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

#!gdown
'https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/001/125/original/aerofit_treadmill.csv?1639992749' -O Aerofit.csv

df =
pd.read_csv('https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/001/125/original/aerofit_treadmill.csv?1639992749')
df.head(10)
```

```
  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
5   KP281   20  Female         14     Partnered      3        3
32973     66
6   KP281   21  Female         14     Partnered      3        3
35247     75
7   KP281   21    Male         13        Single      3        3
32973     85
8   KP281   21    Male         15        Single      5        4
35247    141
9   KP281   21  Female         15     Partnered      2        3
37521     85
```

```
len(df)
```

```
180
```

```
df.describe()
```

```
               Age   Education       Usage     Fitness
Income  \
count  180.000000  180.000000  180.000000  180.000000     180.000000

mean    28.788889   15.572222    3.455556    3.311111   53719.577778

std      6.943498    1.617055    1.084797    0.958869   16506.684226
```

```
min     18.000000   12.000000    2.000000    1.000000   29562.000000

25%     24.000000   14.000000    3.000000    3.000000   44058.750000

50%     26.000000   16.000000    3.000000    3.000000   50596.500000

75%     33.000000   16.000000    4.000000    4.000000   58668.000000

max     50.000000   21.000000    7.000000    5.000000  104581.000000
```

```
             Miles
count  180.000000
mean   103.194444
std     51.863605
min     21.000000
25%     66.000000
50%     94.000000
75%    114.750000
max    360.000000
```

```
df.dtypes
```

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

```
df.isnull().sum()
```

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

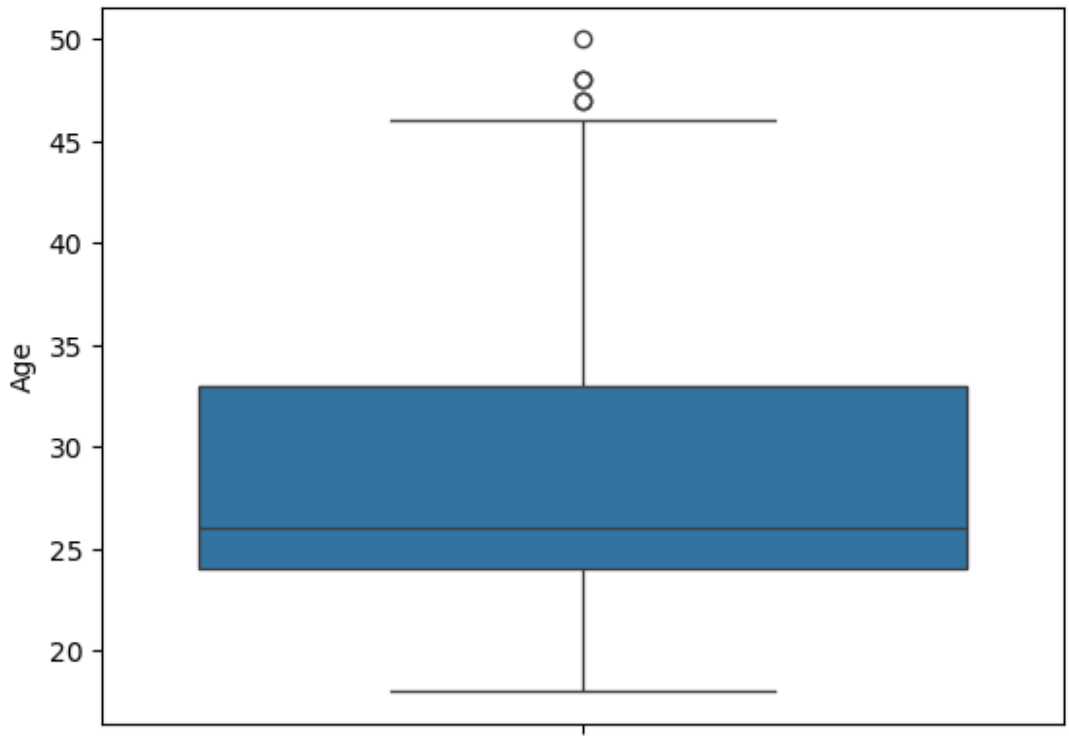
Since there are no null values found we can start with the Exploratory data analysis.

```
def nuniqe(df):
  for i in df.columns:
    print(i,':',df[i].nunique())

nuniqe(df)
```

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

Detection and removal of Outliers

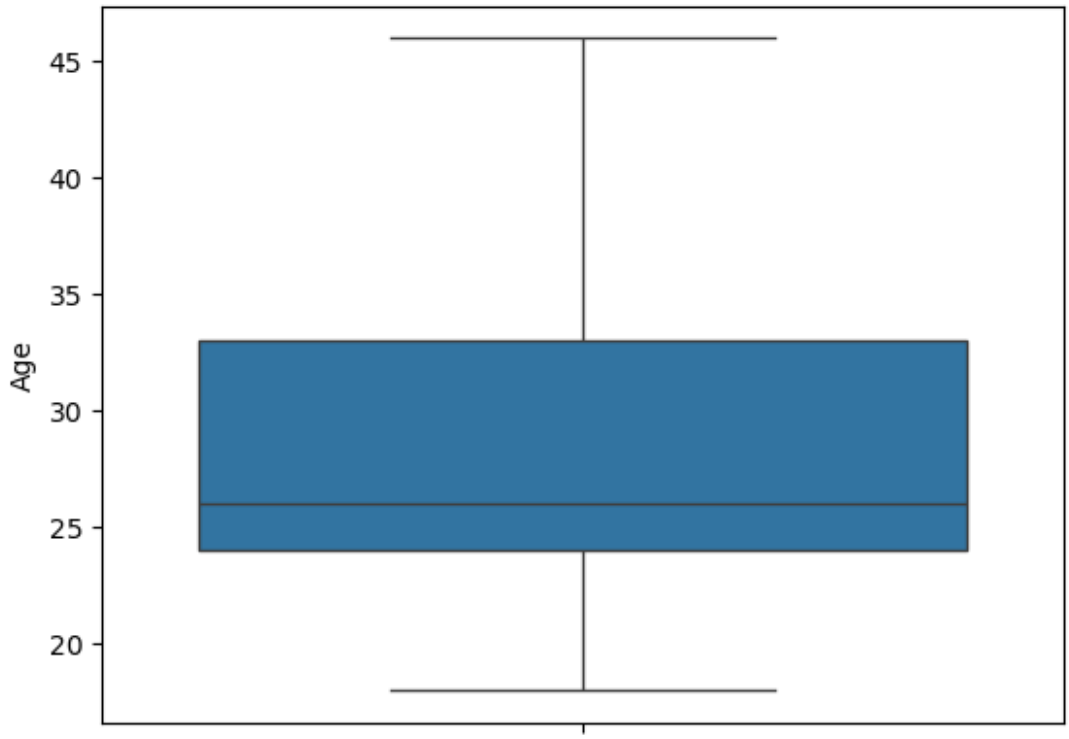
```
Outlier_Age = sns.boxplot(df['Age'])
```



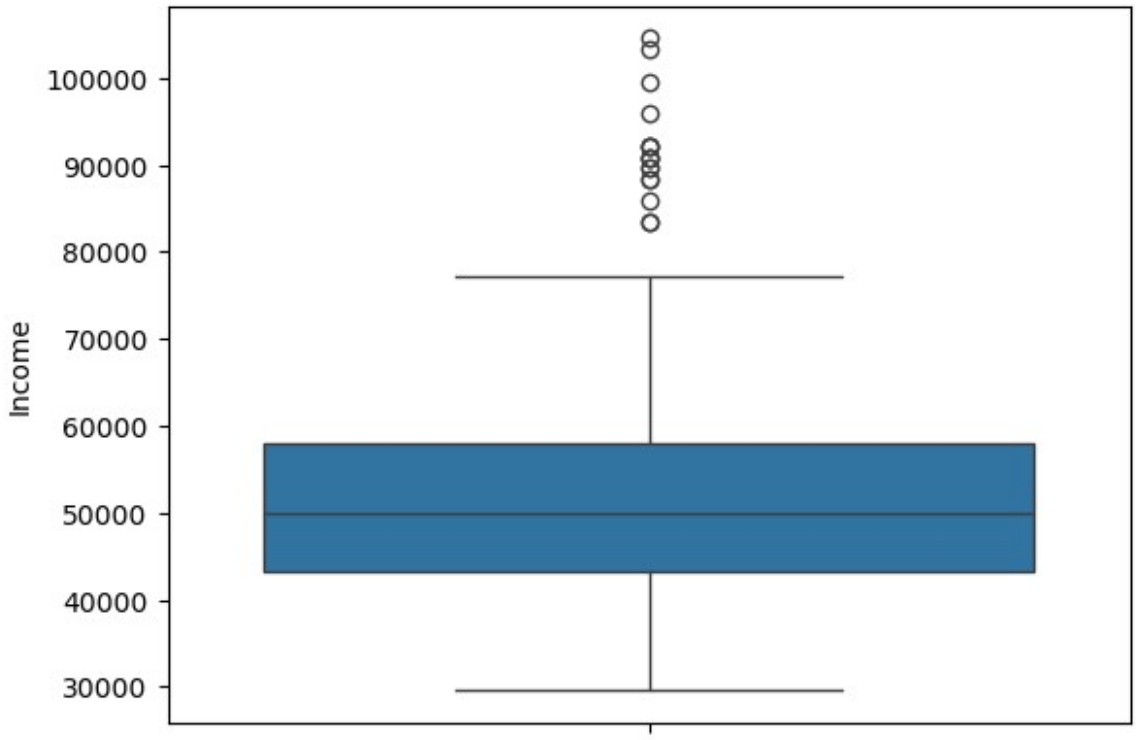

```
# Detecting Outliers by calculating the Inter Quartile Range of age column.
```

```
Q1 = df['Age'].quantile(0.25)
Q3 = df['Age'].quantile(0.75)
IQR = Q3 - Q1
Lower = Q1 - 1.5*IQR
Upper = Q3 + 1.5*IQR

upper_array = np.where(df['Age'] >= Upper)[0]
lower_array = np.where(df['Age'] <= Lower)[0]

#Dropping the Outliers
df.drop(index = upper_array , inplace = True)
df.drop(index = lower_array , inplace = True)

sns.boxplot(df['Age'])
```

```
<Axes: ylabel='Age'>
```

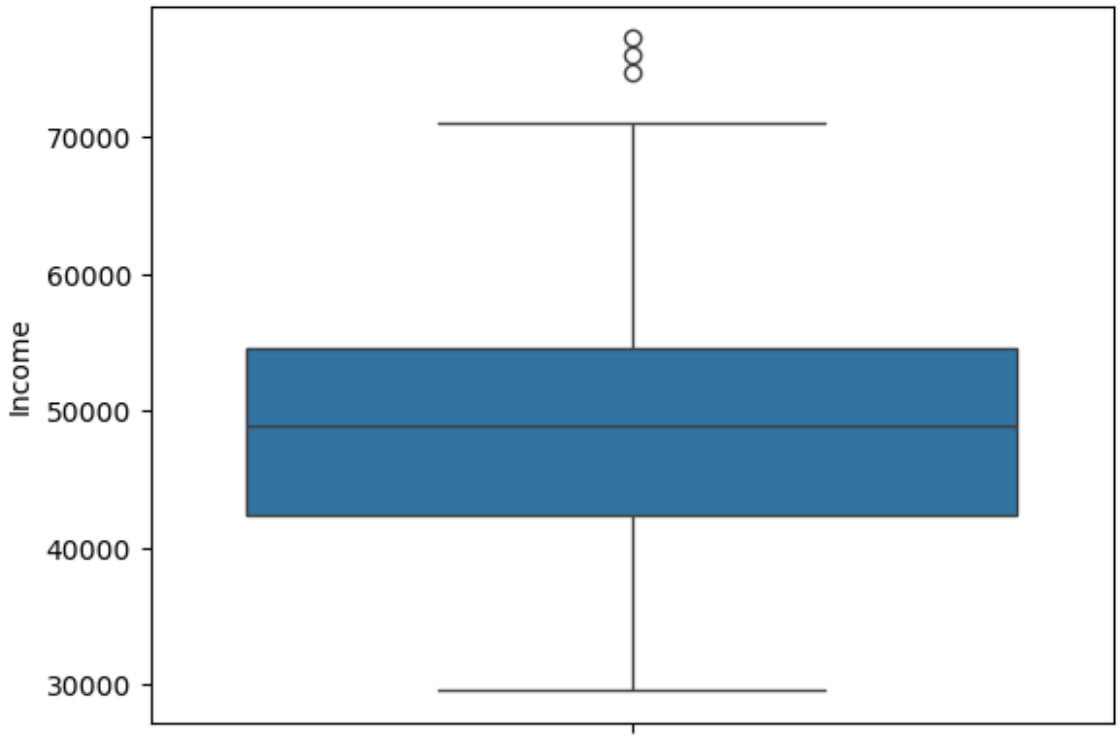



```
outliers_income = sns.boxplot(df['Income'])
```

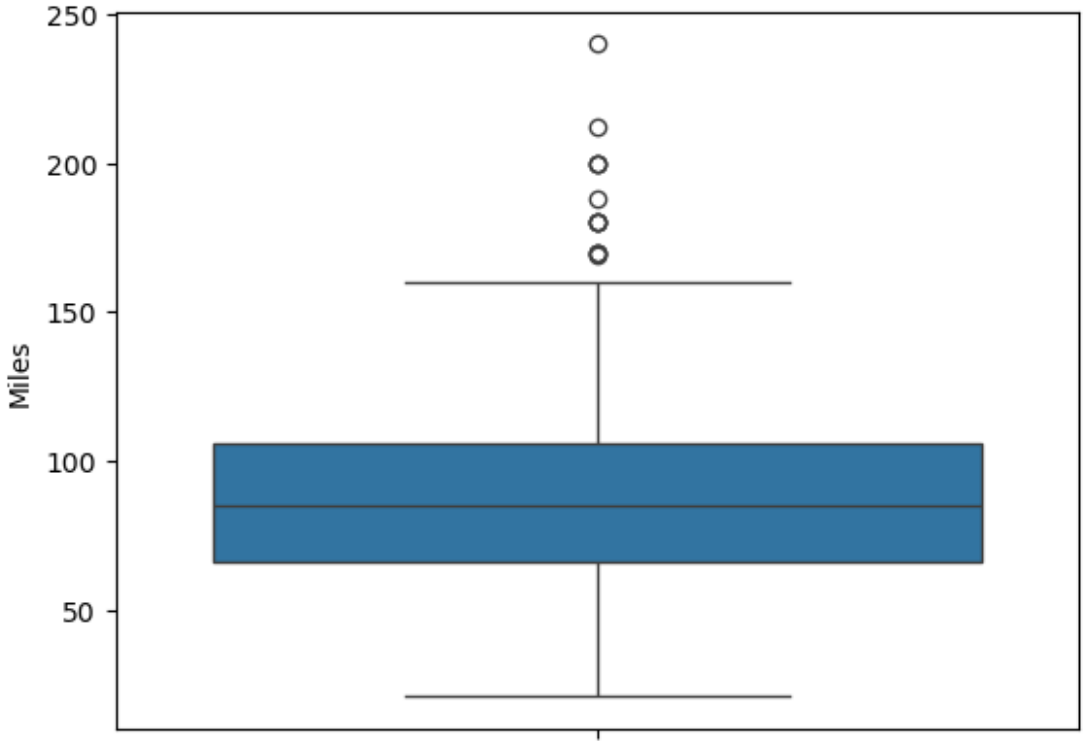



```
# Detecting Outliers by calculating the Inter Quartile Range of Income column.
Q1 = df['Income'].quantile(0.25)
Q3 = df['Income'].quantile(0.75)
IQR = Q3 - Q1
Lower = Q1 - 1.5*IQR
Upper = Q3 + 1.5*IQR

upper_array = df[df['Income'] >= Upper].index
lower_array = df[df['Income'] <= Lower].index

