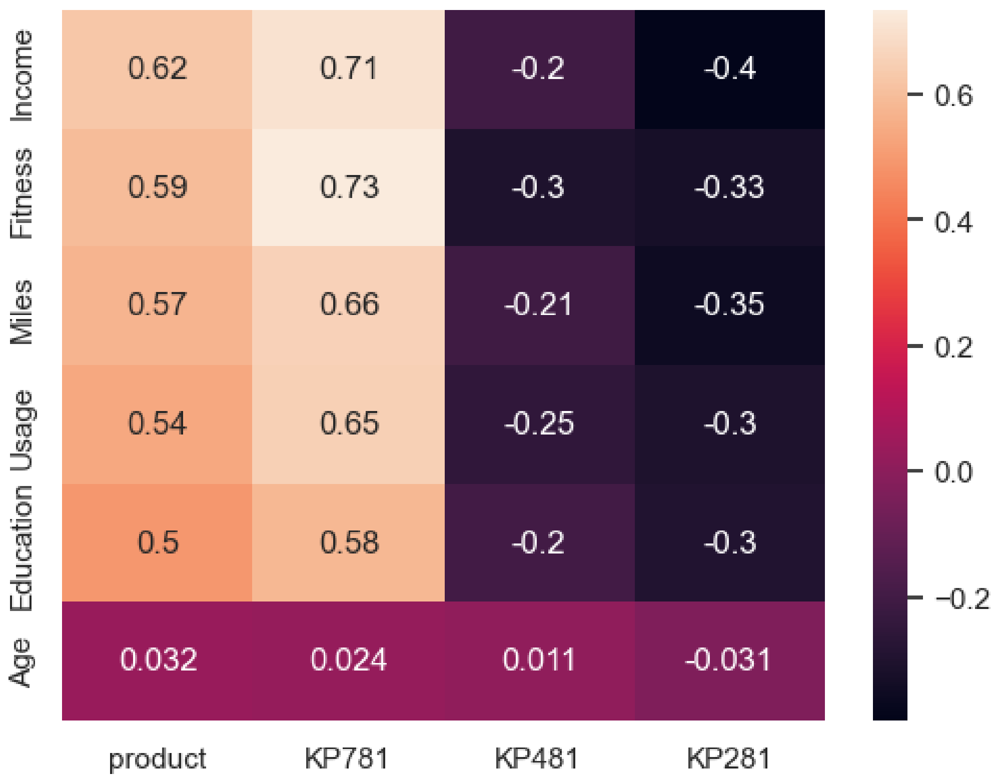
1.5.4 Q3. Top 3 features having the highest coorelatios with the Product column. and Why?

```
[ ]: top_corr = aerofit.copy()
     def add_product_as_column(x):
         return 1 if(x == 'KP281') else (2 if(x == 'KP481') else (3 if(x == 'KP781')␣
      ↪else 0))
     top_corr['product'] = top_corr.apply(lambda row:␣
      ↪add_product_as_column(row['Product']),axis=1)

     def add_product_columns(x):
         x['KP281'] = np.where((x['Product'] == 'KP281'), 1, 0)
         x['KP481'] = np.where((x['Product'] == 'KP481'), 1, 0)
         x['KP781'] = np.where((x['Product'] == 'KP781'), 1, 0)
         return x
     top_corr = add_product_columns(top_corr)
```

```
[ ]: top3_correlations = top_corr[['Age', 'Income', 'Miles', 'Education', 'Fitness',␣
      ↪'Usage', 'product', 'KP281', 'KP481', 'KP781']].corr()[['product', 'KP781',␣
      ↪'KP481', 'KP281']][:6]
```

```
[ ]: top3_correlations.sort_values('product', ascending=False, inplace=True)
```

```
[ ]: sns.heatmap(top3_correlations, annot=True)
     plt.show()
```



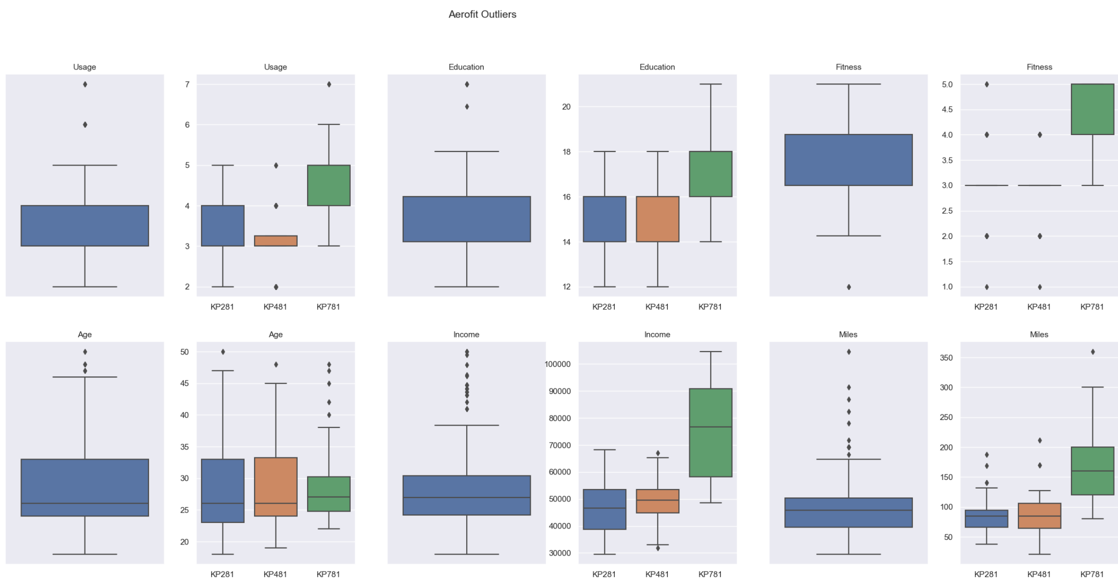
Insight * Product Have higher co-relation with `Income`, `Fitness` & `Miles`. * For **KP781** we have observed same co-relation. * But, for **KP481** Top 3 co-relation are `Age`, `Education` & `Income`. * But, for **KP281** Top 3 co-relation are `Age`, `Education` & `Usage`.

As, we know **KP781** is the expansive & better one, mostly prefered by Athletes or Fitness enthusiast, whos also have higher Income. But, for **KP481**, **KP281** people with good Education, who are health consious, want to have a Treadmill but can't efford a expansive one.

1.5.5 Q4. Were there any outliers present in the Data? If yes, suggest suitable method for their treatment?

[ ]:
```
plt.figure(figsize=(24,12)).suptitle("Aerofit Outliers",fontsize=14)
plt.subplots_adjust(right=1)



plt.subplot(2, 6, 1)
sns.boxplot(aerofit, y='Usage')
plt.title('Usage', fontsize=11)
plt.ylabel('', fontsize=12)
plt.yticks([])
plt.subplot(2, 6, 2)
sns.boxplot(aerofit, y='Usage', x='Product')
plt.title('Usage', fontsize=11)
plt.xlabel('', fontsize=12)
plt.ylabel('', fontsize=12)

plt.subplot(2, 6, 3)
sns.boxplot(aerofit, y="Education")
plt.title('Education', fontsize=11)
plt.ylabel('', fontsize=12)
plt.yticks([])
plt.subplot(2, 6, 4)
sns.boxplot(aerofit, y="Education", x='Product')
plt.title('Education', fontsize=11)
plt.xlabel('', fontsize=12)
plt.ylabel('', fontsize=12)

plt.subplot(2, 6, 5)
sns.boxplot(aerofit, y='Fitness')
plt.title('Fitness', fontsize=11)
plt.ylabel('', fontsize=12)
plt.yticks([])
plt.subplot(2, 6, 6)
```

```
sns.boxplot(aerofit, y='Fitness', x='Product')
plt.title('Fitness', fontsize=11)
plt.xlabel('', fontsize=12)
plt.ylabel('', fontsize=12)

plt.subplot(2, 6, 7)
sns.boxplot(aerofit, y="Age")
plt.title('Age', fontsize=11)
plt.ylabel('', fontsize=12)
plt.yticks([])
plt.subplot(2, 6, 8)
sns.boxplot(aerofit, y="Age", x='Product')
plt.title('Age', fontsize=11)
plt.xlabel('', fontsize=12)
plt.ylabel('', fontsize=12)

plt.subplot(2, 6, 9)
sns.boxplot(aerofit, y="Income")
plt.title('Income', fontsize=11)
plt.ylabel('', fontsize=12)
plt.yticks([])
plt.subplot(2, 6, 10)
sns.boxplot(aerofit, y="Income", x='Product')
plt.title('Income', fontsize=11)
plt.xlabel('', fontsize=12)
plt.ylabel('', fontsize=12)

plt.subplot(2, 6, 11)
sns.boxplot(aerofit, y="Miles")
plt.title('Miles', fontsize=11)
plt.ylabel('', fontsize=12)
plt.yticks([])
plt.subplot(2, 6, 12)
sns.boxplot(aerofit, y="Miles", x='Product')
plt.title('Miles', fontsize=11)
plt.xlabel('', fontsize=12)
plt.ylabel('', fontsize=12)

plt.show()
```



Using Z-Score

[ ]:
```
aerofit[np.abs(zscore(aerofit['Age']))>2]
```

[ ]:
```
    Product  Gender MaritalStatus  Age  Income  Miles  Education  Fitness  \
75    KP281    Male     Partnered   43   53439     66         16        3
76    KP281  Female        Single   44   57987     75         16        4
77    KP281  Female     Partnered   46   60261     47         16        2
78    KP281    Male     Partnered   47   56850     94         16        3
79    KP281  Female     Partnered   50   64809     66         16        3
138   KP481    Male     Partnered   45   54576     42         16        2
139   KP481    Male     Partnered   48   57987     64         16        3
177   KP781    Male        Single   45   90886    160         16        5
178   KP781    Male     Partnered   47  104581    120         18        5
179   KP781    Male     Partnered   48   95508    180         18        5

     Usage age_group income_group miles_group education_group fitness_group  \
75       3     40-45      45K-55K       50-80              16             3
76       3     40-45      55K-65K       50-80              16             4
77       3     45-50      55K-65K       20-50              16             2
78       4     45-50      55K-65K      80-110              16             3
79       3     45-50      55K-65K       50-80              16             3
138      2     40-45      45K-55K       20-50              16             2
139      2     45-50      55K-65K       50-80              16             3
177      5     40-45      85K-95K     140-170              16             5
178      4     45-50     95K-105K     110-140              18             5
179      4     45-50     95K-105K     170-200              18             5
```

```
     usage_group
75             3
76             3
77             3
78             4
79             3
138            2
139            2
177            5
178            4
179            4
```