#Dropping the Outliers
df.drop(index = upper_array , inplace = True)
df.drop(index = lower_array , inplace = True)

sns.boxplot(df['Income'])
```

```
<Axes: ylabel='Income'>
```

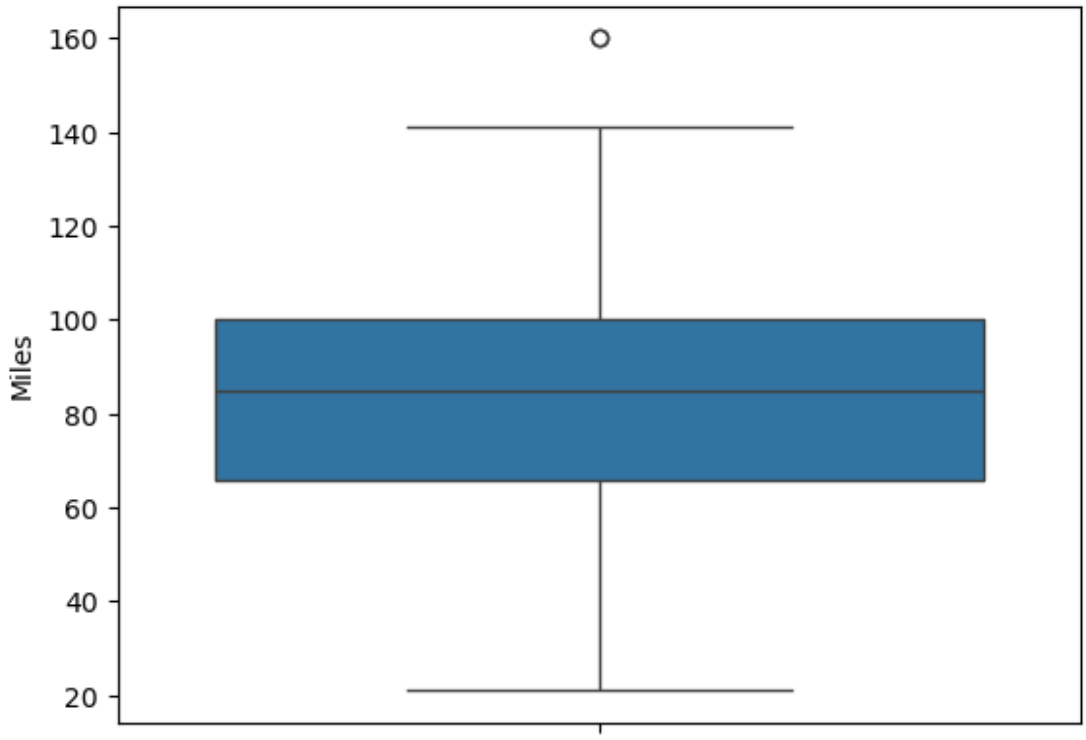



```
outliers_income = sns.boxplot(df['Miles'])
```



```
# Detecting Outliers by calculating the Inter Quartile Range of Miles
column.
Q1 = df['Miles'].quantile(0.25)
Q3 = df['Miles'].quantile(0.75)
IQR = Q3 - Q1
Lower = Q1 - 1.5*IQR
Upper = Q3 + 1.5*IQR

upper_array = df[df['Miles'] >= Upper].index
lower_array = df[df['Miles'] <= Lower].index

##Dropping the Outliers
df.drop(index = upper_array , inplace = True)
df.drop(index = lower_array , inplace = True)

sns.boxplot(df['Miles'])
```

```
<Axes: ylabel='Miles'>
```

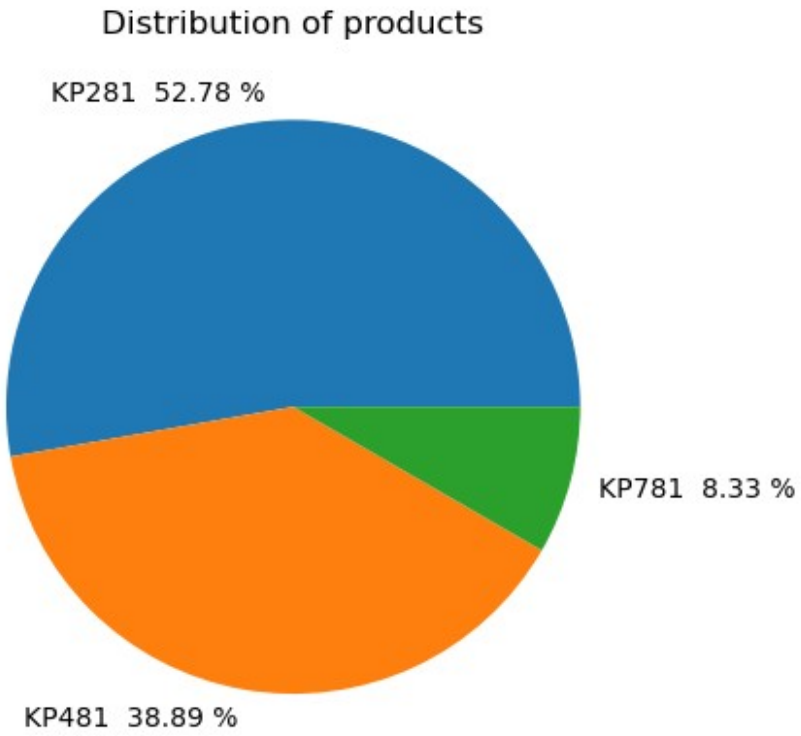


Distribution of Products in the data set.

```
KP281 = df[df['Product']=='KP281'].size

KP481 = df[df['Product']=='KP481'].size
```

```
KP781 = df[df['Product']=='KP781'].size


arr = [KP281,KP481,KP781]
l1 = 'KP281  ' + str(round((KP281/df.size),4)*100) + ' %'
l2 = 'KP481  ' + str(round((KP481/df.size),4)*100) + ' %'
l3 = 'KP781  ' + str(round((KP781/df.size),4)*100) + ' %'
mylabel = [l1,l2,l3]

plt.pie(arr,labels = mylabel)
plt.title('Distribution of products')
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```

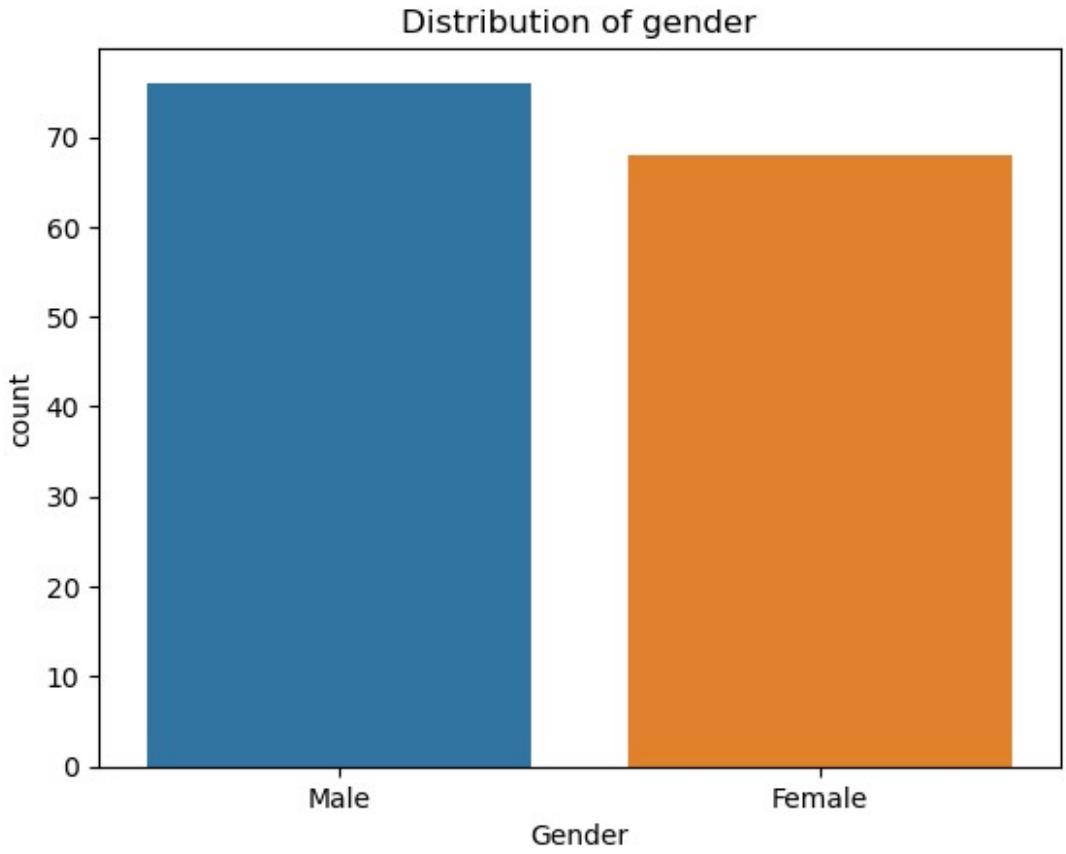


The overall distribution of product KP281 is most sold with sales of 52.78 % and then KP481 with 38.89 % and KP781 is the least sold product with a sales of 8.33%

Distribution of gender and maritial status

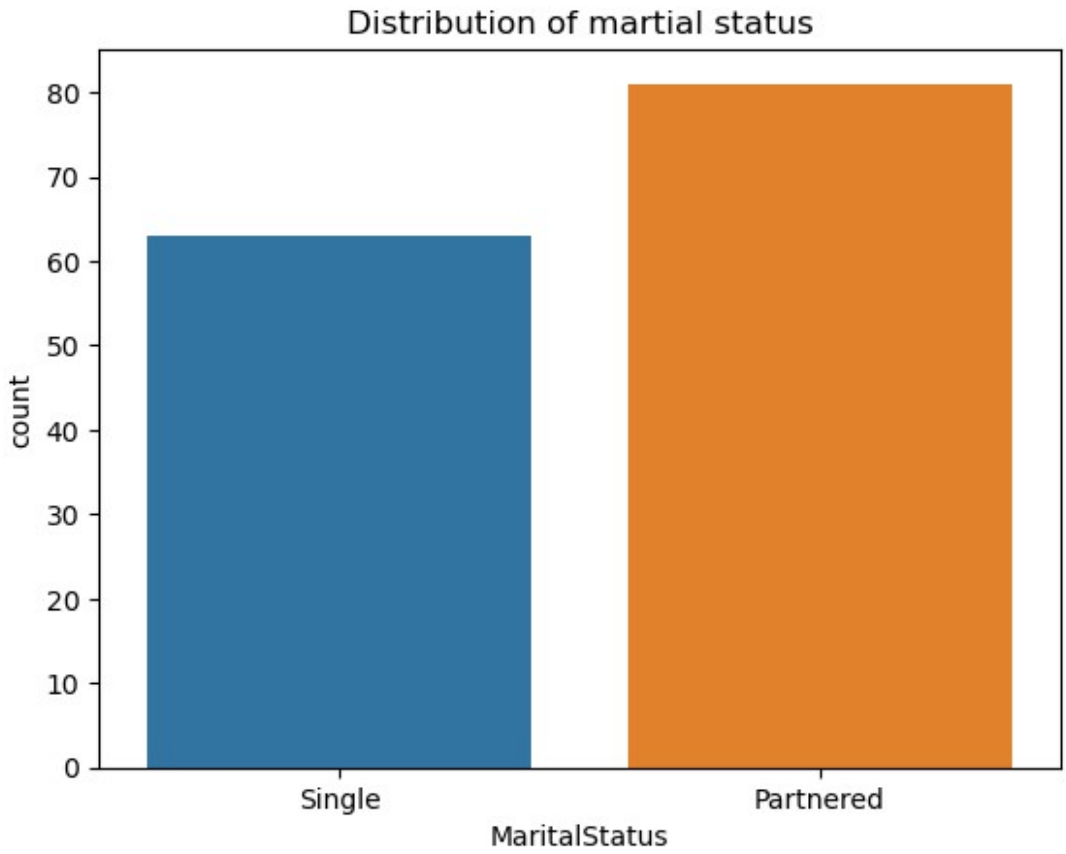
```
sns.countplot(x = 'Gender',data = df,hue = 'Gender')
plt.title('Distribution of gender')
```

```
Text(0.5, 1.0, 'Distribution of gender')
```



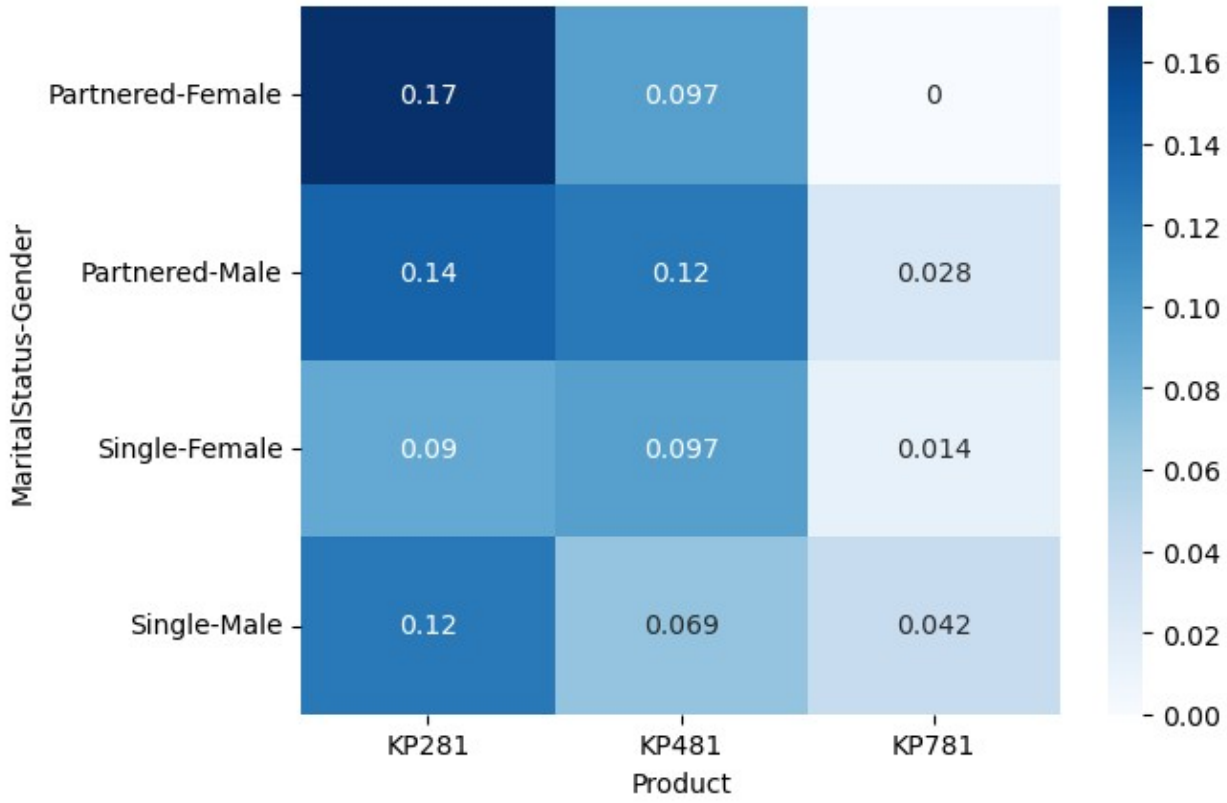

```
sns.countplot(x = 'MaritalStatus',data = df,hue = 'MaritalStatus')
plt.title('Distribution of martial status')
```

```
Text(0.5, 1.0, 'Distribution of martial status')
```

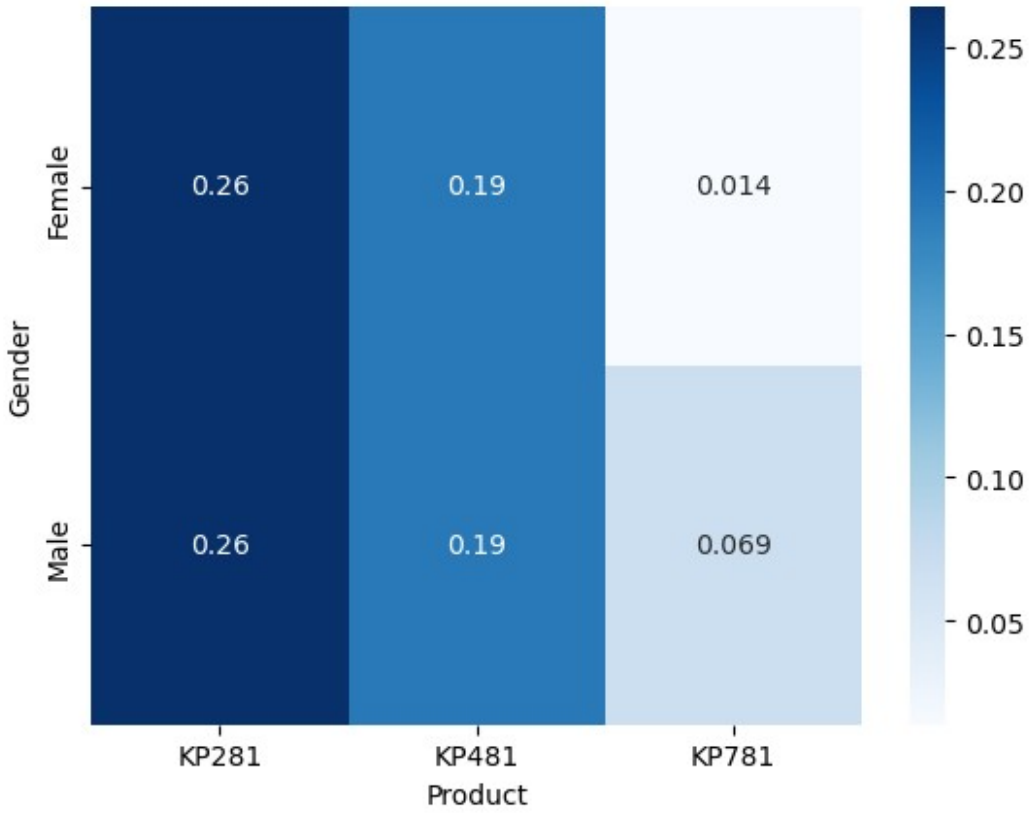



```
ctab = pd.crosstab([df.MaritalStatus,df.Gender],df.Product,normalize =
True).round(4)

sns.heatmap(ctab, cmap = 'Blues',annot=True)
#sns.countplot(data = df , x = 'Gender' , hue = 'MaritalStatus',
stacked = True)
```

```
<Axes: xlabel='Product', ylabel='MaritalStatus-Gender'>
```




```
ctab = pd.crosstab(df.Gender,df.Product,normalize = True).round(4)

sns.heatmap(ctab, cmap = 'Blues',annot=True)

<Axes: xlabel='Product', ylabel='Gender'>
```



Observations from analysing the data reveals that there are more Male Customers then female customers overall and for both gender types there are more married customers then their unmarried counterparts Except for product KP781 for which Single customers are more then their married counterparts.

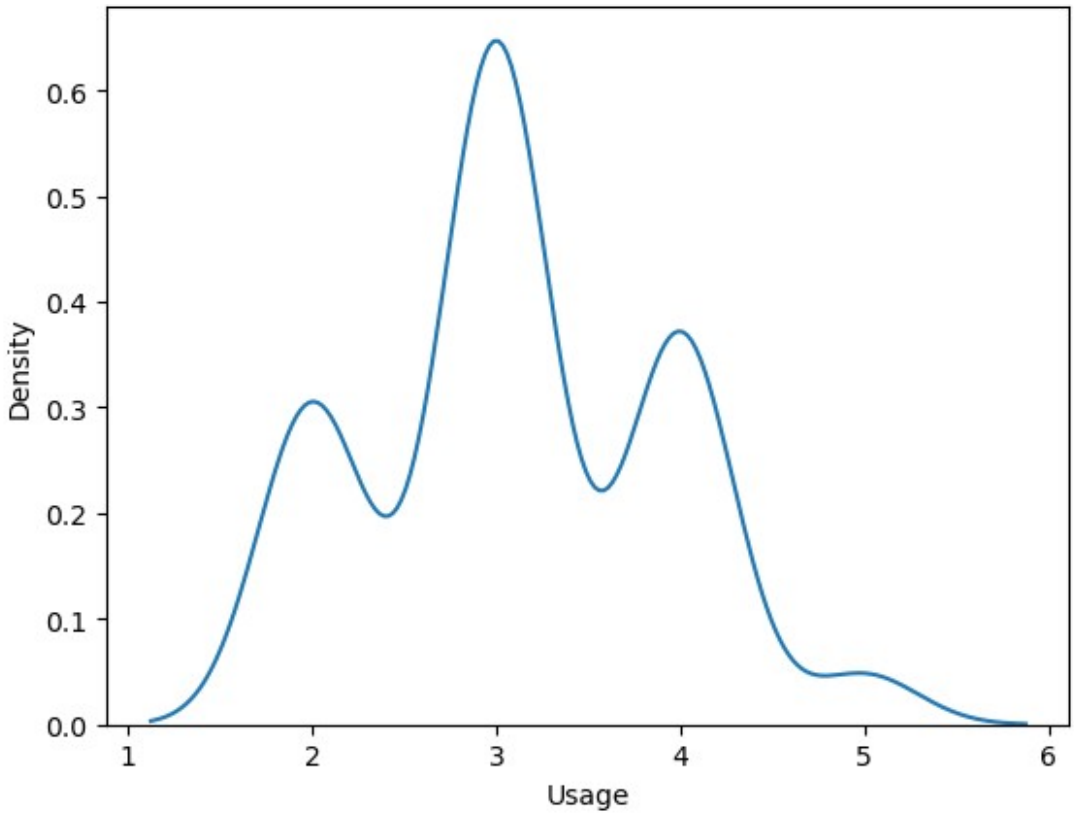
For Product KP281 there are more married Female then married male and for rest products(KP481,KP781) there are more married male customers then un married counterparts.

For Product KP281 and KP781 there are more unmarried Male then unmarried female

For Product KP481 there are more unmarried female then unmarried male

```
sns.kdeplot(data = df , x = 'Usage')
```

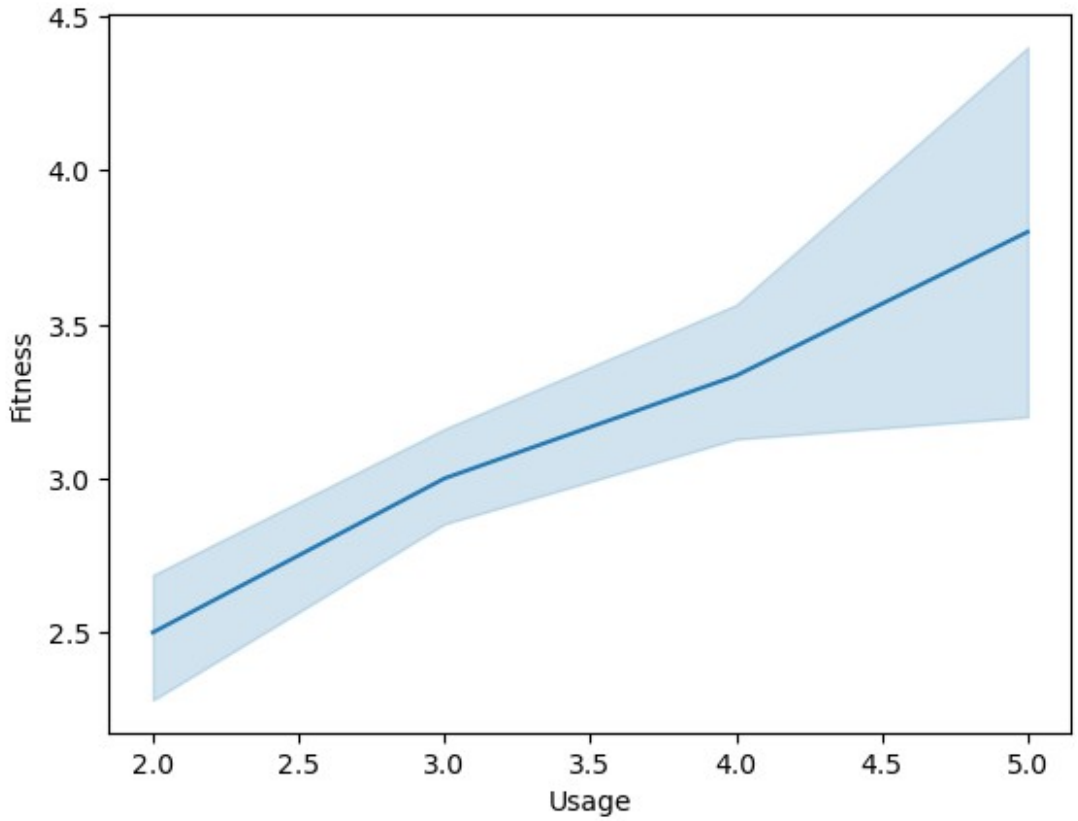
```
<Axes: xlabel='Usage', ylabel='Density'>
```



Relation ship between Fitness and Usage

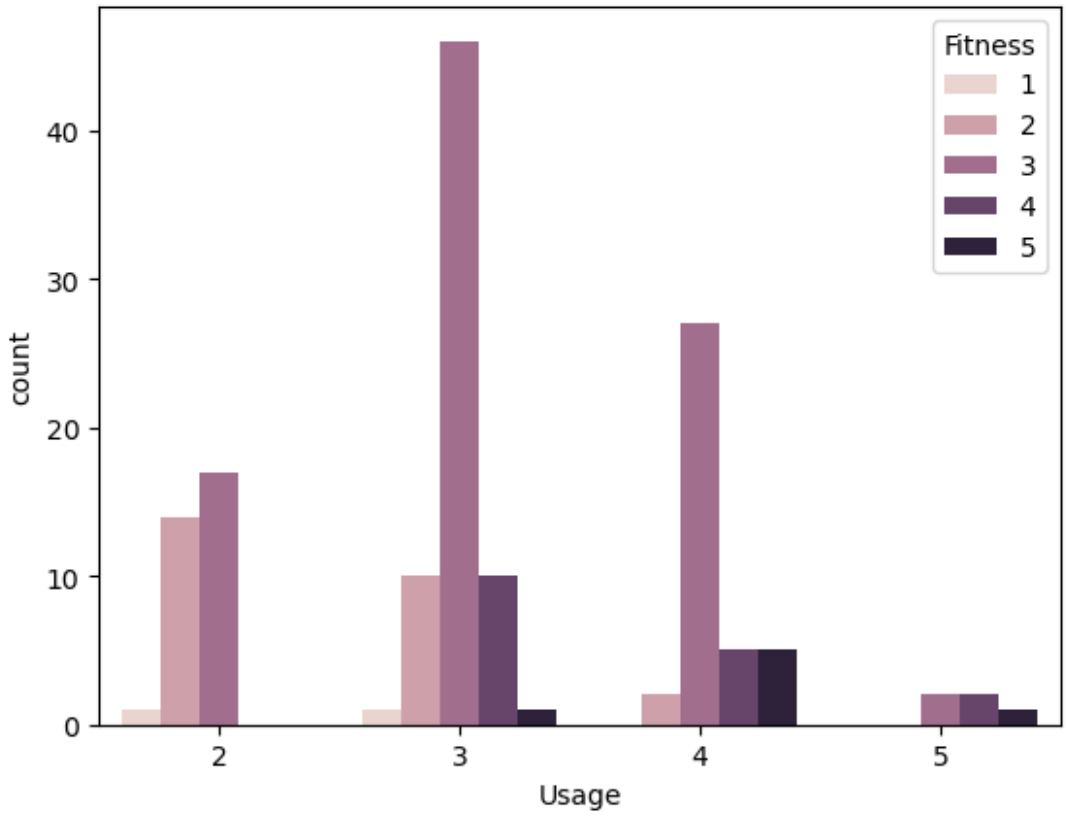
```
sns.lineplot(data = df , x  = 'Usage', y = 'Fitness')
```

```
<Axes: xlabel='Usage', ylabel='Fitness'>
```




```
sns.countplot(data = df , x = 'Usage', hue='Fitness')
```

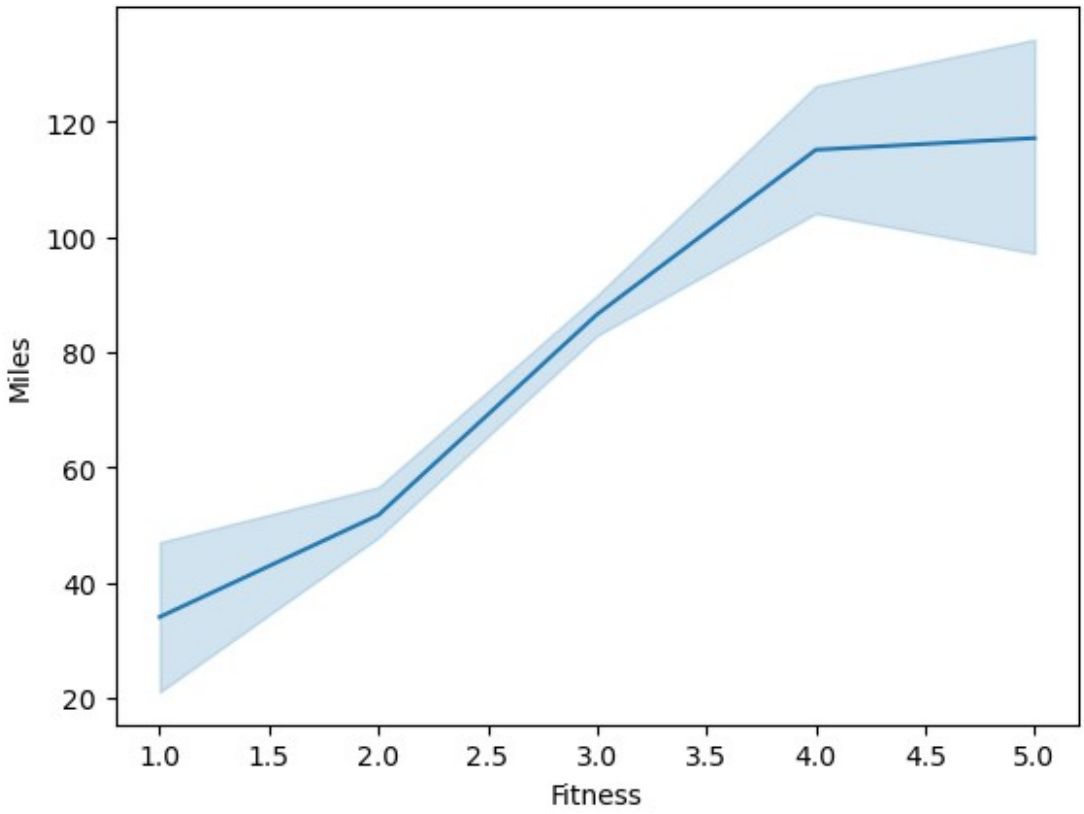
```
<Axes: xlabel='Usage', ylabel='count'>
```



From the above observation we can see that Usage is directly proposnal to the Fitness, Hence people who use more have higher level of fitness

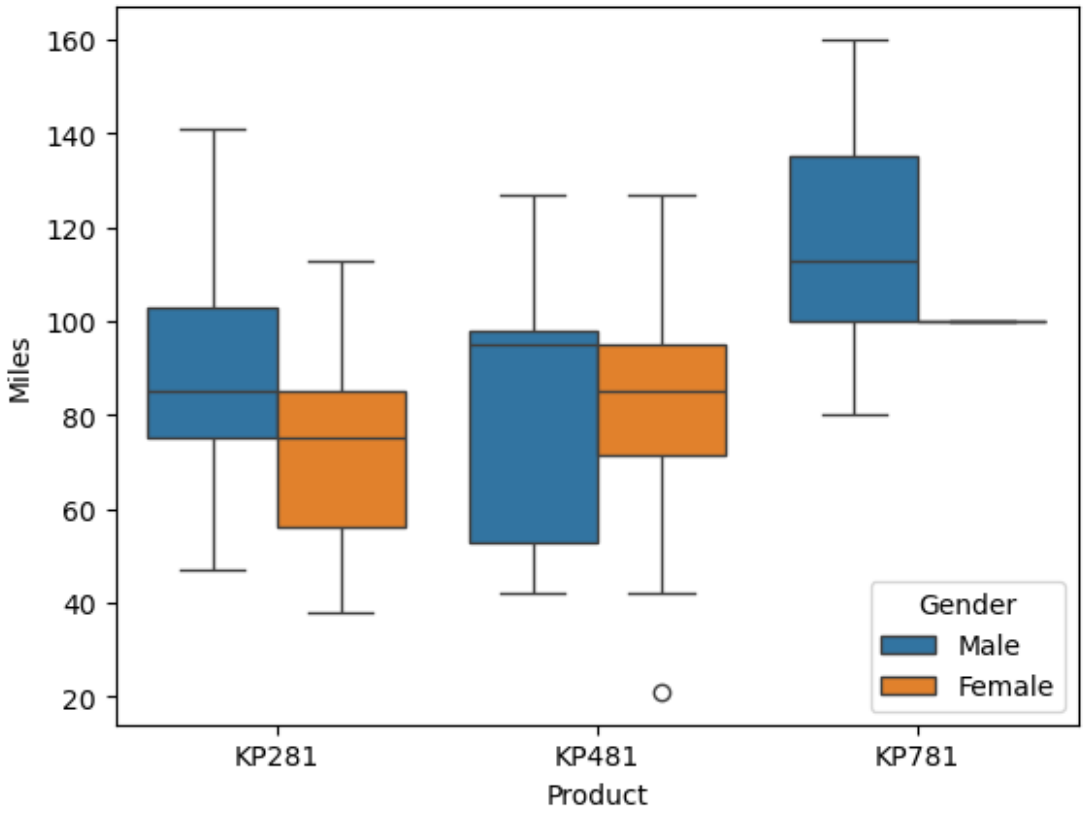
```
sns.lineplot(data = df , x  = 'Fitness', y = 'Miles')
```

```
<Axes: xlabel='Fitness', ylabel='Miles'>
```



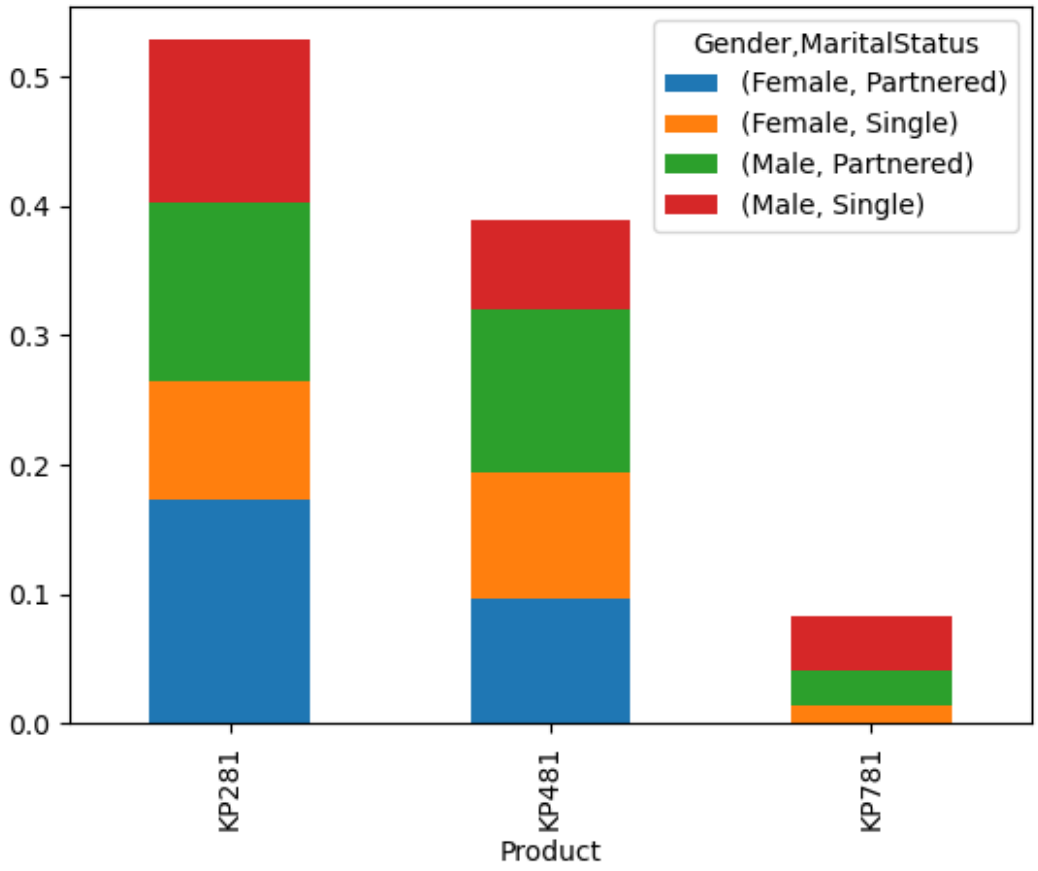

```
sns.boxplot(data = df , x = 'Product' , y = 'Miles' , hue = 'Gender')
```

```
<Axes: xlabel='Product', ylabel='Miles'>
```




```
ctab = pd.crosstab(df.Product,
[df.Gender,df.MaritalStatus],values=df.Usage,aggfunc='count',normalize
= True).round(4)
ctab.plot(kind = 'bar',stacked=True)
```

```
<Axes: xlabel='Product'>
```




```
ctab
```

Gender	Female		Male	
MaritalStatus	Partnered	Single	Partnered	Single
Product				
KP281	0.1736	0.0903	0.1389	0.1250
KP481	0.0972	0.0972	0.1250	0.0694
KP781	0.0000	0.0139	0.0278	0.0417

From the observation we can see that Fitness is directly proposnal to the Usage. Hence people with more usage are generally more fit.