Using `IQR` (Inner Quartile Range)

```
[ ]: age_outlier = check_outlier(aerofit, 'Age')
income_outlier = check_outlier(aerofit, 'Income')
miles_outlier = check_outlier(aerofit, 'Miles')
education_outlier = check_outlier(aerofit, 'Education')
fitness_outlier = check_outlier(aerofit, 'Fitness')
usage_outlier = check_outlier(aerofit, 'Usage')
```

```
[ ]: print("Age: \t\t => Lower outlier: {}  => Upper outlier: {}" .
  ↪format(age_outlier['lower']['length'], age_outlier['upper']['length']))
print("Income: \t => Lower outlier: {}  => Upper outlier: {}" .
  ↪format(income_outlier['lower']['length'], income_outlier['upper']['length']))
print("Miles: \t\t => Lower outlier: {}  => Upper outlier: {}" .
  ↪format(miles_outlier['lower']['length'], miles_outlier['upper']['length']))
print("Education: \t => Lower outlier: {}  => Upper outlier: {}" .
  ↪format(education_outlier['lower']['length'],␣
  ↪education_outlier['upper']['length']))
print("Fitness: \t => Lower outlier: {}  => Upper outlier: {}" .
  ↪format(fitness_outlier['lower']['length'],␣
  ↪fitness_outlier['upper']['length']))
print("Usage: \t\t => Lower outlier: {}  => Upper outlier: {}" .
  ↪format(usage_outlier['lower']['length'], usage_outlier['upper']['length']))
# print("%d, %d" %(age_outlier['lower']['length'],␣
  ↪age_outlier['upper']['length']))
```

```
Age:             => Lower outlier: 0  => Upper outlier: 5
Income:          => Lower outlier: 0  => Upper outlier: 19
Miles:           => Lower outlier: 0  => Upper outlier: 13
Education:       => Lower outlier: 0  => Upper outlier: 4
Fitness:         => Lower outlier: 2  => Upper outlier: 0
Usage:           => Lower outlier: 0  => Upper outlier: 9
```

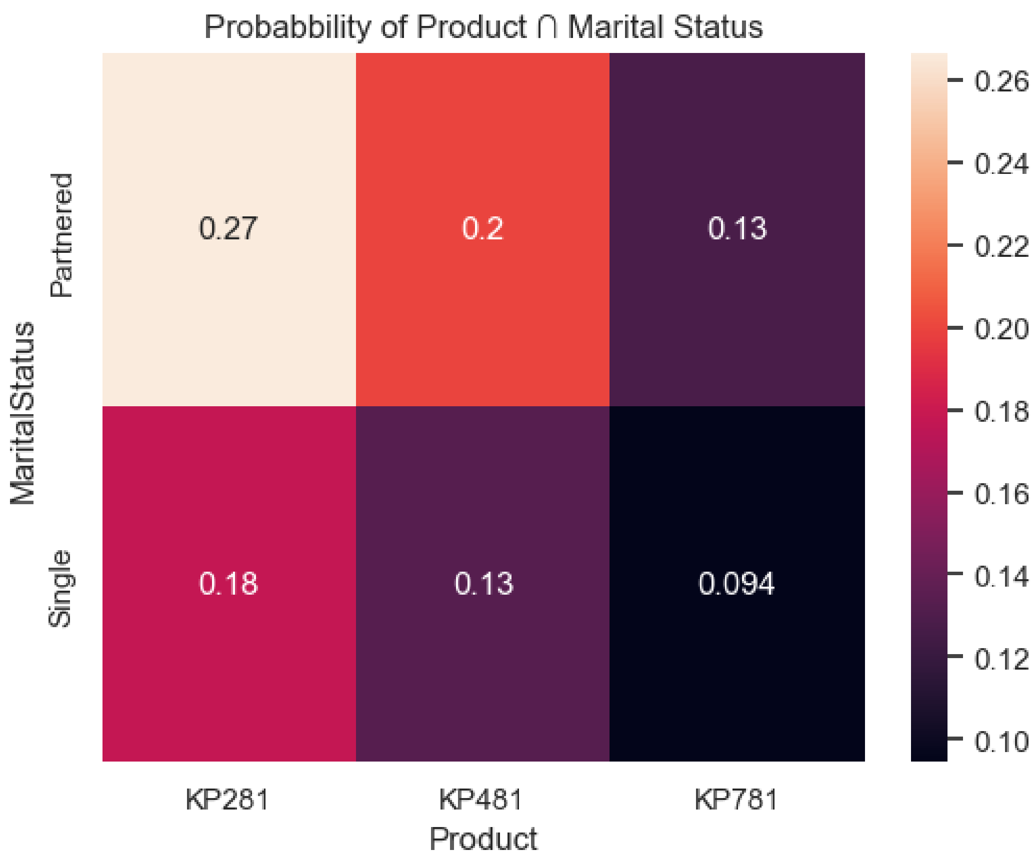
Insight * Yes, There is Outlier Present in DataSet for All of the Continuous Values, like

* Age: => Lower outlier: `0` => Upper outlier: `5` * Income: => Lower outlier: `0` => Upper outlier: `19` * Miles: => Lower outlier: `0` => Upper outlier: `13` * Education: => Lower outlier: `0` => Upper outlier: `4` * Fitness: => Lower outlier: `2` => Upper outlier: `0` * Usage: => Lower outlier: `0` => Upper outlier: `9`

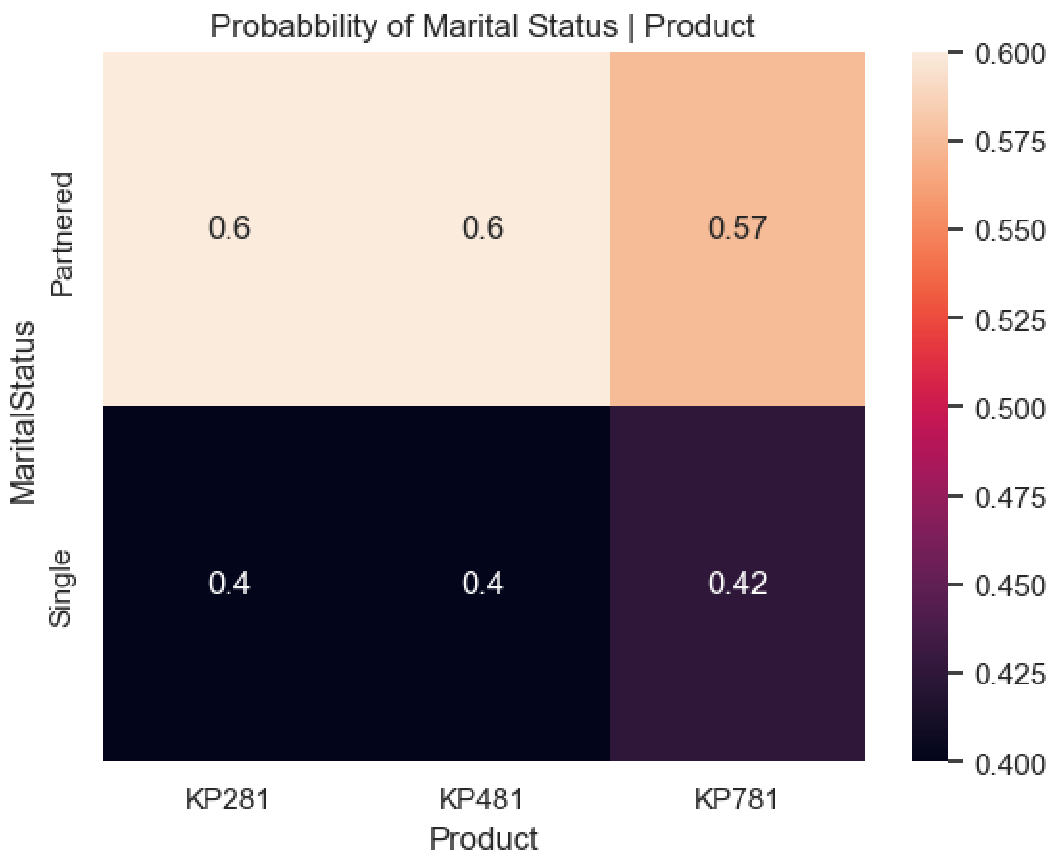
When, we remove these outliers it might effect credebility of `Product` specific analysis. Because Some of the product dependent on the datas.

1.5.6 Q5. Marital Status Implies no significant information on the usages of different TreadMills? (T/F)

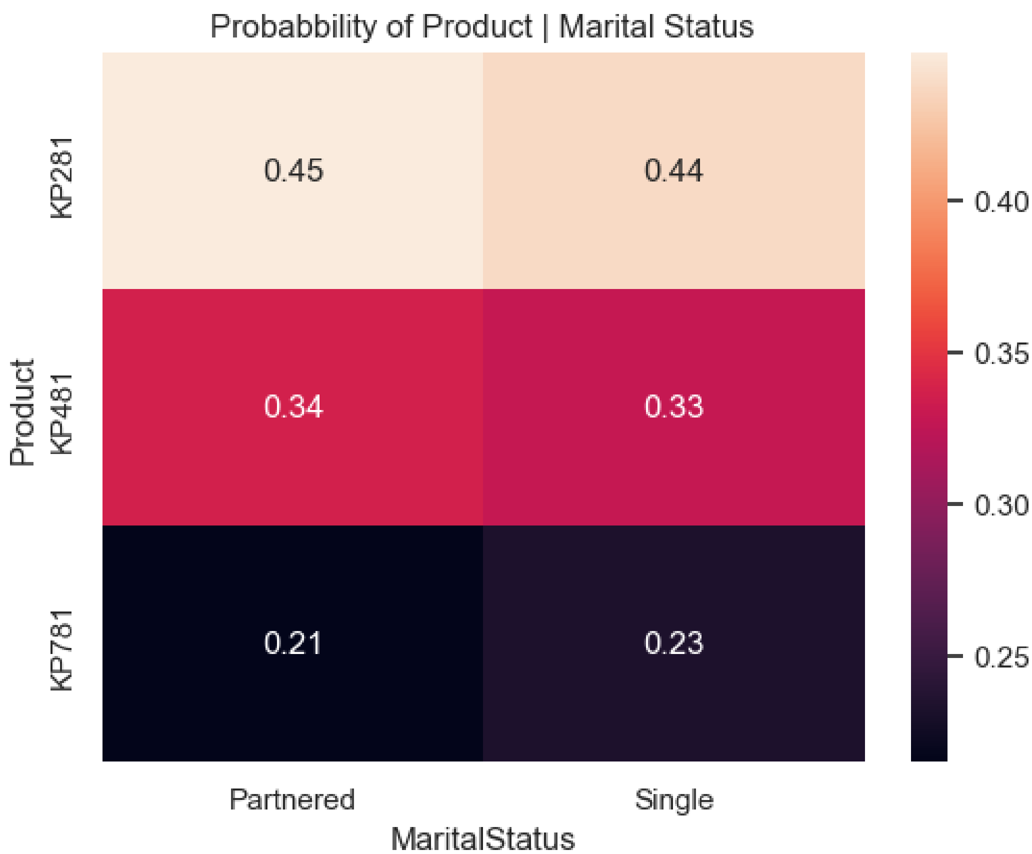
[ ]:
```
sns.heatmap(pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'],
 ↪normalize=True),annot=True)
plt.title('Probabbility of Product  Marital Status', fontsize=12)
plt.show()
```