We also observed that people with high fitness has more miles as well.

When we compared product,miles and Gender we found out that generally more miles are covered on KP781 And on an average in all products males have more miles then females.

But since no of people used KP781 is the least and it has the most miles, it may suggest that athelets use this product more for training, then normal people do for daily fitness.

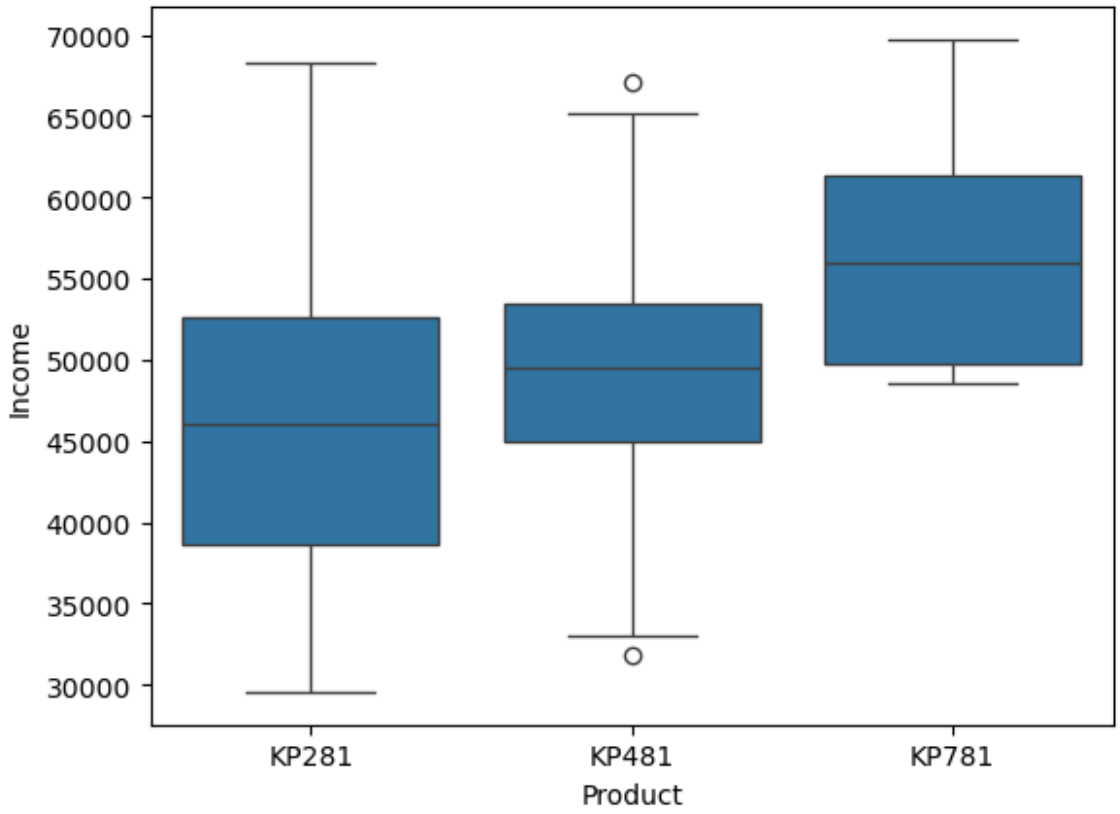
When we analysed the Usage with Product,gender and maritalstatus, it shows that KP281 is the most used product followed by KP481 and KP781.

we can also see from the above chart that for product KP481 and KP281 is used mostly by Married Males and Married Females, whereas for product KP781 there are more Unmarried and Married male users then their female counterparts.

We can conclude from the above analysis that people with more fitness generally use the product more and these kind of people prefer product KP781.

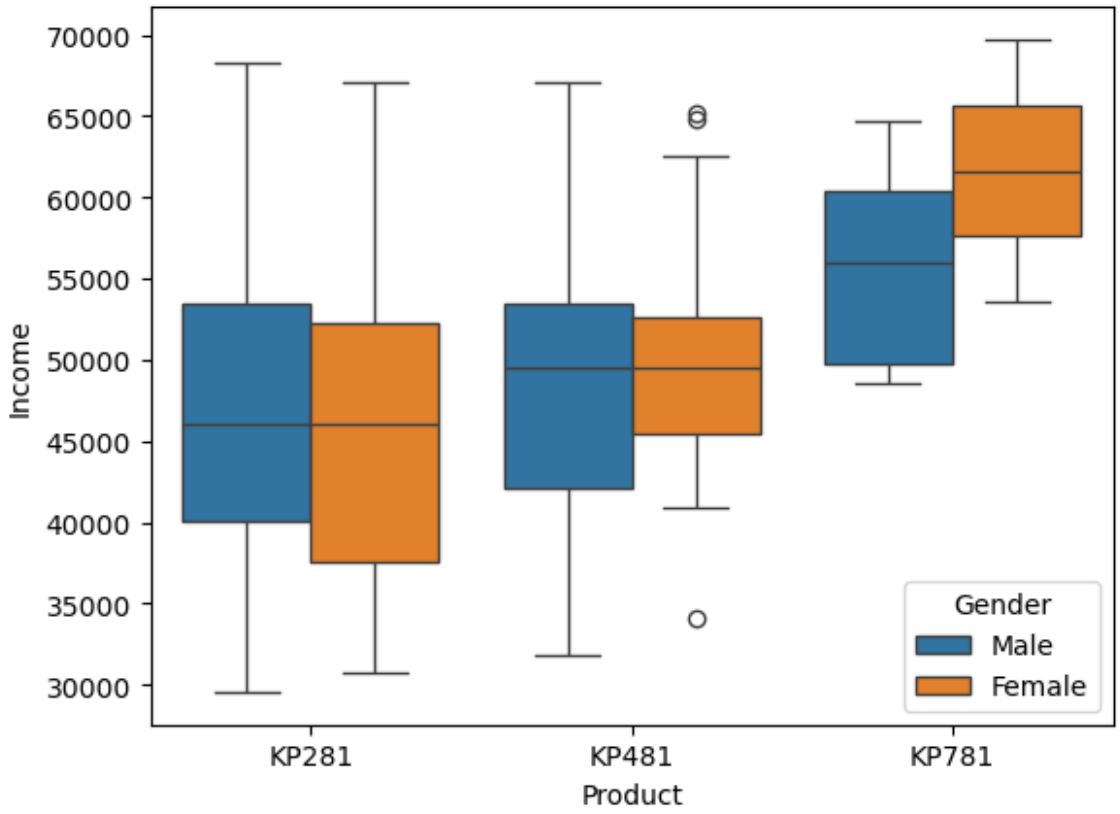
```
sns.boxplot(data = df , x= 'Product' , y = 'Income')
```

```
<Axes: xlabel='Product', ylabel='Income'>
```



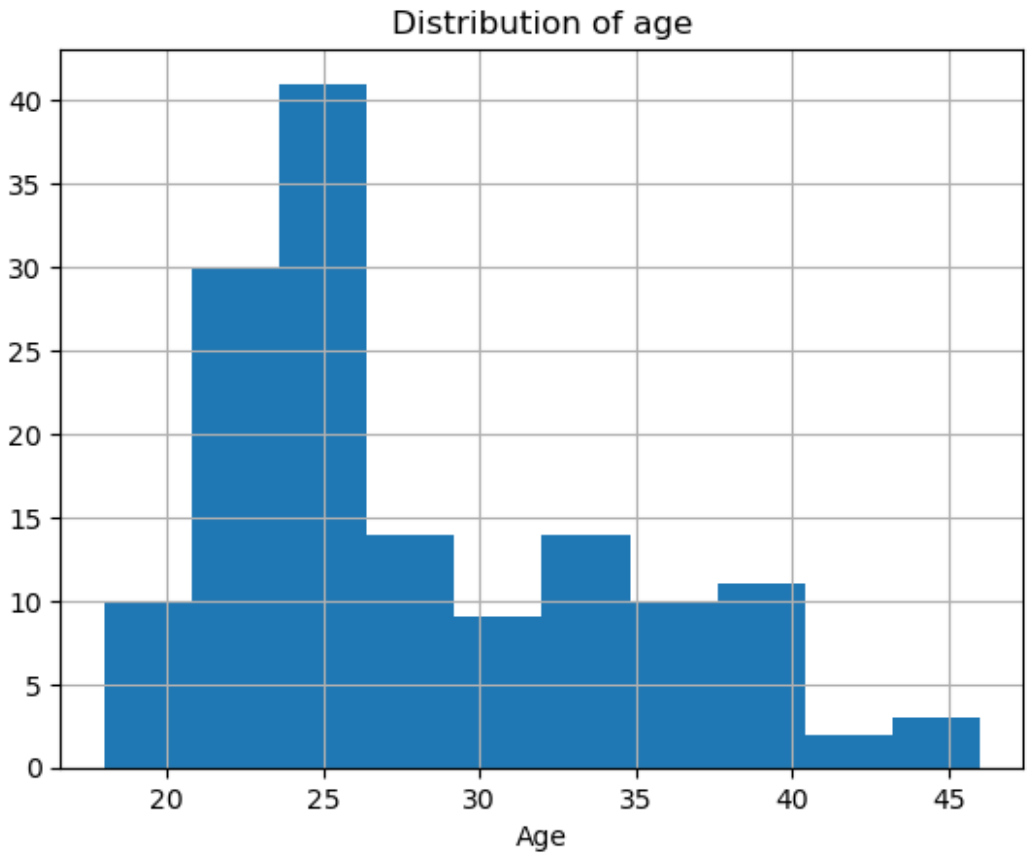

```
sns.boxplot(data = df , x= 'Product' , y = 'Income' , hue = 'Gender')
```

```
<Axes: xlabel='Product', ylabel='Income'>
```



From the above observation we can see that people with higher incomes mostly prefer product KP781 and people with average income prefer KP481 or KP281, but people with low income compared to others prefer KP281. Which also tells us that KP281 is most Budget friendly.

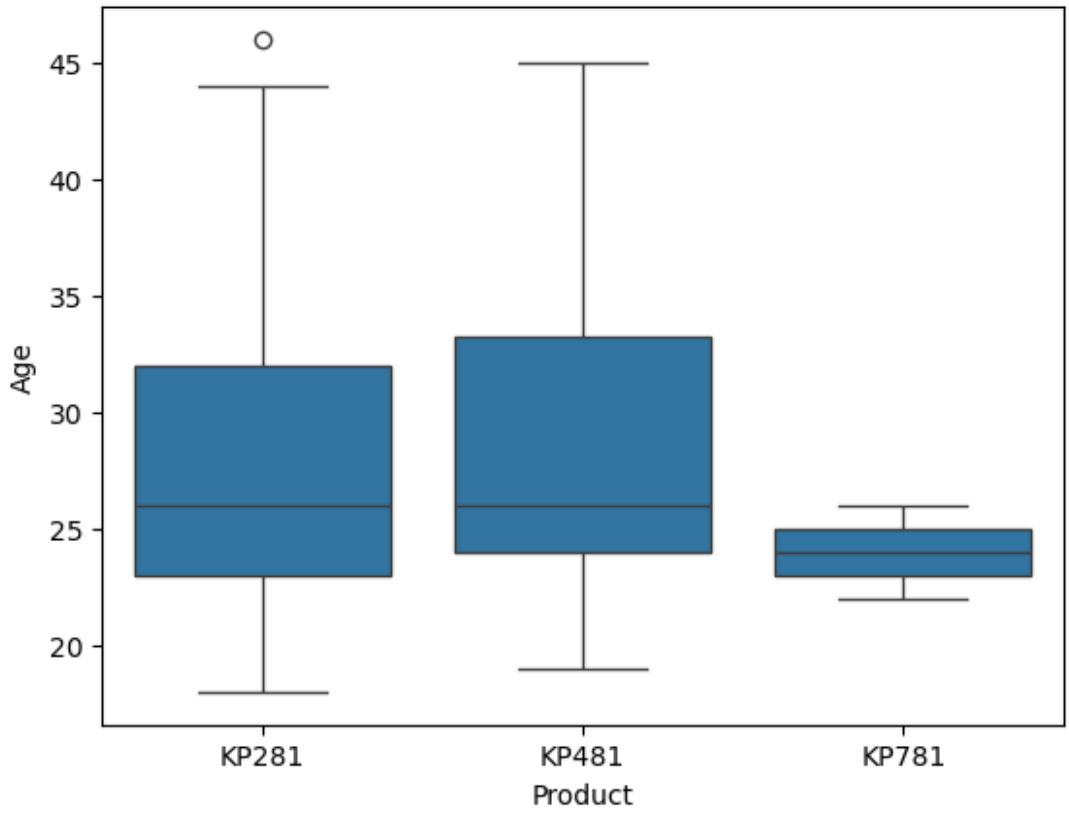
```
df.hist('Age')
plt.title('Distribution of age')
plt.xlabel('Age')

Text(0.5, 0, 'Age')
```



The above distribution shows that customers aging between range of 20 and 30 tend to buy the product more.

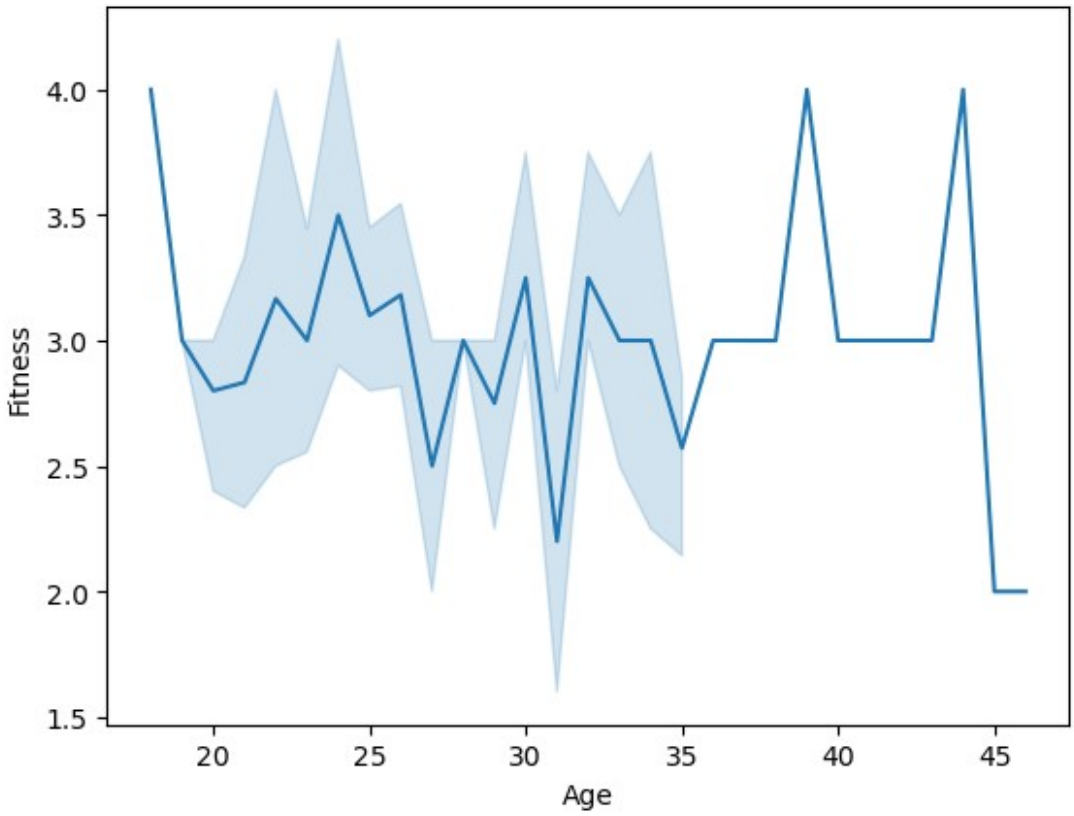
```
sns.boxplot(data = df , x = 'Product' , y = 'Age')
```

```
<Axes: xlabel='Product', ylabel='Age'>
```



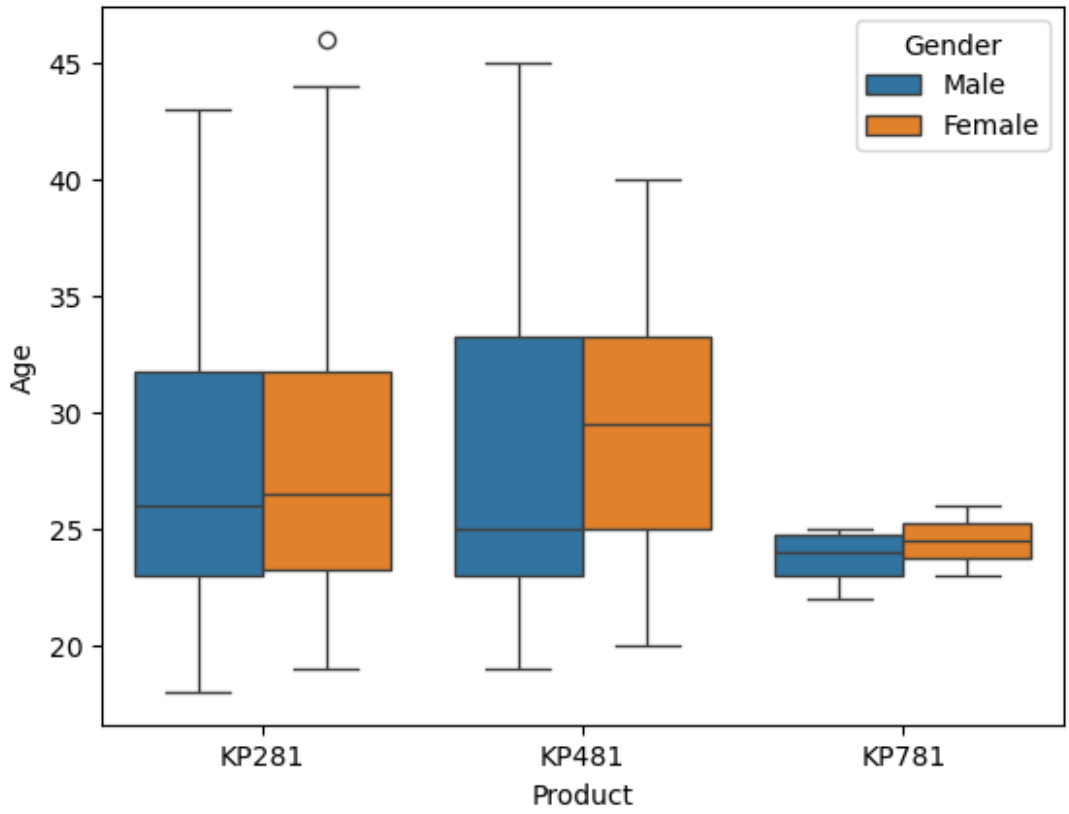

```
sns.lineplot(data = df , x = 'Age',y = 'Fitness')
```

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



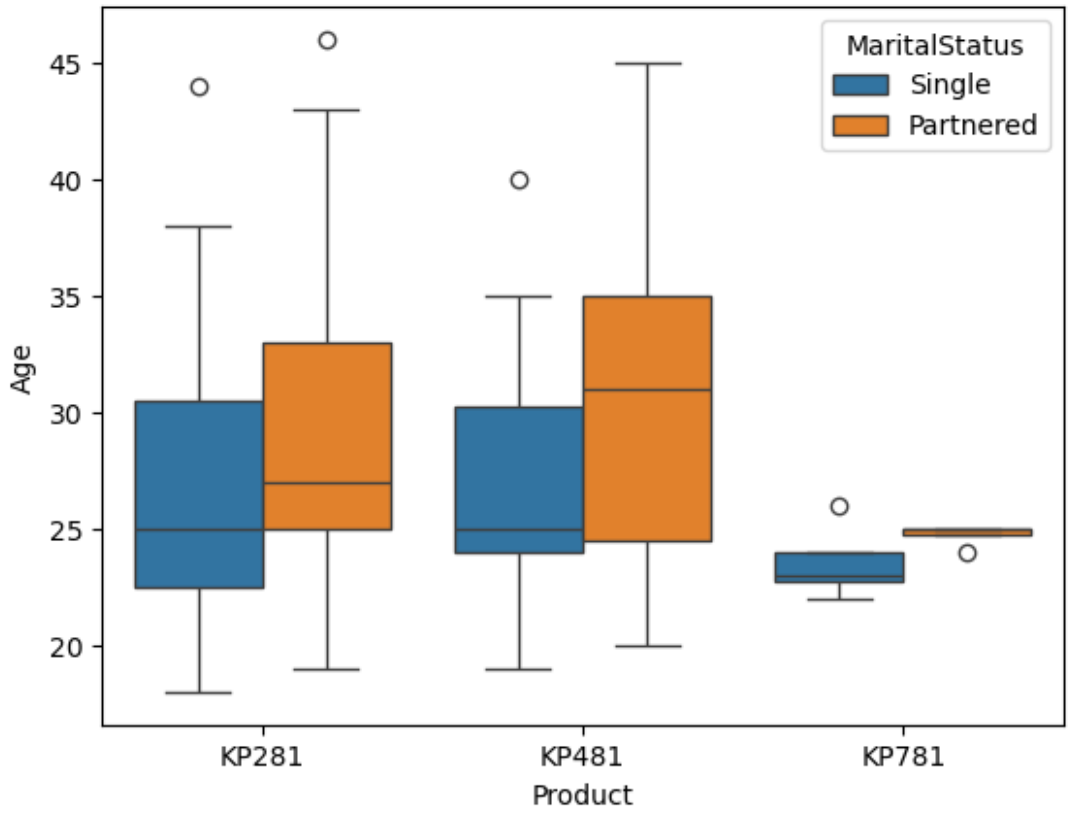

```
sns.boxplot(data = df , x = 'Product' , y = 'Age',hue = 'Gender')
```

```
<Axes: xlabel='Product', ylabel='Age'>
```




```
sns.boxplot(data = df , x = 'Product' , y = 'Age',hue =
'MaritalStatus')
```

```
<Axes: xlabel='Product', ylabel='Age'>
```



From the above observation we can conclude that product KP781 is only bought by small segment of young people upto the age between 22 to 27.

Product KP481 and KP281 is prefferd by people with all types of ages ranging from below 20 years to above 35 years.

KP481 and KP281 are preffered by married individuals.

Segmenting the products for product wise analysis.

```
KP281 = df[df['Product']=='KP281']

KP481 = df[df['Product']=='KP481']

KP781 = df[df['Product']=='KP781']
```

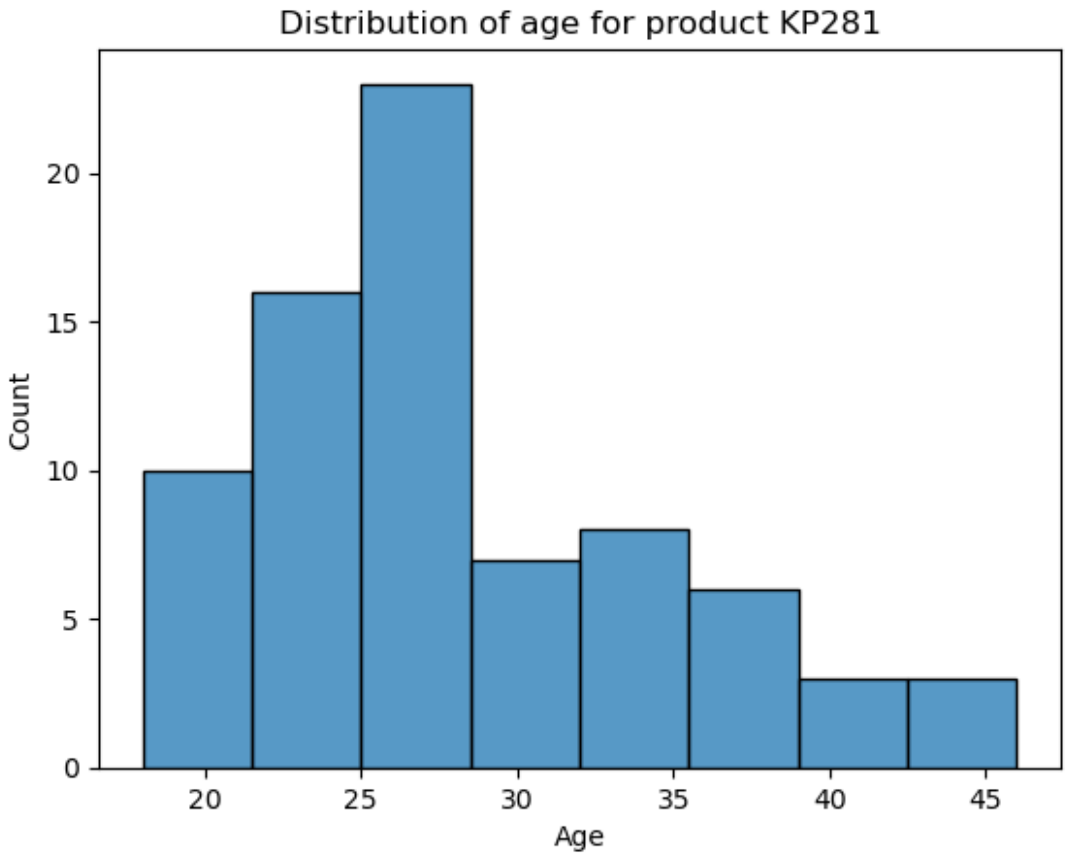
KP281 Analysis

```
KP281.describe()
```

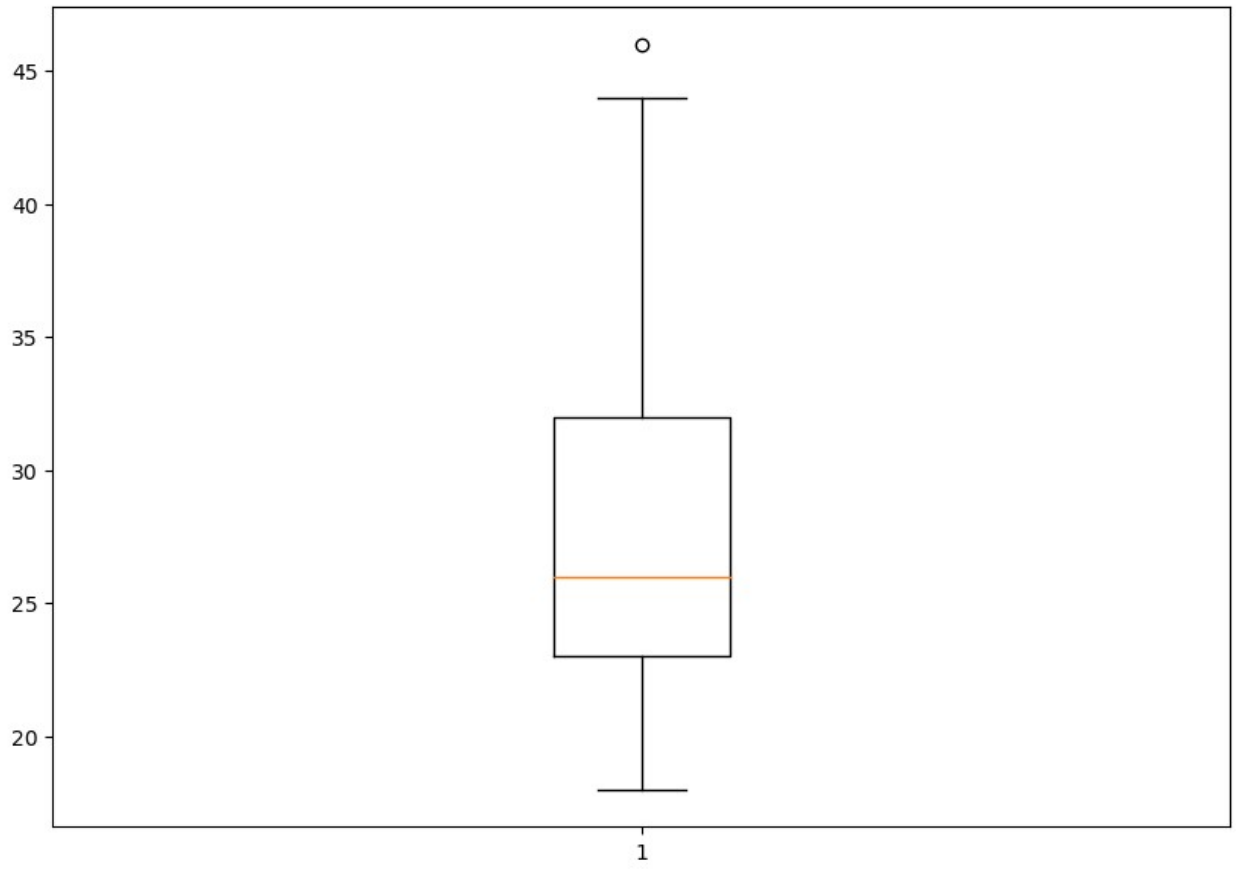
```
              Age  Education      Usage    Fitness        Income
Miles
count  76.000000  76.000000  76.000000  76.000000     76.000000
76.000000
mean   28.013158  14.986842   3.039474   2.907895  46003.618421
80.342105
std     6.579754   1.227392   0.756144   0.592793   8959.369131
24.899560
min    18.000000  12.000000   2.000000   1.000000  29562.000000
38.000000
25%    23.000000  14.000000   2.750000   3.000000  38658.000000
66.000000
50%    26.000000  15.000000   3.000000   3.000000  46048.500000
85.000000
75%    32.000000  16.000000   4.000000   3.000000  52586.250000
94.000000
max    46.000000  18.000000   5.000000   4.000000  68220.000000
141.000000
```

```
# Age Distribution for the Product KP281
sns.histplot(data = KP281 , x = 'Age')
plt.xlabel('Age')
plt.title('Distribution of age for product KP281')
```

```
Text(0.5, 1.0, 'Distribution of age for product KP281')
```

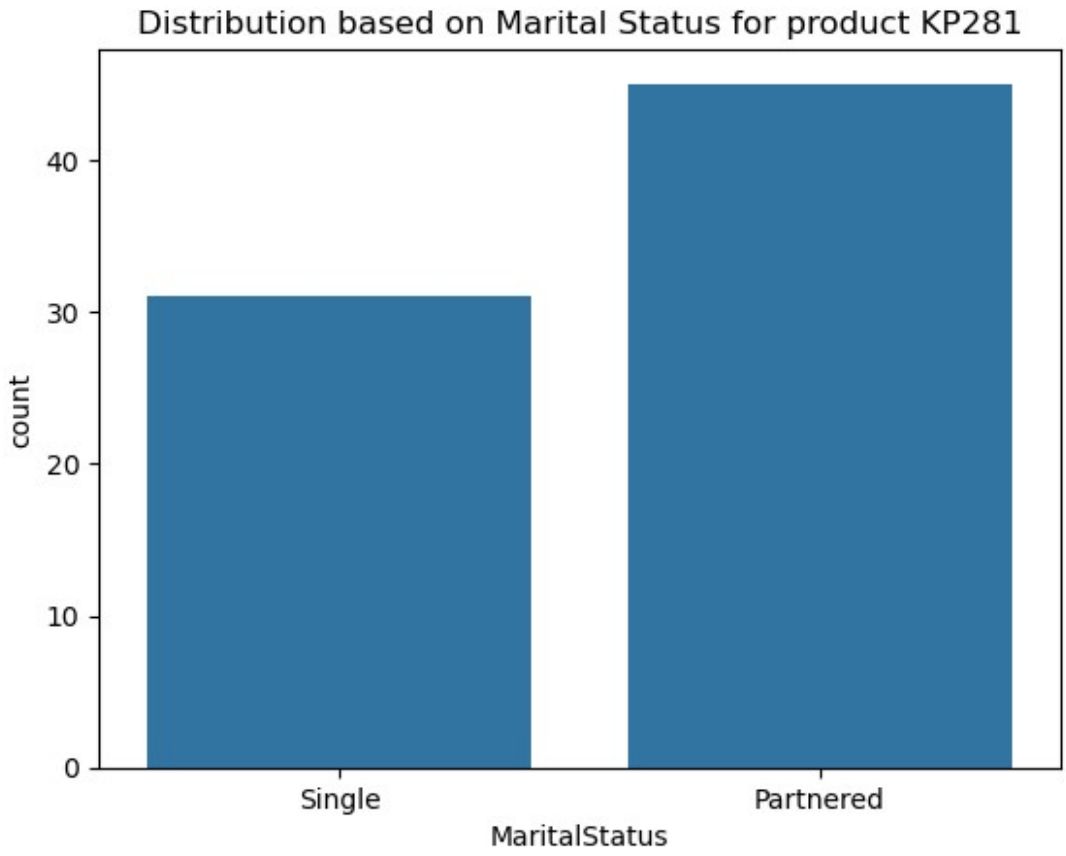



```
fig = plt.figure(figsize=(10,7))
plt.boxplot(KP281['Age'])
plt.show()
```