[ ]:
```
sns.heatmap(pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'],
 ↪normalize='columns'),annot=True)
plt.title('Probabbility of Marital Status | Product', fontsize=12)
plt.show()
```



[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Product'], aerofit['MaritalStatus'],␣
↪normalize='columns'),annot=True)
plt.title('Probabbility of Product | Marital Status', fontsize=12)
plt.show()
```



Insight * From Above Probability Heatmap, observed that for each product given marital status have nearly same probability.

Thus, Statement is True

1.5.7 Q6. The variance of Income in lower ages is smaller as compare to the variance in higher ages. *In Statistics , this is known as*

```
[ ]: low_income_age = aerofit.copy().loc[aerofit['Age']<aerofit['Age'].
       ↪mean()][['Income', "Age"]]
     high_income_age = aerofit.copy().loc[aerofit['Age']>aerofit['Age'].
       ↪mean()][['Income', "Age"]]
```

```
[ ]: sns.scatterplot(aerofit, x='Income', y='Age', hue='Product')
     plt.title("Income vs Age", fontsize=12)
     plt.show()
```

[ ]:
```
low_income_age['Income'].var() < high_income_age['Income'].var()
```

[ ]: True

[ ]:
```
low_income_age['Income'].std() < high_income_age['Income'].std()
```

[ ]: True

Insight * Here Variance & Standard Daviation in low Age Income Group is less then Higher Age Income Group. * Thus, It results a funnel shape & It's known as **Heteroscedasticity**

1.5.8 Q7. What proportion of woman have brought the KP781 TreadMill? Provide reson of Answar.

[ ]:
```
product_gender = pd.crosstab(aerofit['Gender'], aerofit['Product'],␣
  ↪normalize='index', margins=True)*100
product_gender
```

[ ]:
```
Product      KP281      KP481      KP781
Gender
Female   52.631579  38.157895   9.210526
Male     38.461538  29.807692  31.730769
All      44.444444  33.333333  22.222222
```

[ ]:
```
product_gender['KP781']['Female']
```

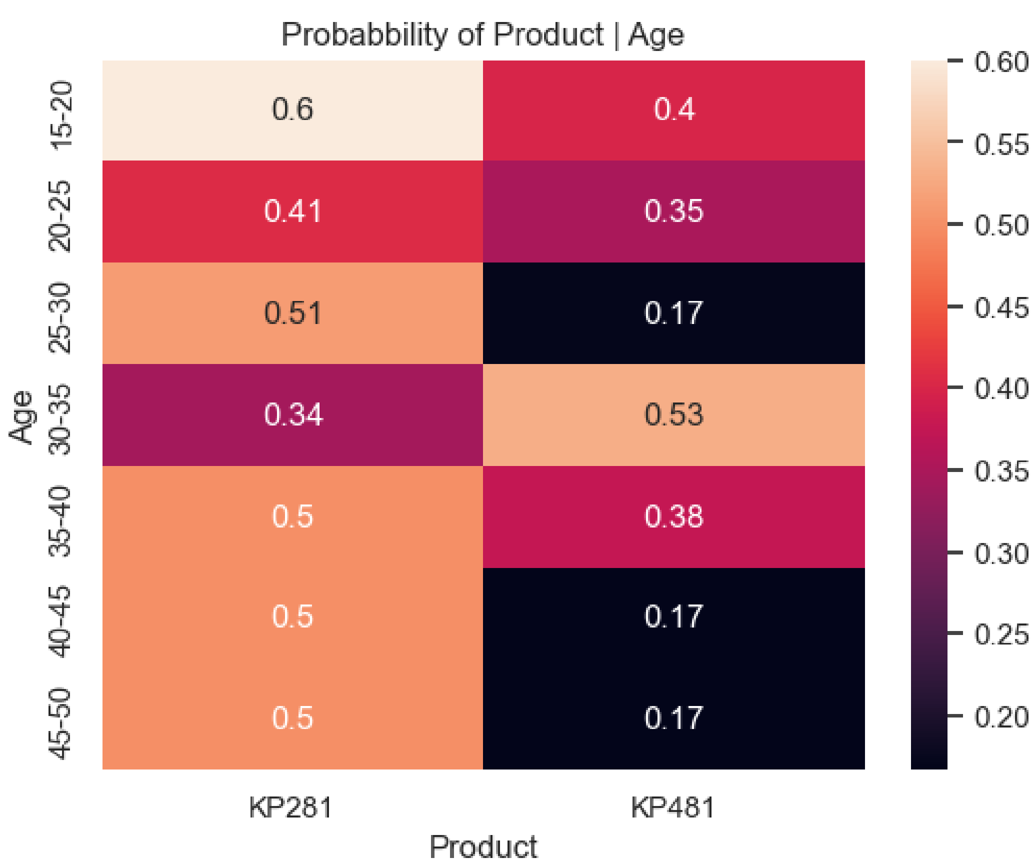
[ ]:
```
9.210526315789473
```

Insight * There is `9.21%` chance a male customer will purchase `KP781`

1.5.9 Q8. Distinguish between Customer Profiles for KP281 and KP481 TreadMill.

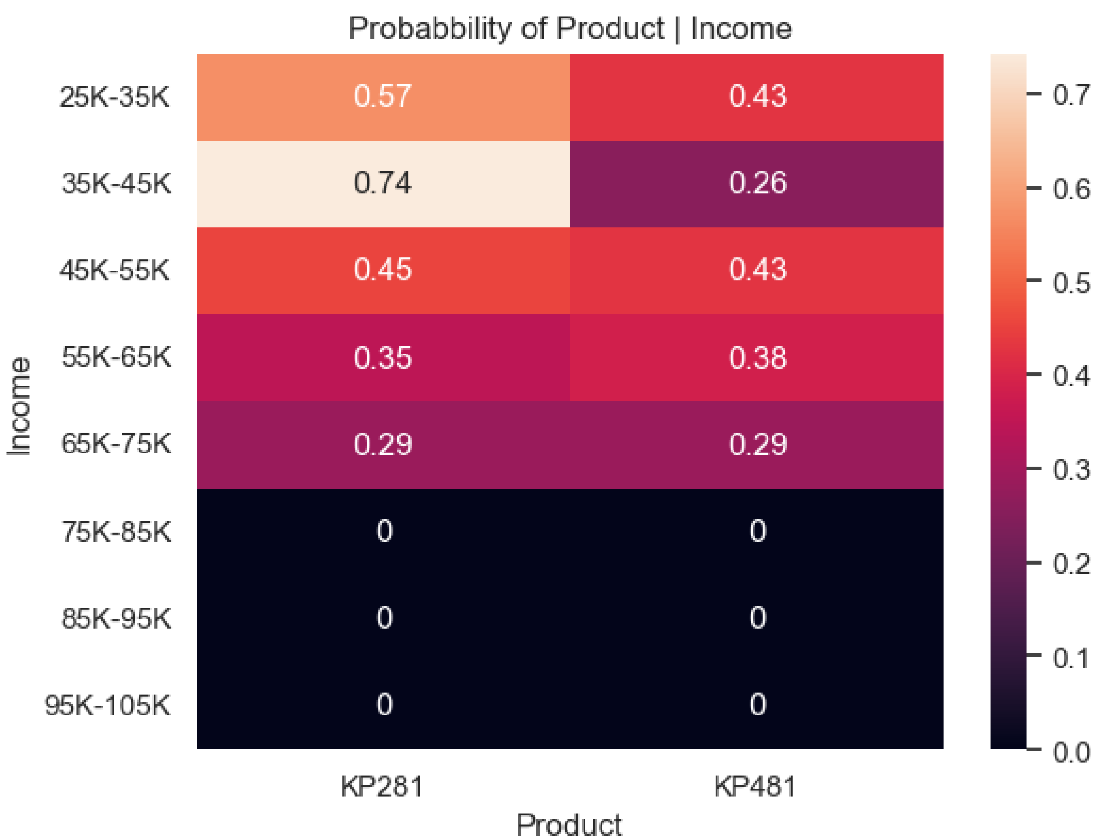
Probability of `Product's` for given `Age` *"Product | Age"*

[ ]:
```
sns.heatmap(pd.crosstab(aerofit['age_group'], aerofit['Product'],␣
 ↪normalize='index')[['KP281', 'KP481']], annot=True)
plt.title('Probabbility of Product | Age', fontsize=12)
plt.ylabel('Age')
plt.show()
```



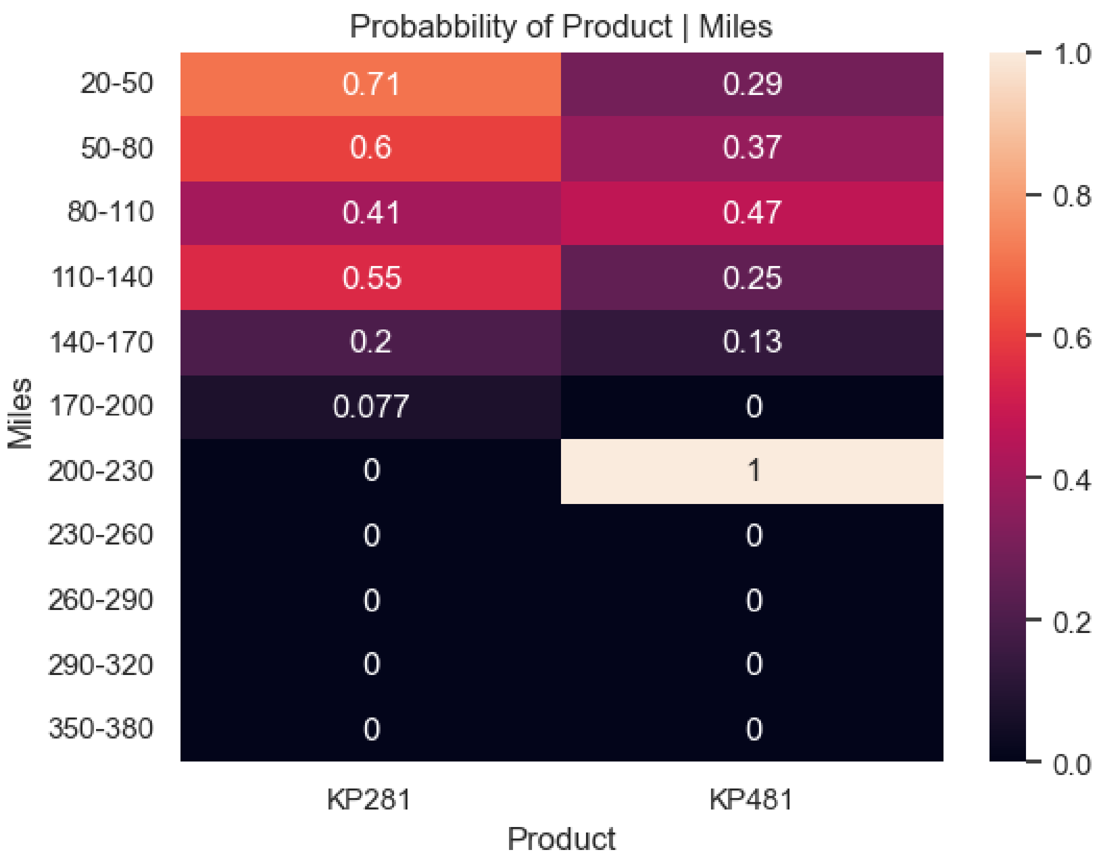
Probability of `Product`'s for given `Income` *"Product | Income"*