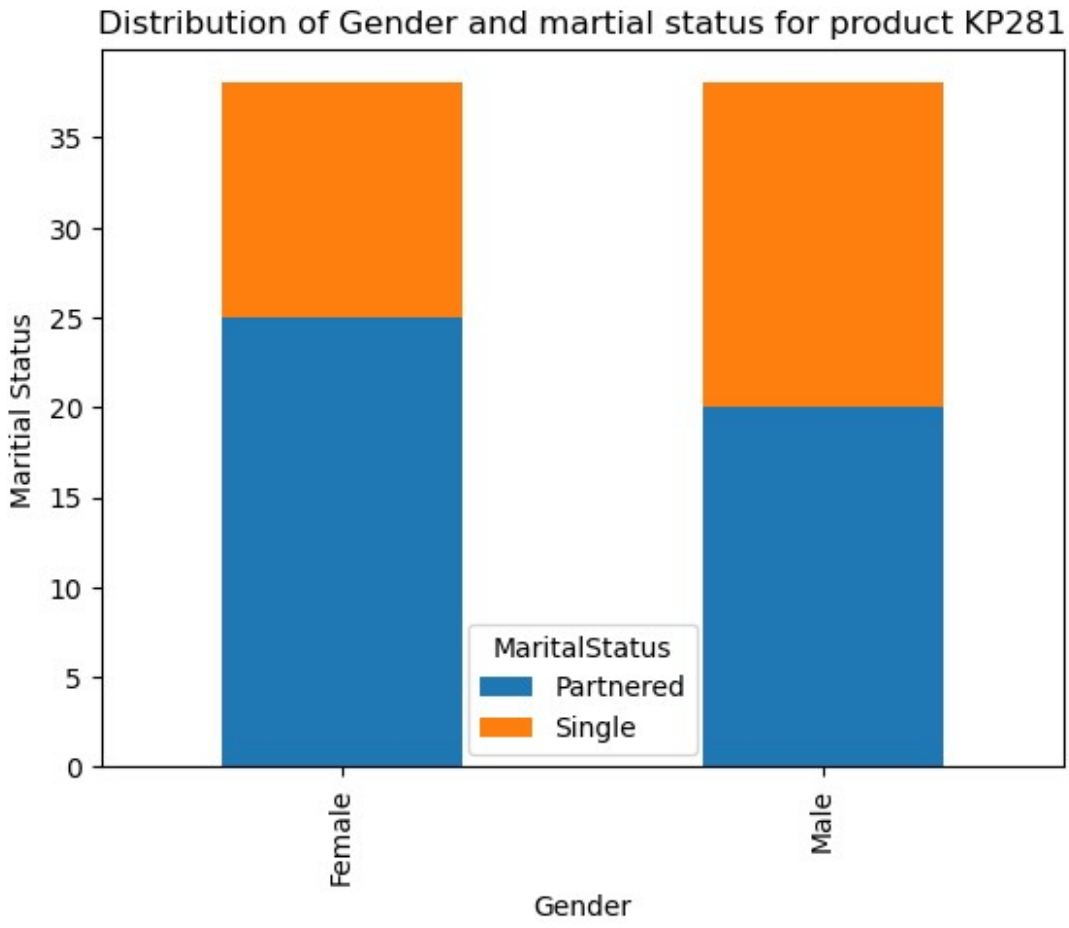



```
sns.countplot(x = 'MaritalStatus',data = KP281)
plt.title('Distribution based on Marital Status for product KP281')
```

```
Text(0.5, 1.0, 'Distribution based on Marital Status for product
KP281')
```

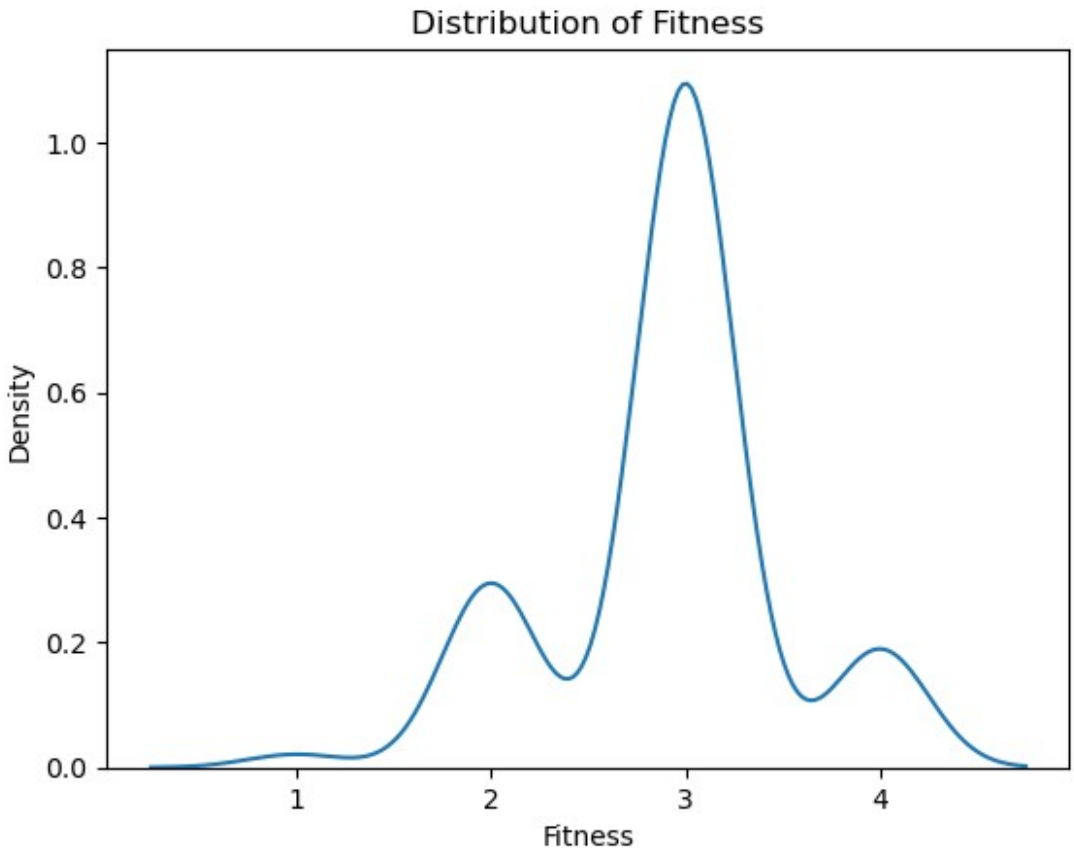



```
ctab = pd.crosstab(KP281.Gender,KP281.MaritalStatus,values =
KP281.Product,aggfunc = 'count').round(0)
ctab.plot(kind = 'bar',stacked = True)
plt.xlabel('Gender')
plt.ylabel('Maritial Status')
plt.title('Distribution of Gender and martial status for product
KP281')
plt.show()
```

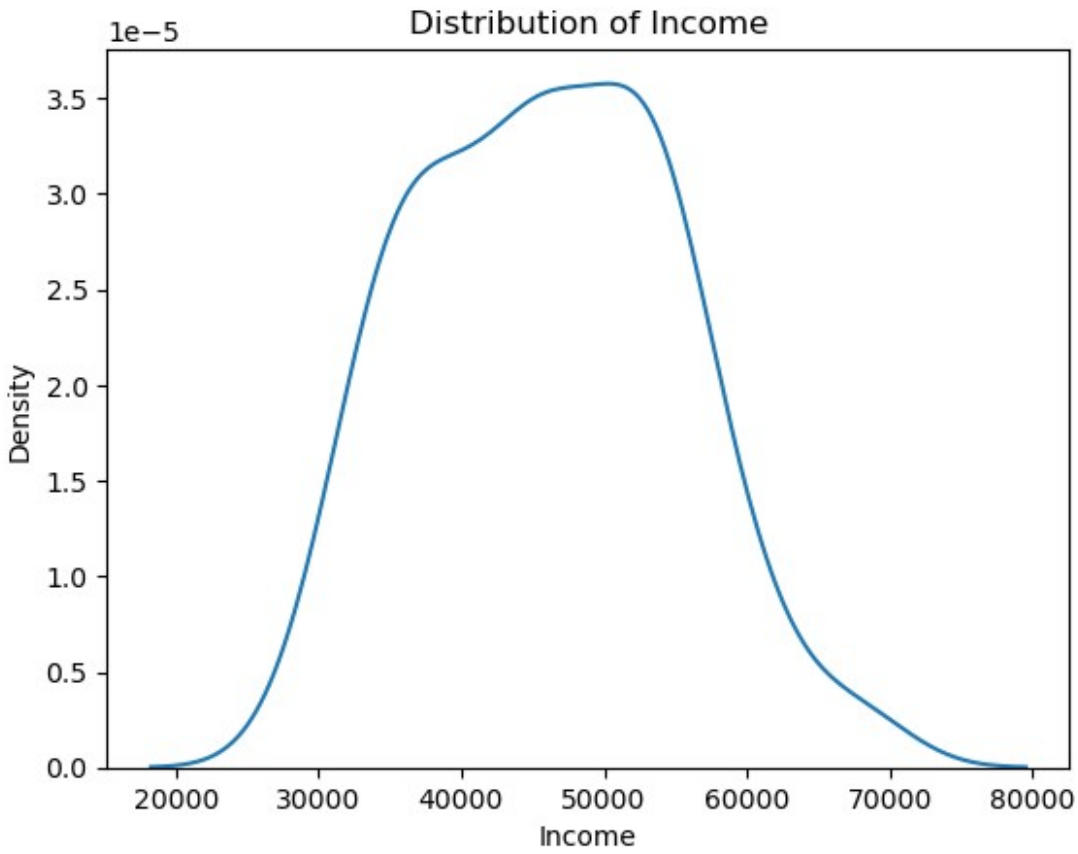



```
#nuniqe(KP281)
sns.kdeplot(data = KP281 , x = 'Fitness')
plt.title('Distribution of Fitness')
```

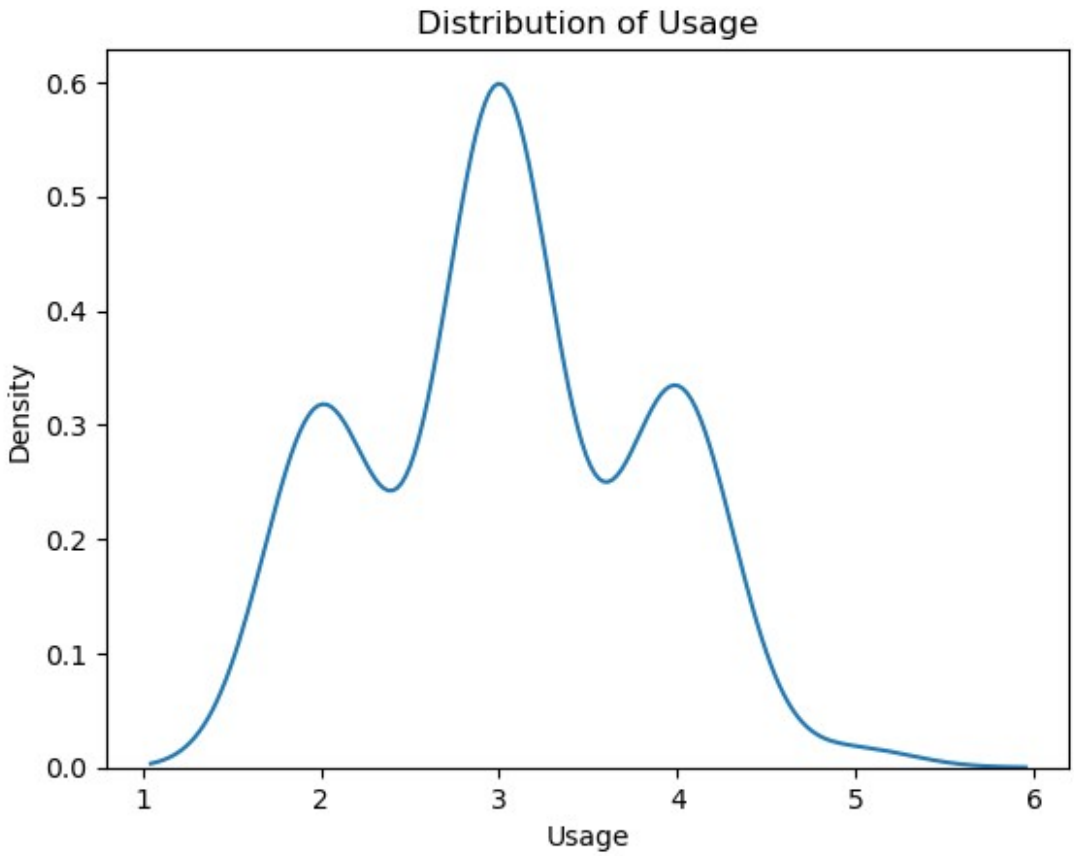
```
Text(0.5, 1.0, 'Distribution of Fitness')
```




```
sns.kdeplot(data = KP281 , x = 'Income')
plt.title('Distribution of Income')

Text(0.5, 1.0, 'Distribution of Income')
```

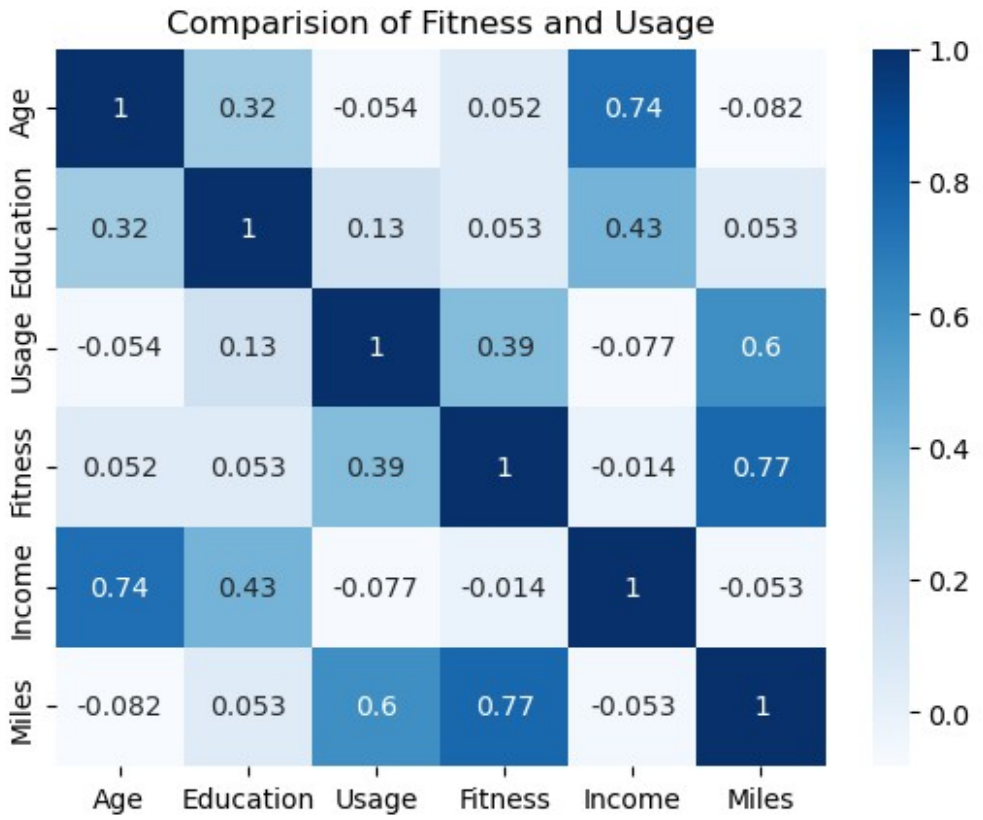



```
sns.kdeplot(data = KP281 , x = 'Usage')
plt.title('Distribution of Usage')

Text(0.5, 1.0, 'Distribution of Usage')
```




```
sns.heatmap(KP281.select_dtypes('number').corr(), cmap =
'Blues',annot=True)
plt.title('Comparision of Fitness and Usage')
```

```
Text(0.5, 1.0, 'Comparision of Fitness and Usage')
```



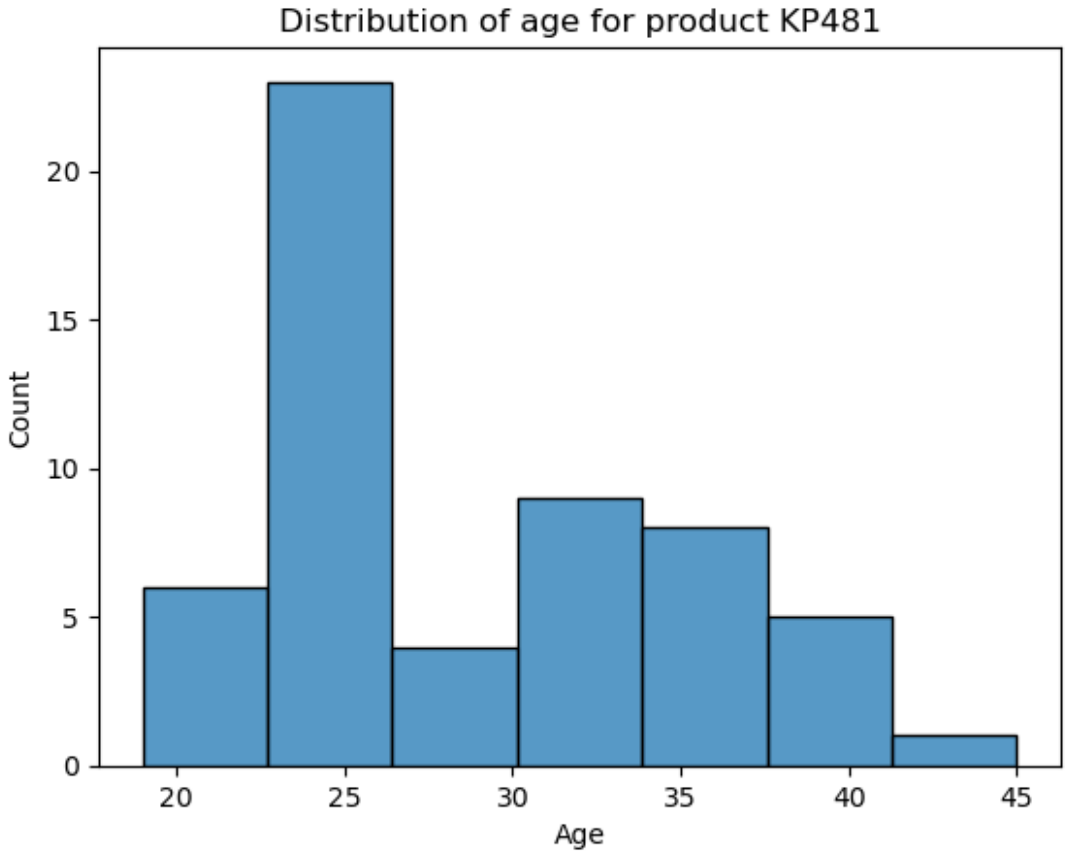
KP481 Analysis

```
KP481.describe()
```

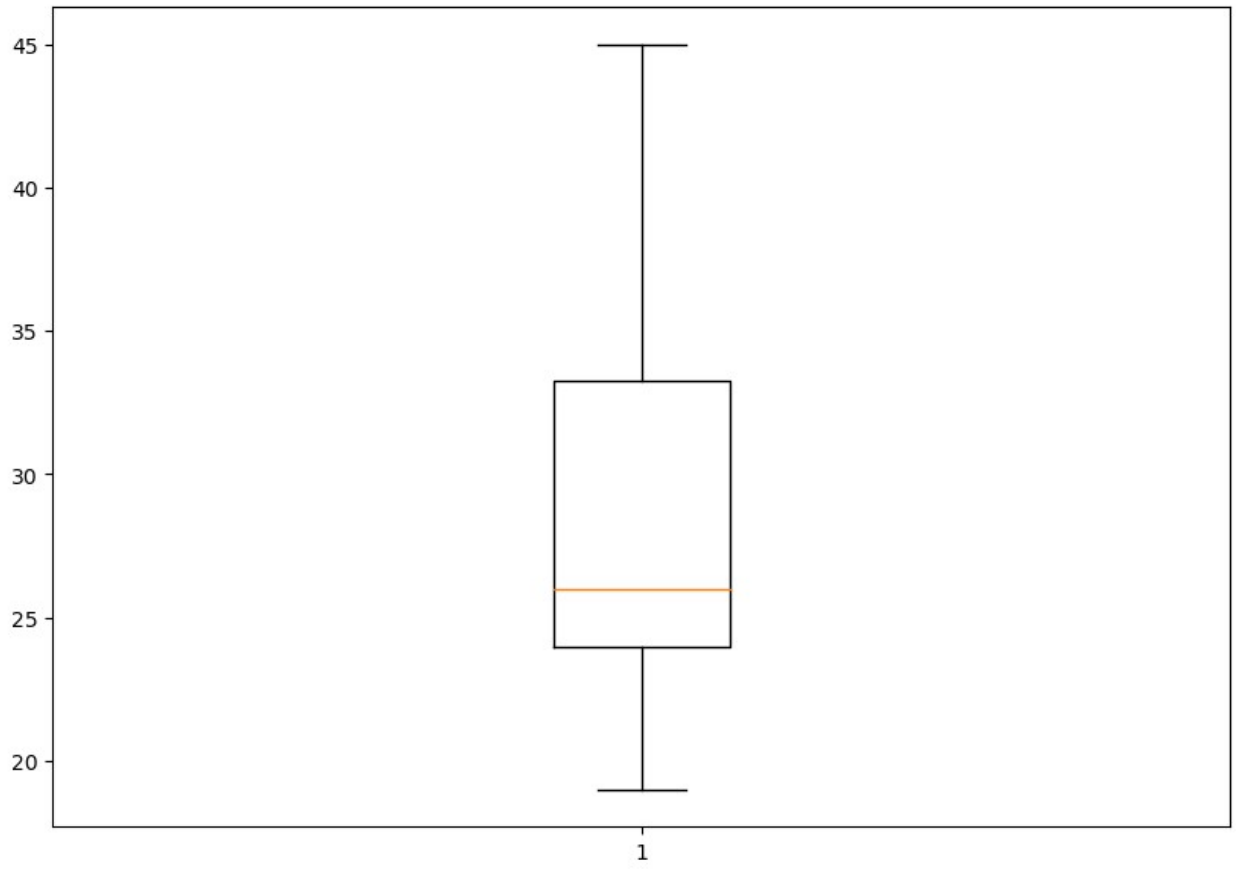
	Age	Education	Usage	Fitness	Income	Miles
count	56.000000	56.000000	56.000000	56.000000	56.000000	56.000000
mean	28.696429	15.178571	3.017857	2.857143	49060.767857	83.214286
std	6.243308	1.207660	0.750541	0.615809	8616.962008	25.080753
min	19.000000	12.000000	2.000000	1.000000	31836.000000	21.000000
25%	24.000000	14.000000	3.000000	3.000000	44911.500000	64.000000
50%	26.000000	16.000000	3.000000	3.000000	49459.500000	85.000000
75%	33.250000	16.000000	3.000000	3.000000	53439.000000	95.000000
max	45.000000	18.000000	5.000000	4.000000	67083.000000	127.000000

```
# Age Distribution for the Product KP481
sns.histplot(data = KP481 , x = 'Age')
plt.xlabel('Age')
plt.title('Distribution of age for product KP481')
```

```
Text(0.5, 1.0, 'Distribution of age for product KP481')
```

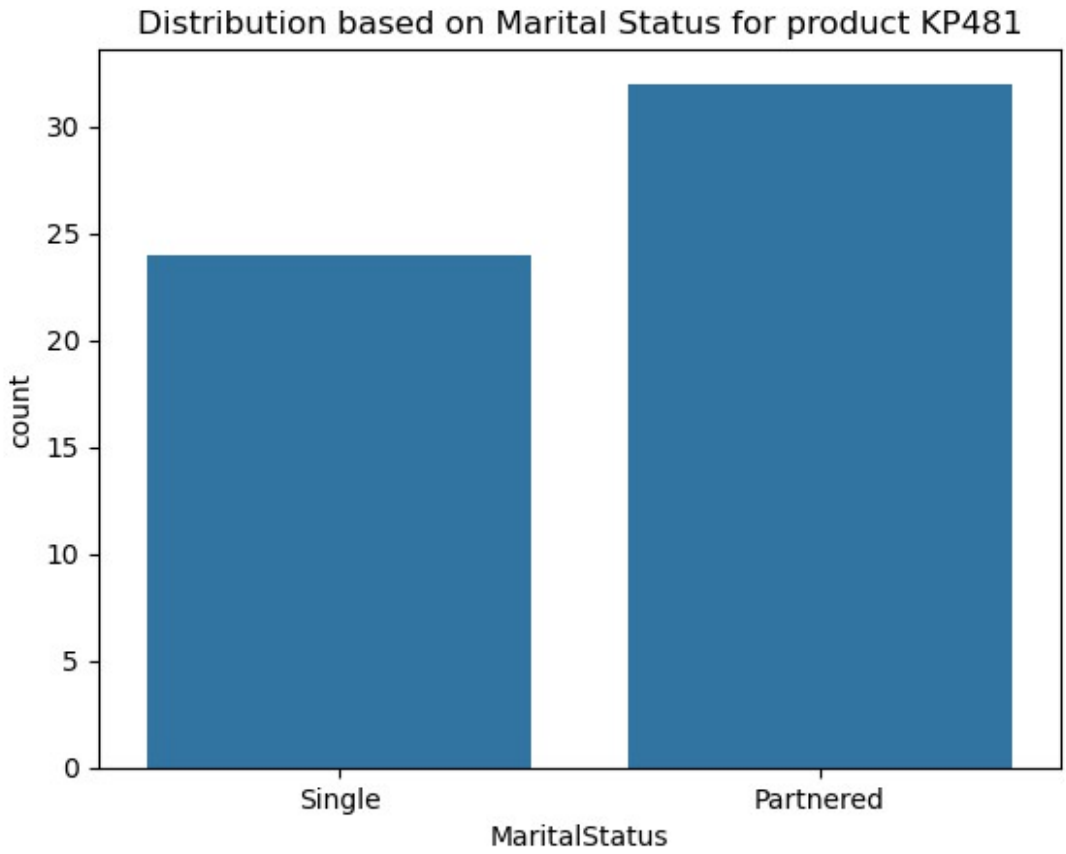



```
fig = plt.figure(figsize=(10,7))
plt.boxplot(KP481['Age'])
plt.show()
```

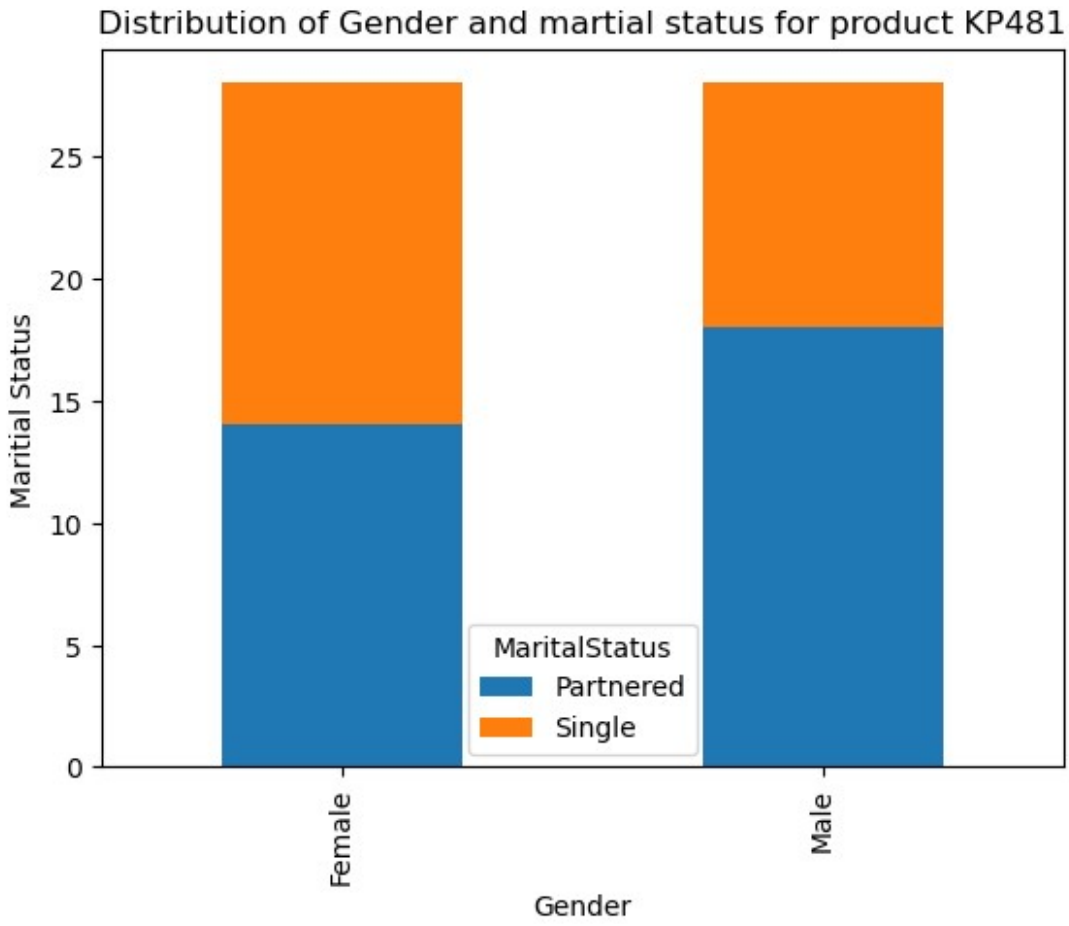



```
sns.countplot(x = 'MaritalStatus',data = KP481)
plt.title('Distribution based on Marital Status for product KP481')
```

```
Text(0.5, 1.0, 'Distribution based on Marital Status for product
KP481')
```

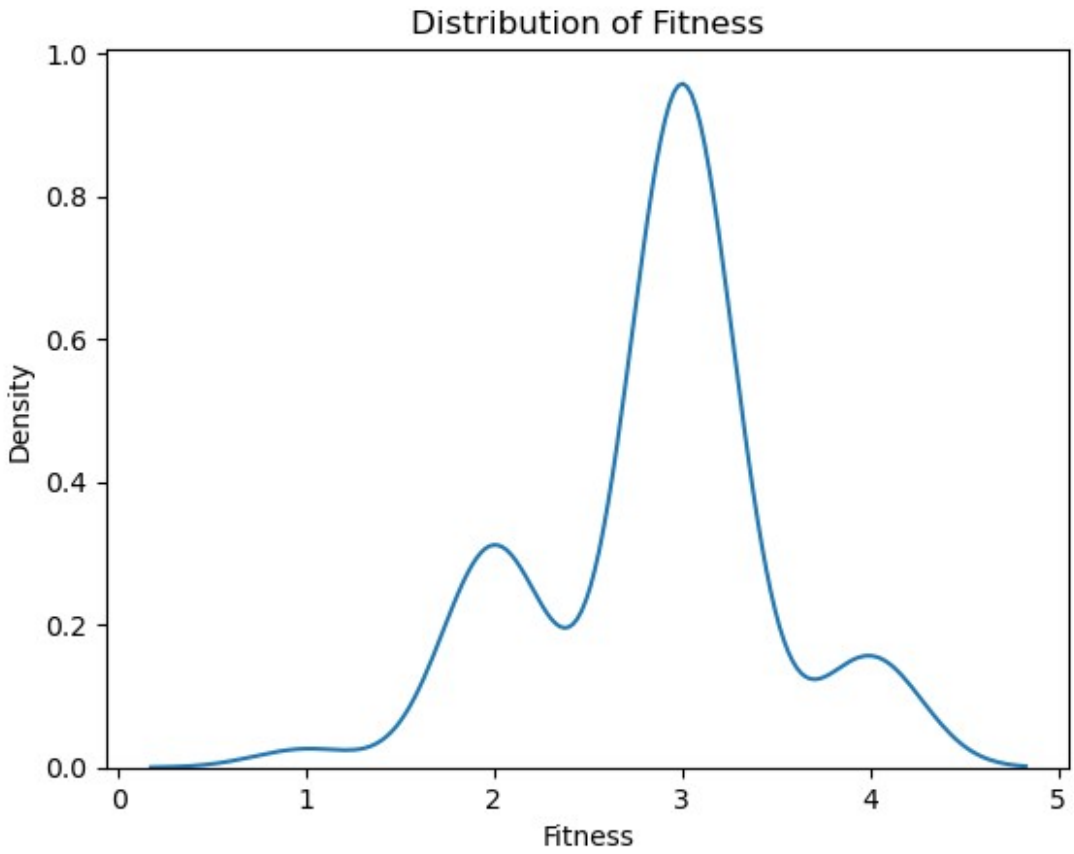



```
ctab = pd.crosstab(KP481.Gender,KP481.MaritalStatus,values =
KP481.Product,aggfunc = 'count').round(0)
ctab.plot(kind = 'bar',stacked = True)
plt.xlabel('Gender')
plt.ylabel('Maritial Status')
plt.title('Distribution of Gender and martial status for product
KP481')
plt.show()
```