```
[ ]: sns.heatmap(pd.crosstab(aerofit['income_group'], aerofit['Product'],␣
       ↪normalize='index')[['KP281', 'KP481']], annot=True)
     plt.title('Probabbility of Product | Income', fontsize=12)
     plt.ylabel('Income')
     plt.show()
```



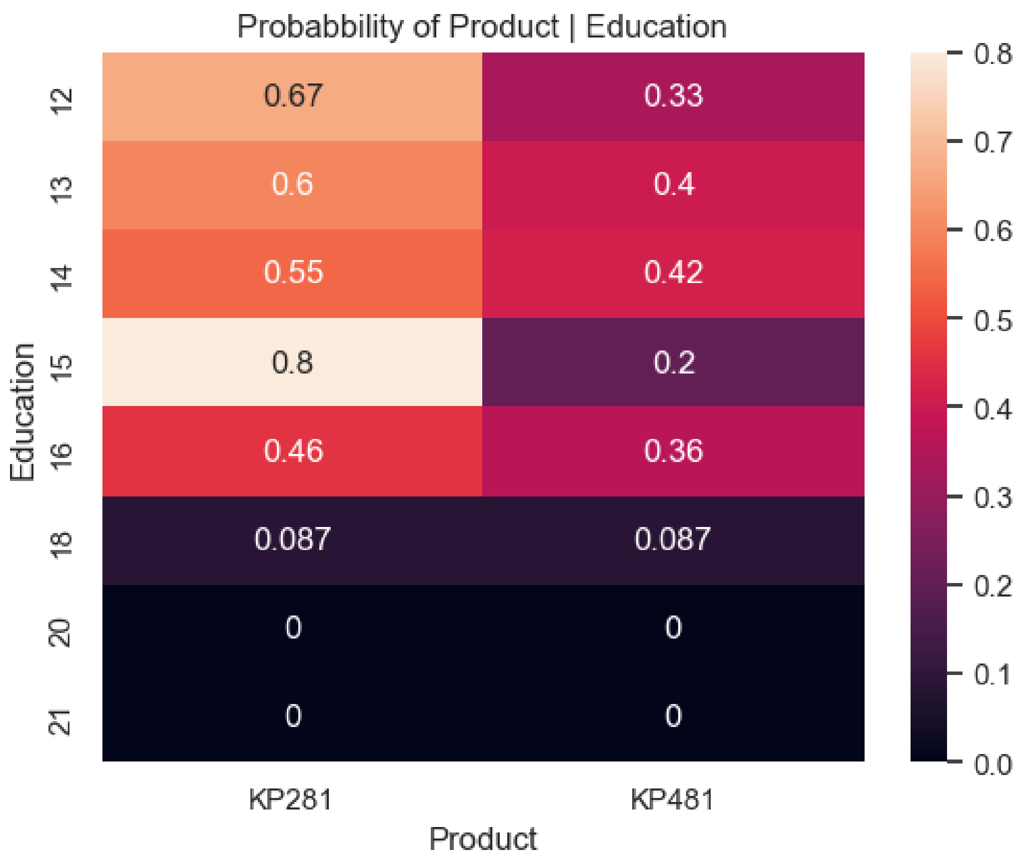
Probability of `Product`'s for given `Miles` *"Product | Miles"*

```
[ ]: sns.heatmap(pd.crosstab(aerofit['miles_group'], aerofit['Product'],␣
       ↪normalize='index')[['KP281', 'KP481']], annot=True)
     plt.title('Probabbility of Product | Miles', fontsize=12)
     plt.ylabel('Miles')
     plt.show()
```



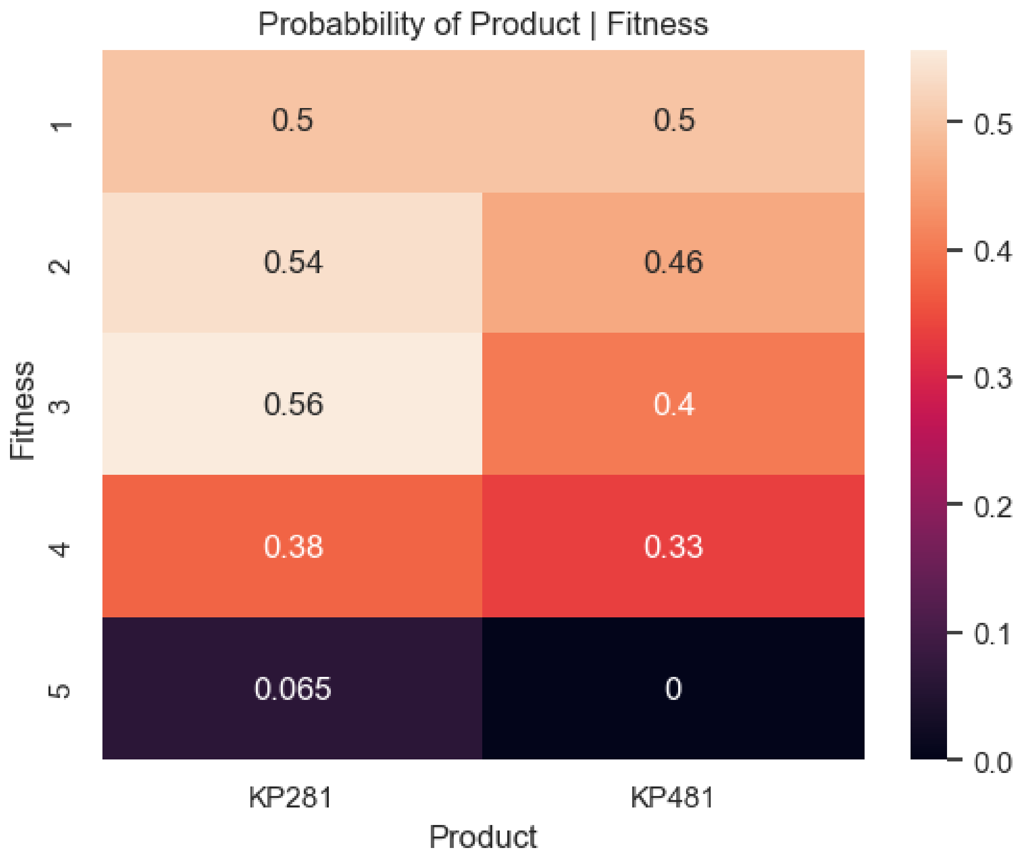
Probability of `Product`**'s for given** `Education` ***"Product | Education"***

```
[ ]: sns.heatmap(pd.crosstab(aerofit['Education'], aerofit['Product'],␣
       ↪normalize='index')[['KP281', 'KP481']], annot=True)
     plt.title('Probabbility of Product | Education', fontsize=12)
     plt.show()
```



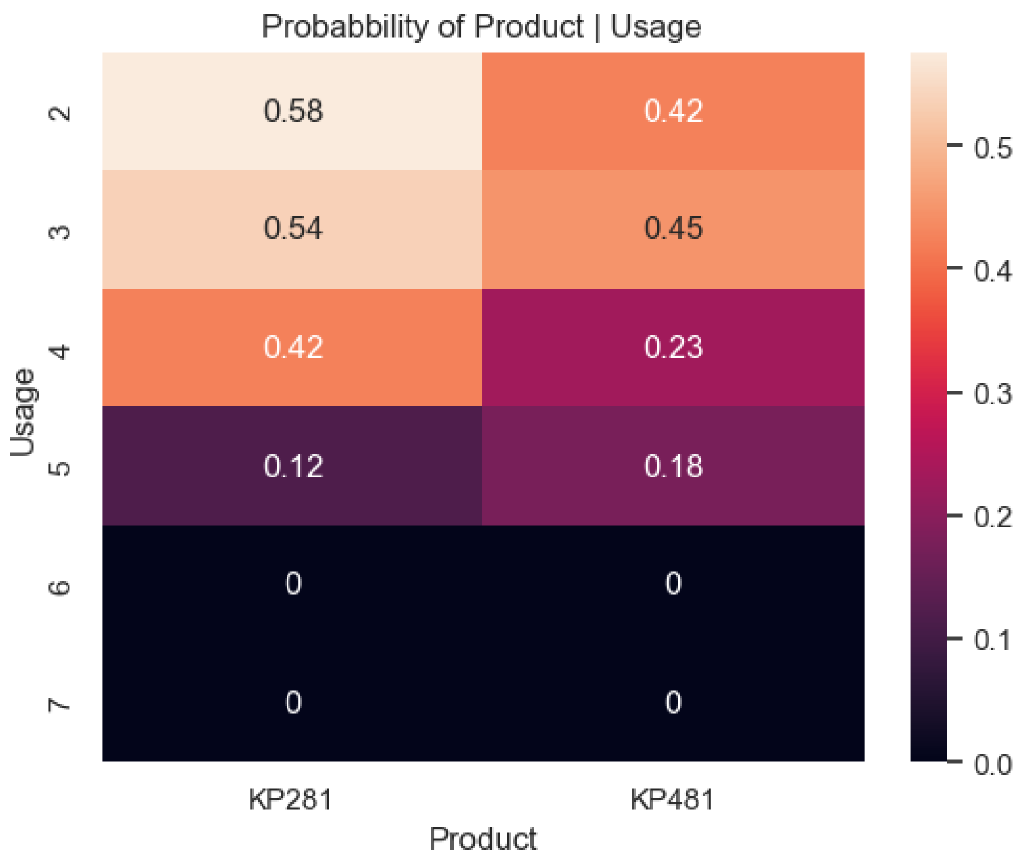
Probability of `Product`'s for given `Fitness` *"Product | Fitness"*

[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Fitness'], aerofit['Product'],␣
  ↪normalize='index')[['KP281', 'KP481']], annot=True)
plt.title('Probabbility of Product | Fitness', fontsize=12)
plt.show()
```



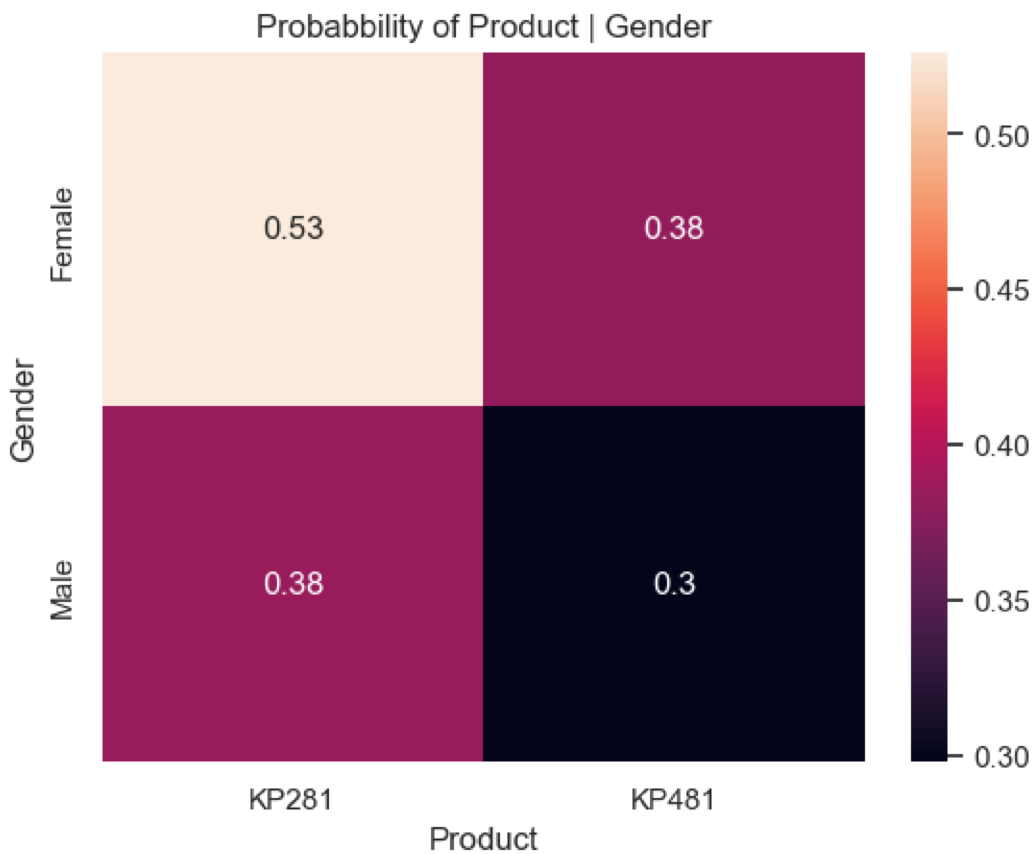
Probability of `Product`'s for given `Usage` ***"Product | Usage"***

[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Usage'], aerofit['Product'],␣
  ↪normalize='index')[['KP281', 'KP481']], annot=True)
plt.title('Probabbility of Product | Usage', fontsize=12)
plt.show()
```



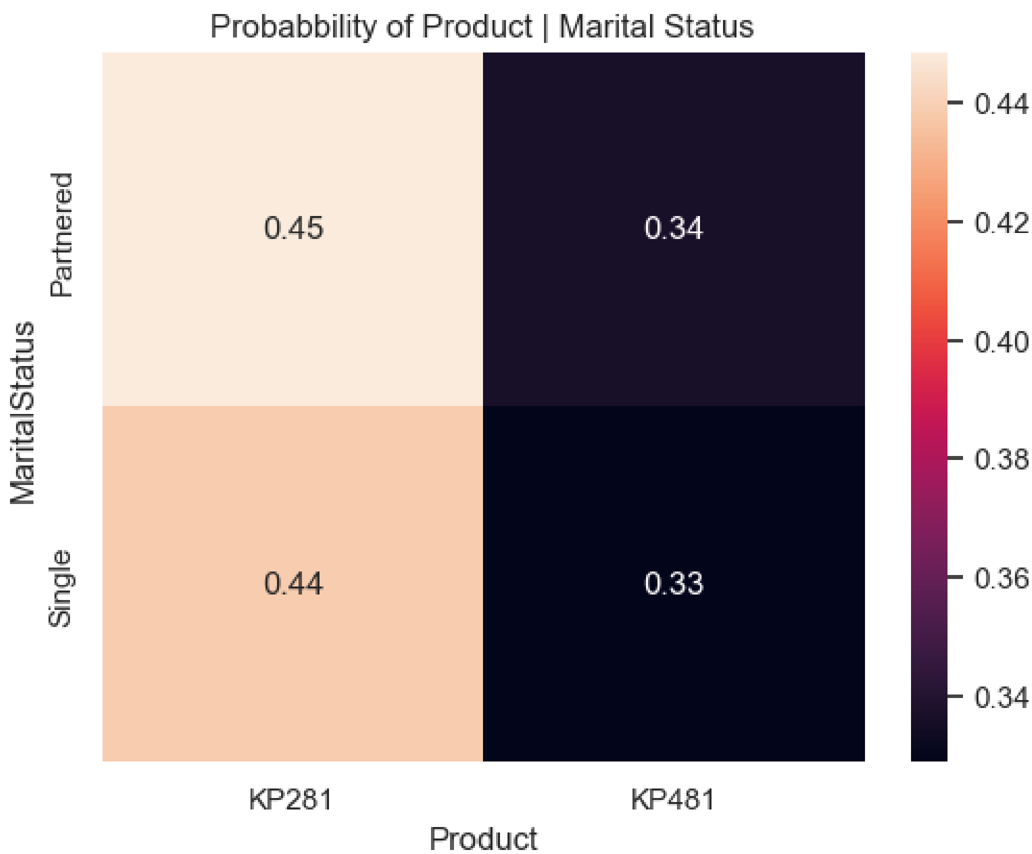
Probability of `Product's` for given `Gender` *"Product | Gender"*

[ ]:
```
sns.heatmap(pd.crosstab(aerofit['Gender'], aerofit['Product'],␣
↪normalize='index')[['KP281', 'KP481']], annot=True)
plt.title('Probabbility of Product | Gender', fontsize=12)
plt.show()
```



Probability of `Product's` for given `MaritalStatus` ***"Product | Marital Status"***

[ ]:
```
sns.heatmap(pd.crosstab(aerofit['MaritalStatus'], aerofit['Product'],␣
 ↪normalize='index')[['KP281', 'KP481']], annot=True)
plt.title('Probabbility of Product | Marital Status', fontsize=12)
plt.show()
```



1.5.10 **Q9. The overall Probability of purchase for KP281, KP481 & KP781 TreadMill is ___ , _____ , _____.**

[ ]:
```
aerofit.groupby('Product')['Product'].count()/1.80
```

[ ]:
```
Product
KP281    44.444444
KP481    33.333333
KP781    22.222222
Name: Product, dtype: float64
```

1.5.11 Q10. Give conditions when you will and when you 'll not recomended KP781 TreadMill to a Customer?

When to recomend KP781 * Male's * Age between `20-30`. * Income with `90K`. * Who inteded or alredy covered `150-200` Miles. * Have Education between `16-19`. * Have Fitness of level`5`. * Have Usages level of `4-5`.

When not to recomend KP781 * Females's * Age above 35. * Income below 75K. * Have Fitness level less than 3. * Have Usages level less than 4.

1.6 Multi Variate Analysis

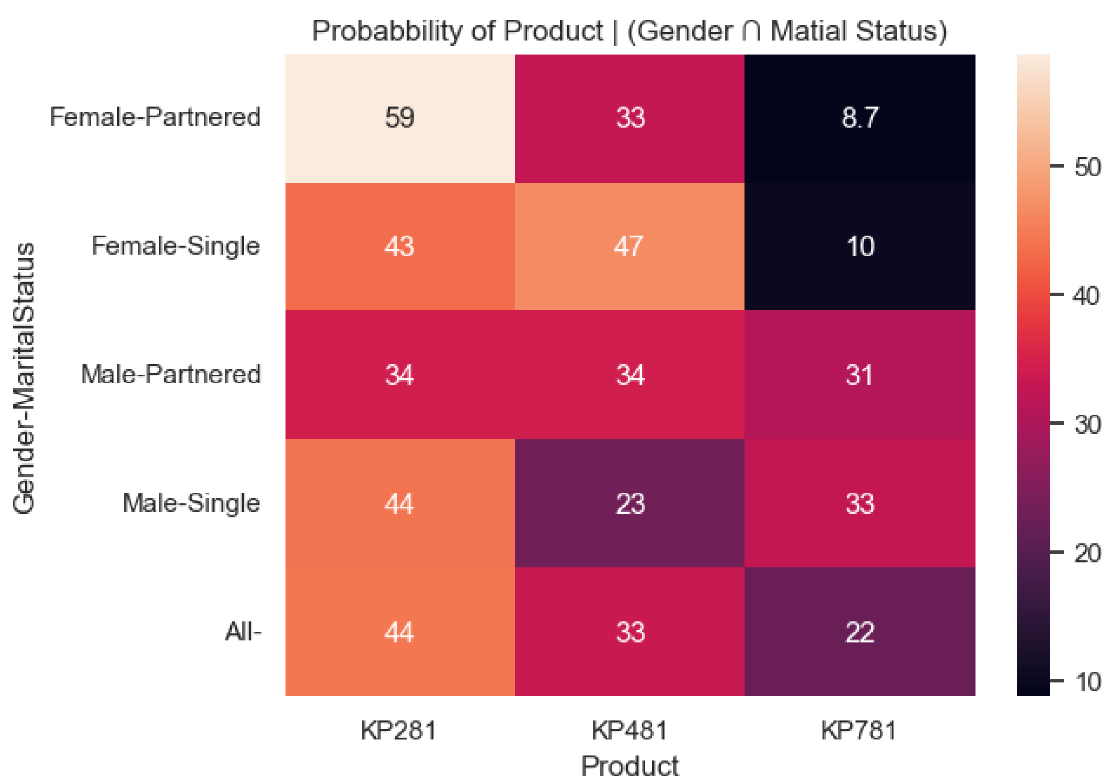
Find Probability & Coorelation

Probability of `Product's` for given `Gender & Marital Status` *"Product | (Gender Matial Status)"*

```
[ ]: p_pord_gend_marital= pd.crosstab([aerofit['Gender'], aerofit['MaritalStatus']],
       aerofit['Product'], normalize='index', margins=True)*100
     # p_pord_gend_marital
```

```
[ ]: sns.heatmap(p_pord_gend_marital, annot=True)
     plt.title('Probabbility of Product | (Gender  Matial Status)', fontsize=12)
```

```
[ ]: Text(0.5, 1.0, 'Probabbility of Product | (Gender  Matial Status)')
```

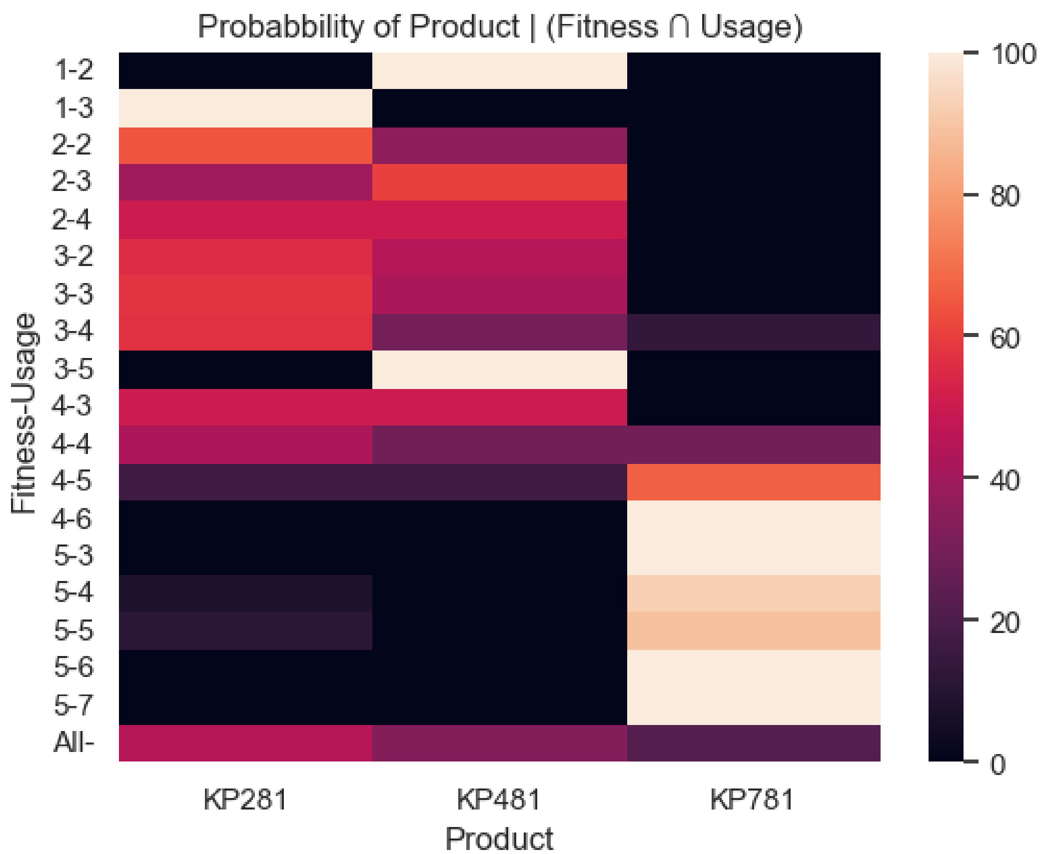


Probability of `Product's` for given `Fitness & Usage` *"Product | (Fitness Usage)"*

```
[ ]: p_pord_fit_usag= pd.crosstab([aerofit['Fitness'], aerofit['Usage']],
       aerofit['Product'], normalize='index', margins=True)*100
     # p_pord_fit_usag
```

[ ]:
```
sns.heatmap(p_pord_fit_usag)
plt.title('Probabbility of Product | (Fitness   Usage)', fontsize=12)
```

[ ]: Text(0.5, 1.0, 'Probabbility of Product | (Fitness   Usage)')

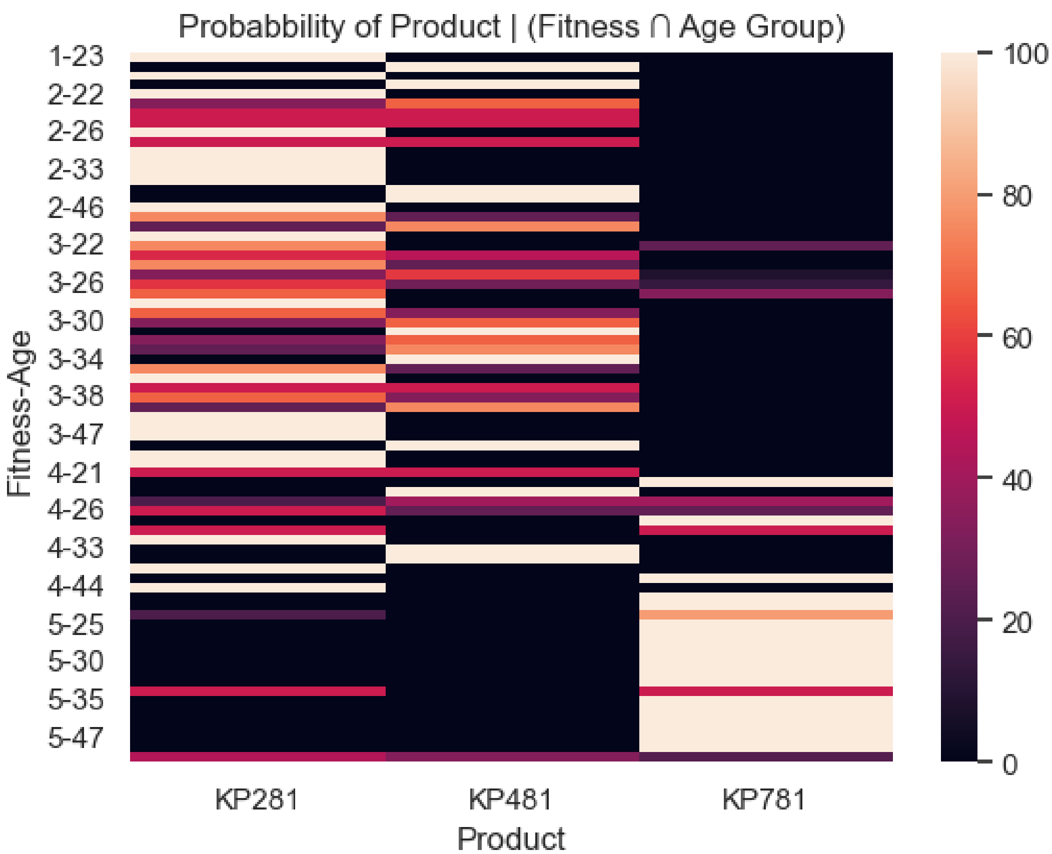


Probability of Product's for given Fitness & Age Group ***"Product | (Fitness   Miles)"***

[ ]:
```
p_pord_fit_age_group= pd.crosstab([aerofit['Fitness'], aerofit['Age']],␣
↪aerofit['Product'], normalize='index', margins=True)*100
# p_pord_fit_age_group
```

[ ]:
```
sns.heatmap(p_pord_fit_age_group)
plt.title('Probabbility of Product | (Fitness   Age Group)', fontsize=12)
```

[ ]: Text(0.5, 1.0, 'Probabbility of Product | (Fitness   Age Group)')

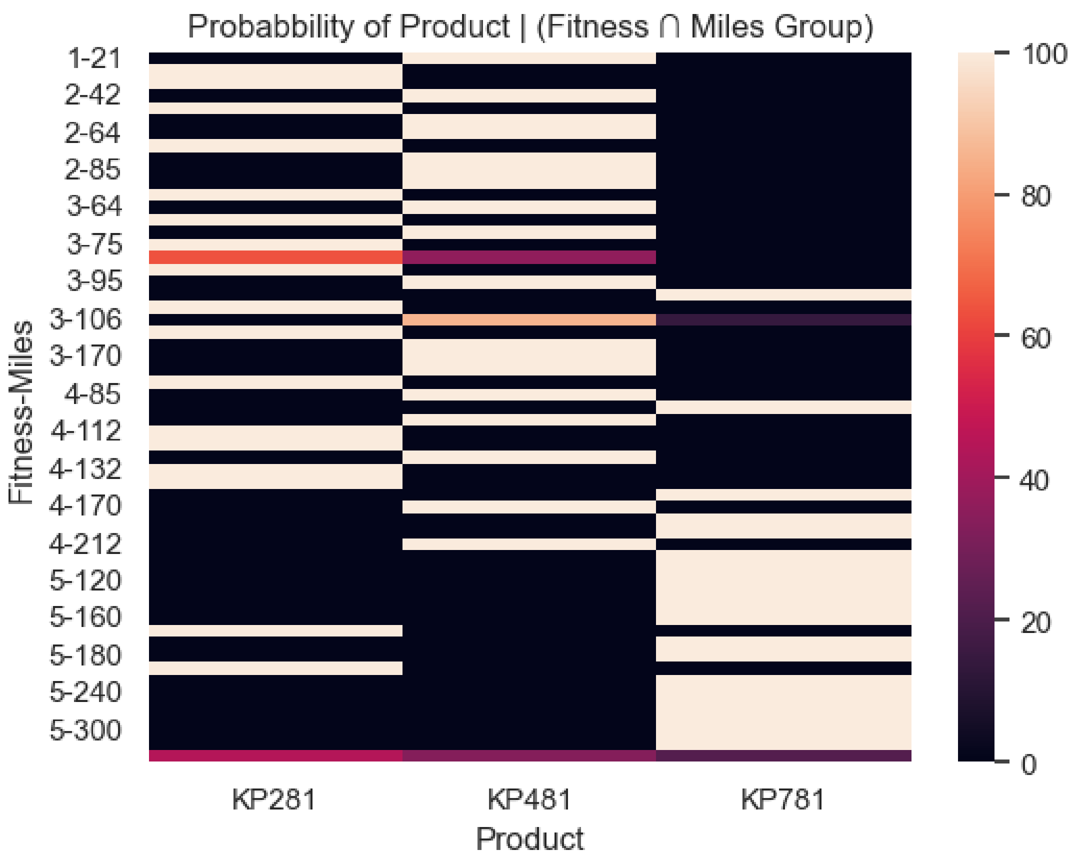


Probability of `Product's` for given `Fitness & Mile Group` *"Product | (Fitness   Mile Group)"*

[ ]:
```
p_pord_fit_mile_group= pd.crosstab([aerofit['Fitness'], aerofit['Miles']],␣
↪aerofit['Product'], normalize='index', margins=True)*100
# p_pord_fit_mile_group
```

[ ]:
```
sns.heatmap(p_pord_fit_mile_group)
plt.title('Probabbility of Product | (Fitness   Miles Group)', fontsize=12)
```

[ ]:
```
Text(0.5, 1.0, 'Probabbility of Product | (Fitness   Miles Group)')
```

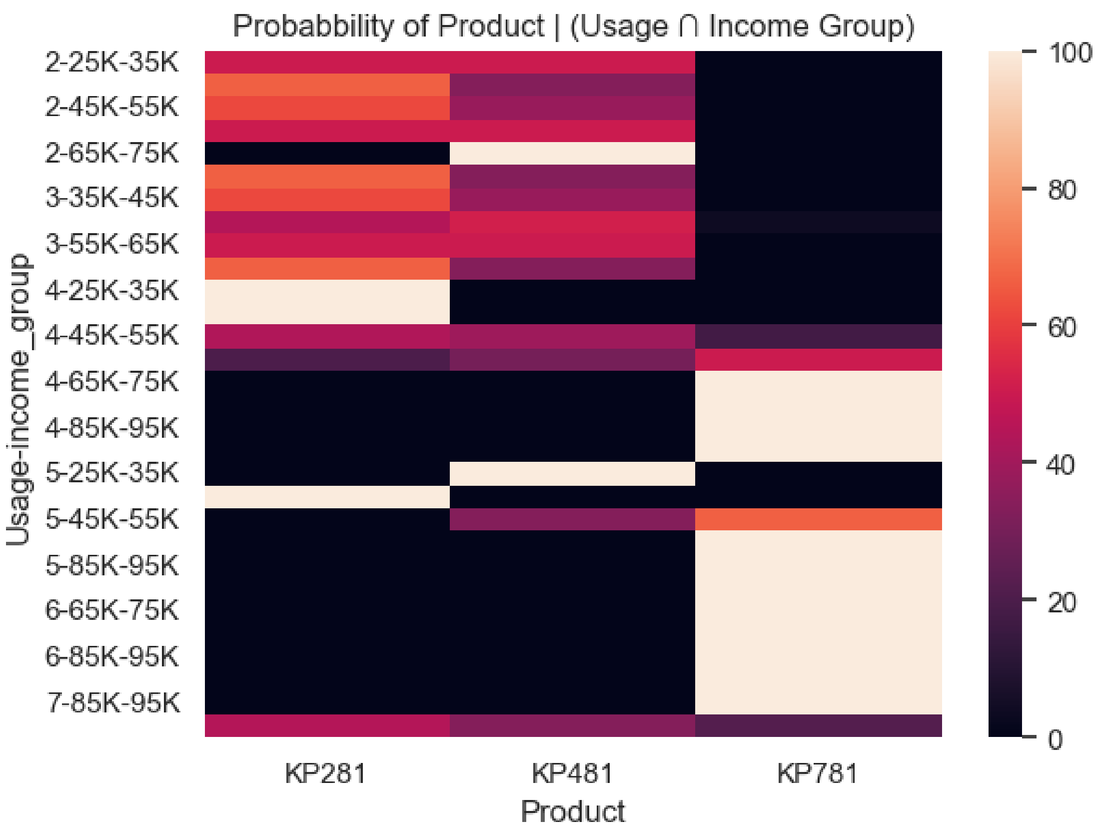


Probability of `Product's` **for given** `Usage & Income Group` ***"Product | (Fitness Mile Group)"***

[ ]:
```
p_pord_usage_income_group= pd.crosstab([aerofit['Usage'],␣
↪aerofit['income_group']], aerofit['Product'], normalize='index',␣
↪margins=True)*100
# p_pord_usage_income_group
```

[ ]:
```
sns.heatmap(p_pord_usage_income_group)
plt.title('Probabbility of Product | (Usage  Income Group)', fontsize=12)
```

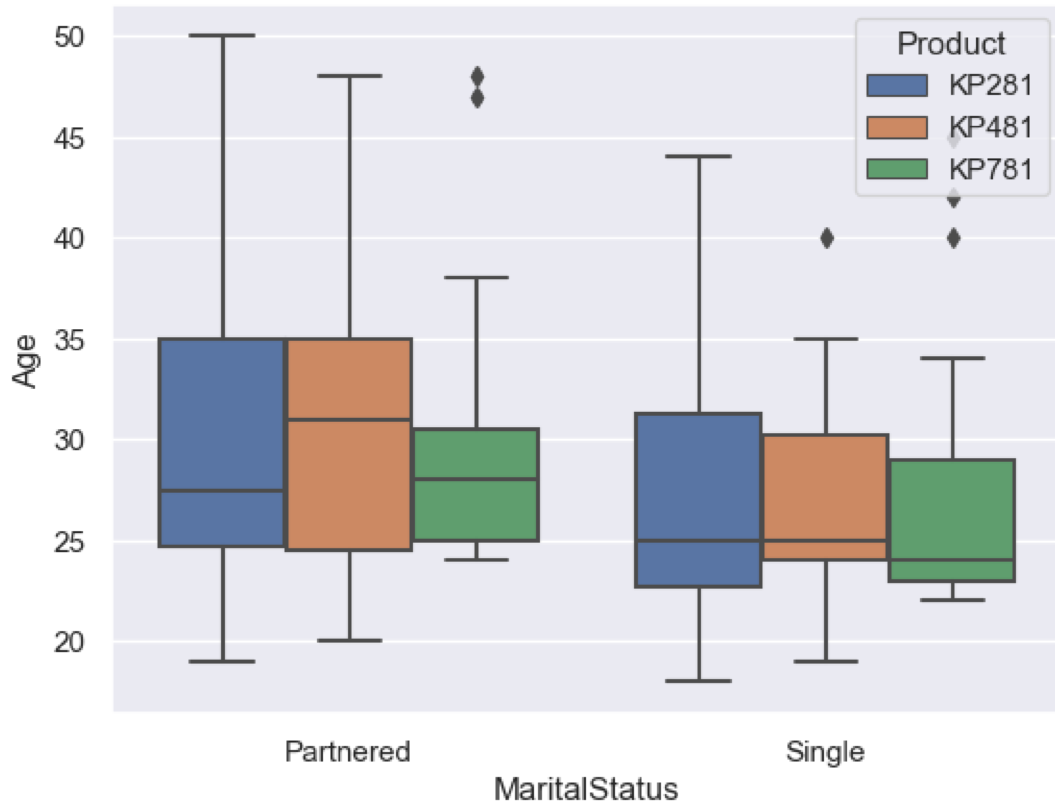
[ ]: Text(0.5, 1.0, 'Probabbility of Product | (Usage Income Group)')



Find Correlation

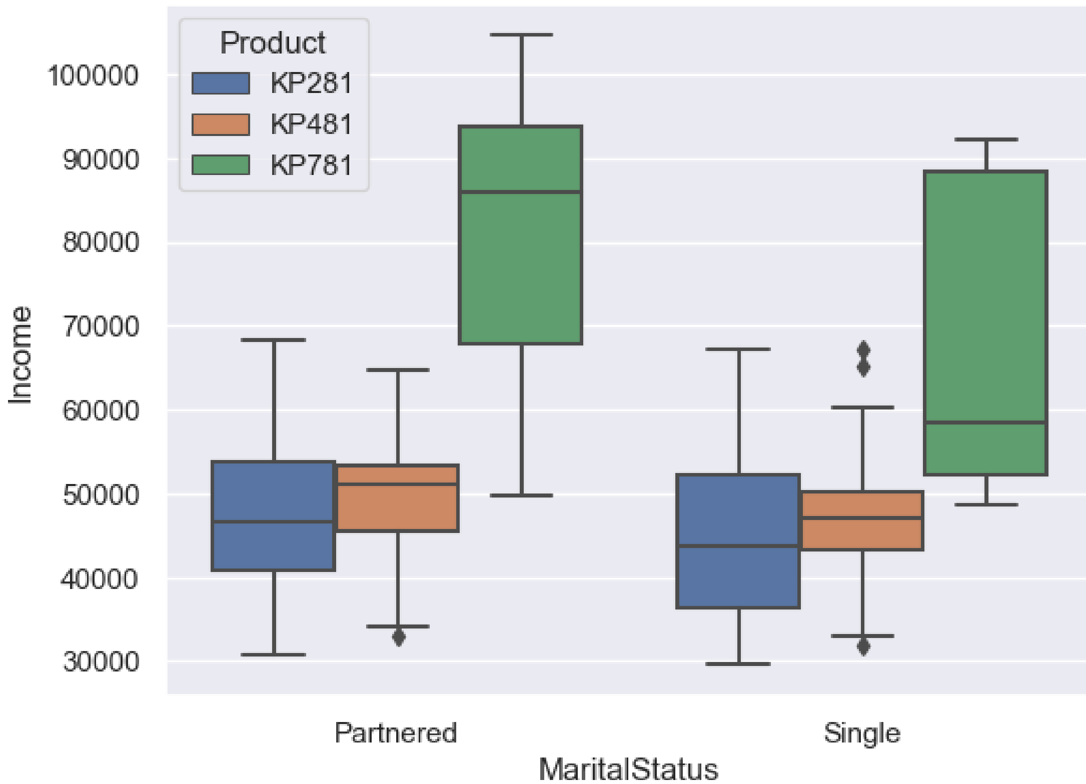
[ ]:
```
sns.boxplot(x="MaritalStatus", y="Age", hue="Product", data=aerofit)
```

[ ]: <Axes: xlabel='MaritalStatus', ylabel='Age'>



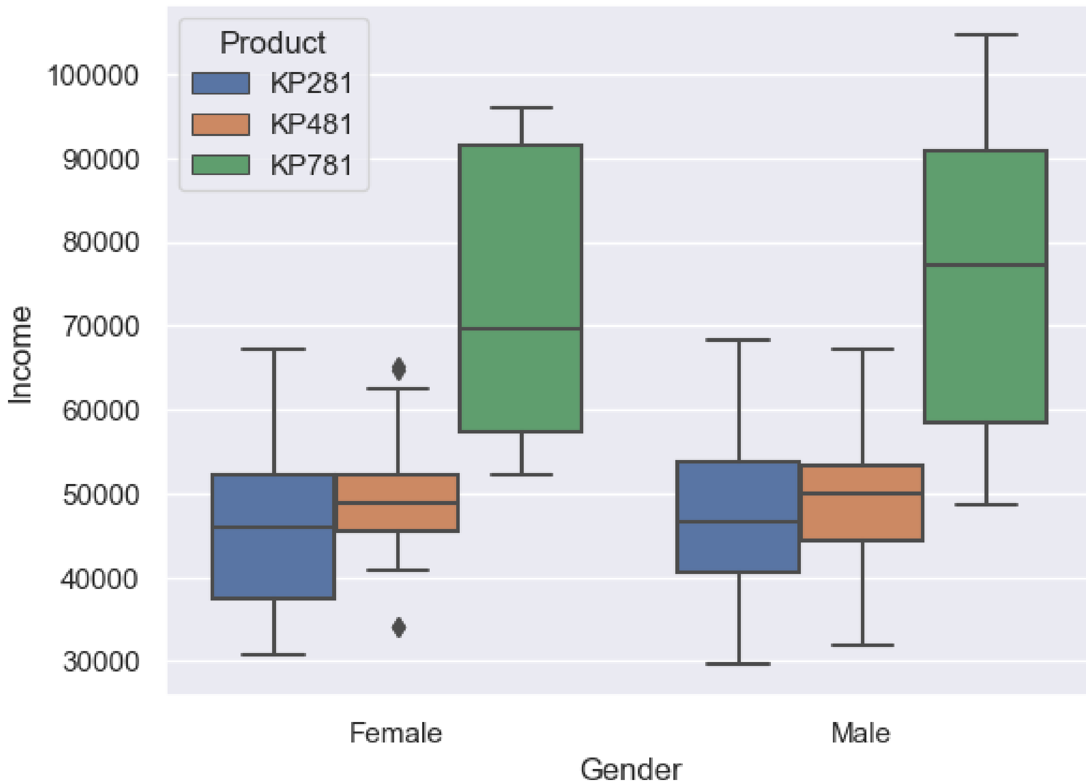

```
[ ]: sns.boxplot(x="MaritalStatus", y="Income", hue="Product", data=aerofit)
```

```
[ ]: <Axes: xlabel='MaritalStatus', ylabel='Income'>
```



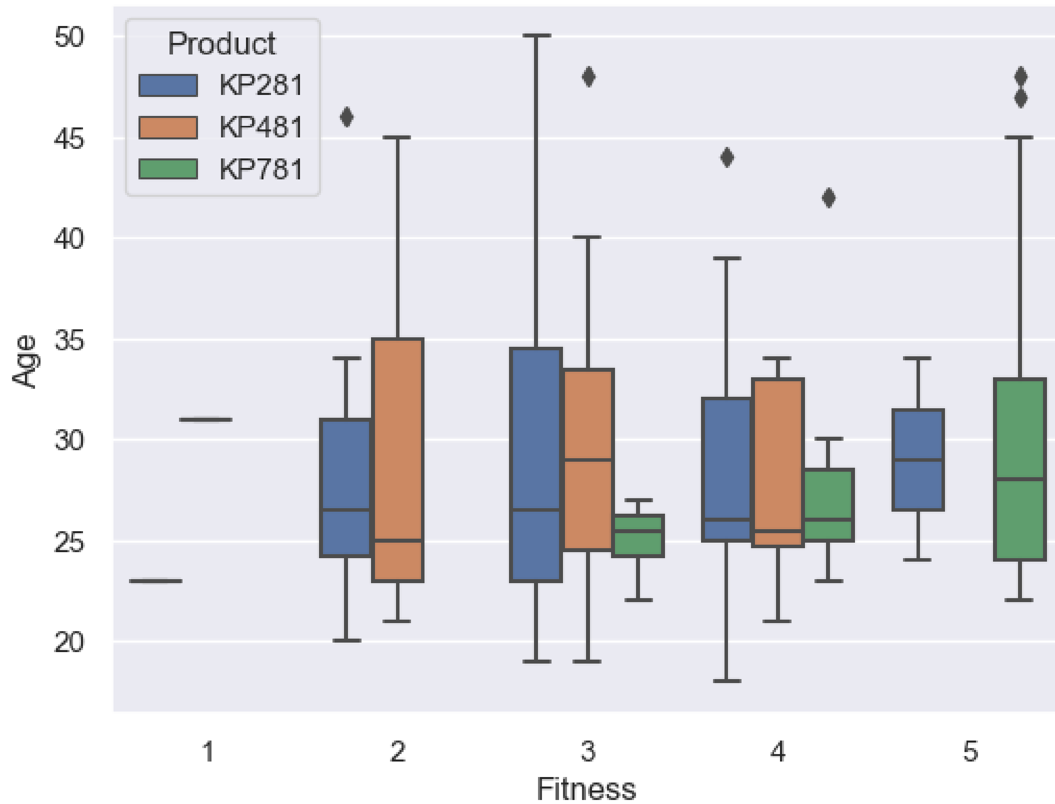

```
[ ]: sns.boxplot(x="Gender", y="Income", hue="Product", data=aerofit)
```

```
[ ]: <Axes: xlabel='Gender', ylabel='Income'>
```



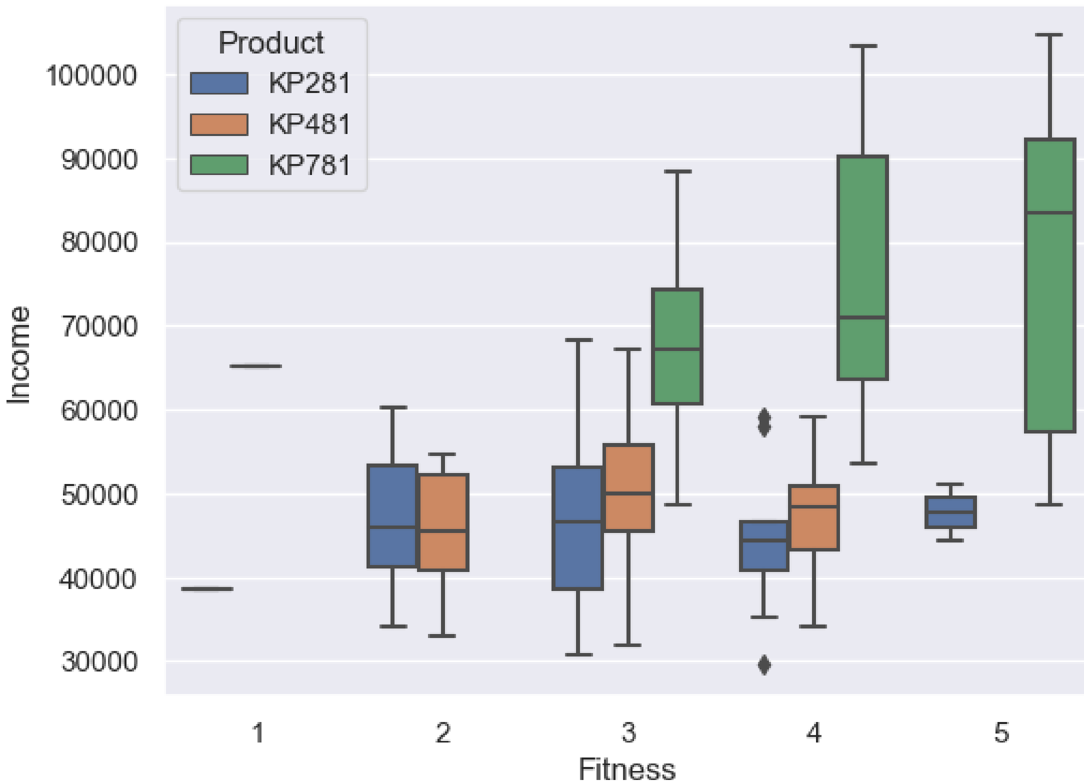

```
[ ]: sns.boxplot(x="Fitness", y="Age", hue="Product", data=aerofit)
```

```
[ ]: <Axes: xlabel='Fitness', ylabel='Age'>
```



[ ]:
```
sns.boxplot(x="Fitness", y="Income", hue="Product", data=aerofit)
```

[ ]: <Axes: xlabel='Fitness', ylabel='Income'>




```
[ ]: sns.lineplot(x="Age", y="Education", hue="Product", data=aerofit)
```

```
[ ]: <Axes: xlabel='Age', ylabel='Education'>
```


Product
KP281
KP481
KP781
Education
Age
20
18
16
14
12
20
25
30
35
40
45
50

2 END