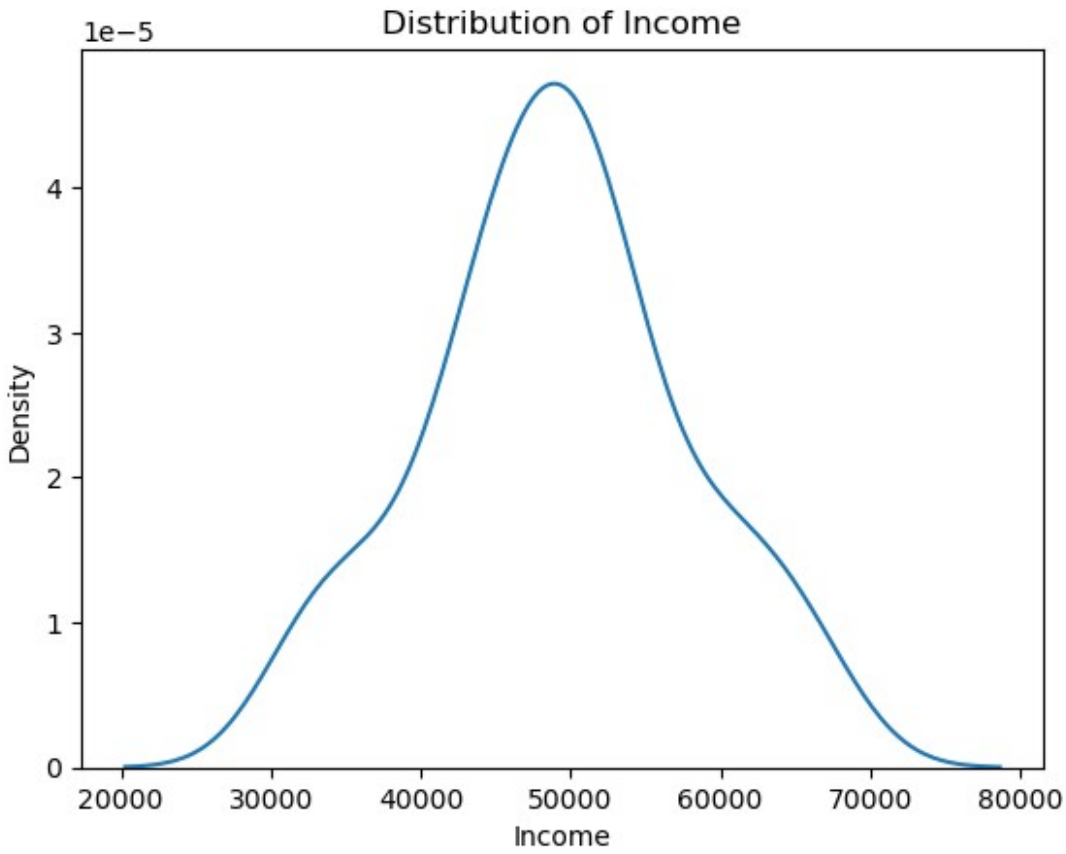



```
sns.kdeplot(data = KP481 , x = 'Fitness')
plt.title('Distribution of Fitness')
```

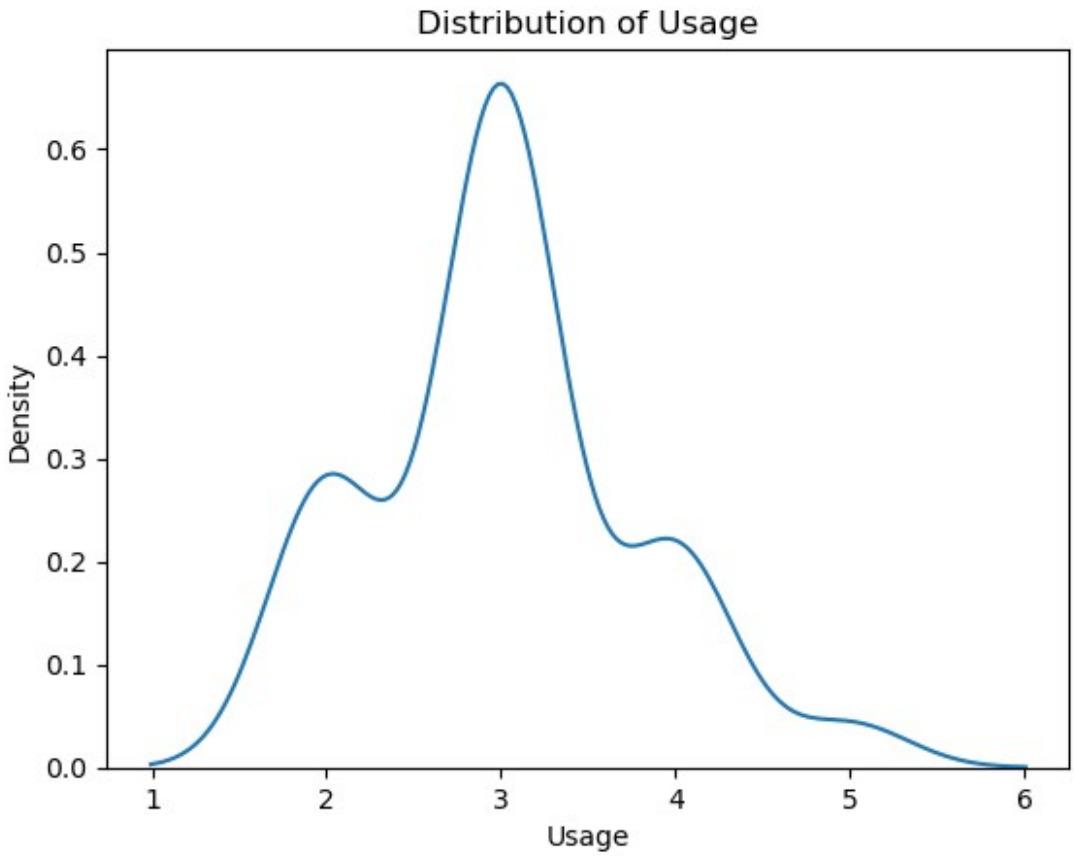
```
Text(0.5, 1.0, 'Distribution of Fitness')
```




```
sns.kdeplot(data = KP481 , x = 'Income')
plt.title('Distribution of Income')

Text(0.5, 1.0, 'Distribution of Income')
```

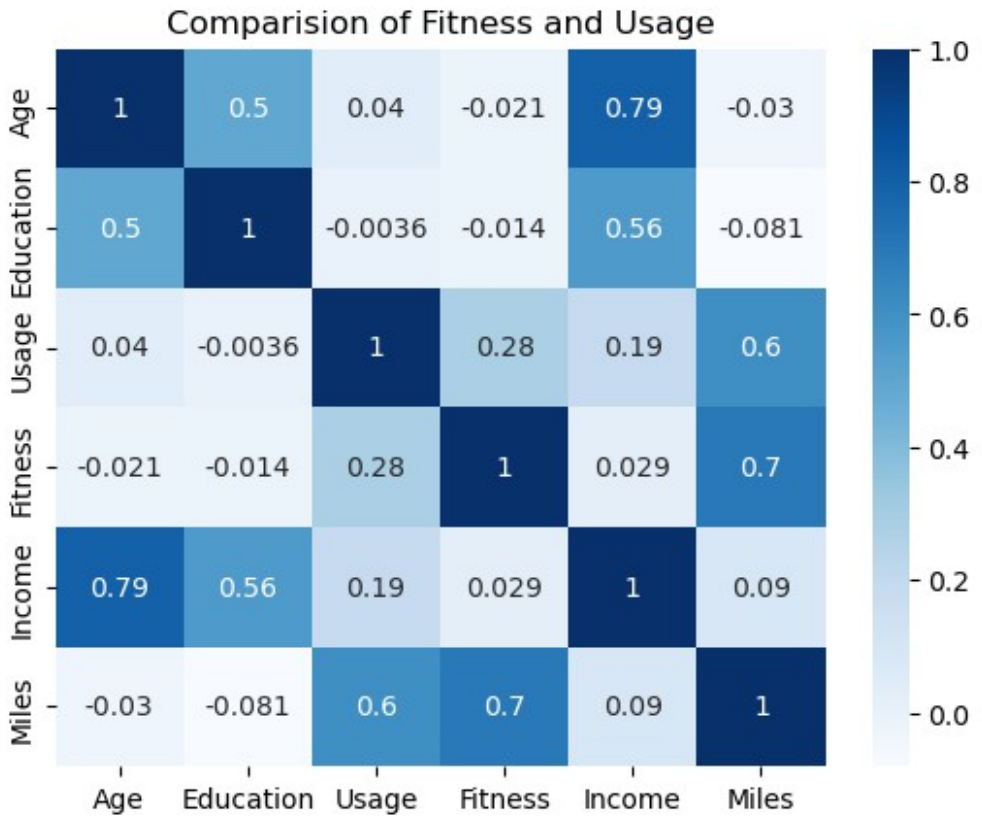



```
sns.kdeplot(data = KP481 , x = 'Usage')
plt.title('Distribution of Usage')

Text(0.5, 1.0, 'Distribution of Usage')
```




```
sns.heatmap(KP481.select_dtypes('number').corr(), cmap =
'Blues',annot=True)
plt.title('Comparision of Fitness and Usage')
```

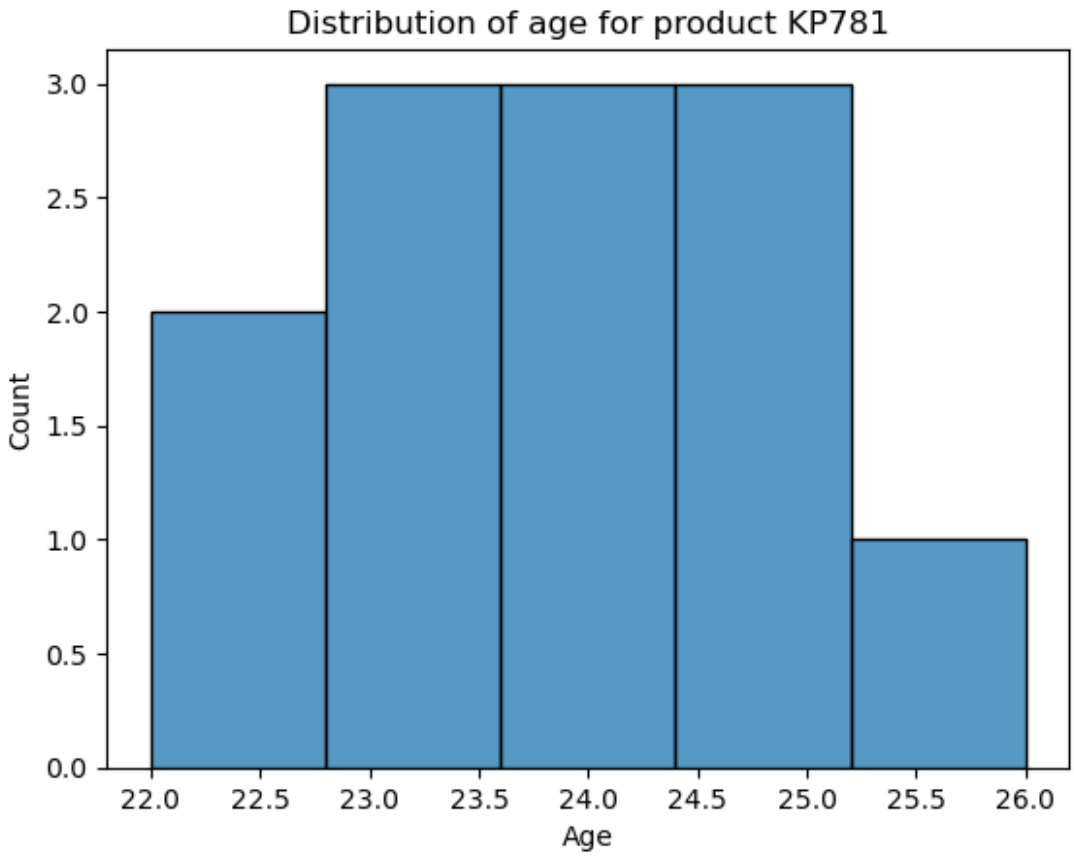
```
Text(0.5, 1.0, 'Comparision of Fitness and Usage')
```



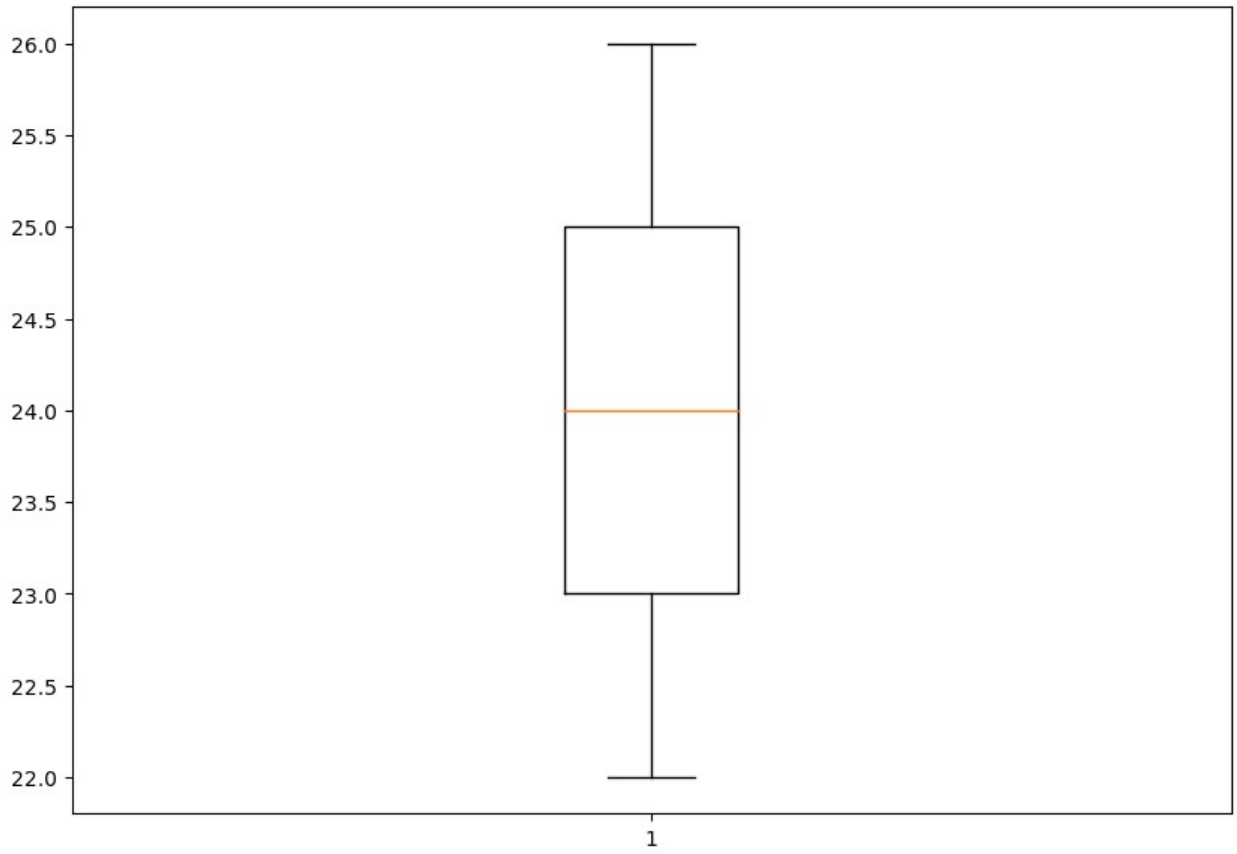
KP781 Analysis

```
sns.histplot(data = KP781 , x = 'Age')
plt.xlabel('Age')
plt.title('Distribution of age for product KP781')
```

```
Text(0.5, 1.0, 'Distribution of age for product KP781')
```

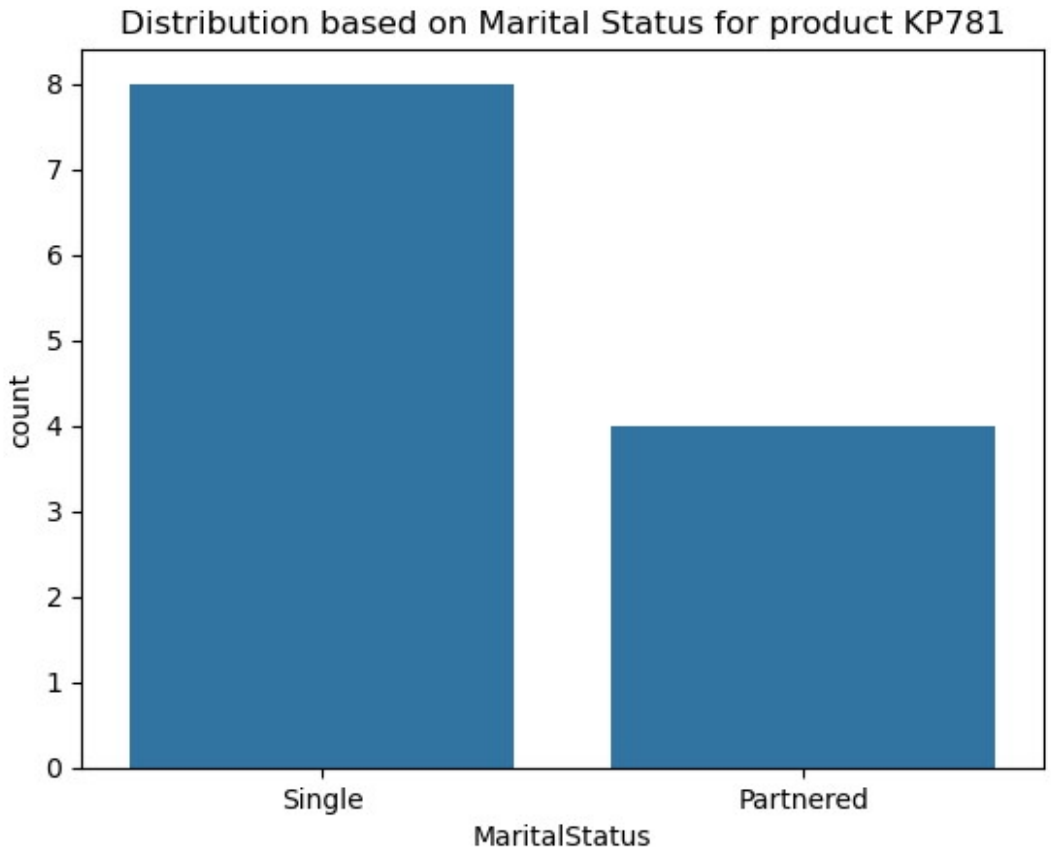



```
fig = plt.figure(figsize=(10,7))
plt.boxplot(KP781['Age'])
plt.show()
```

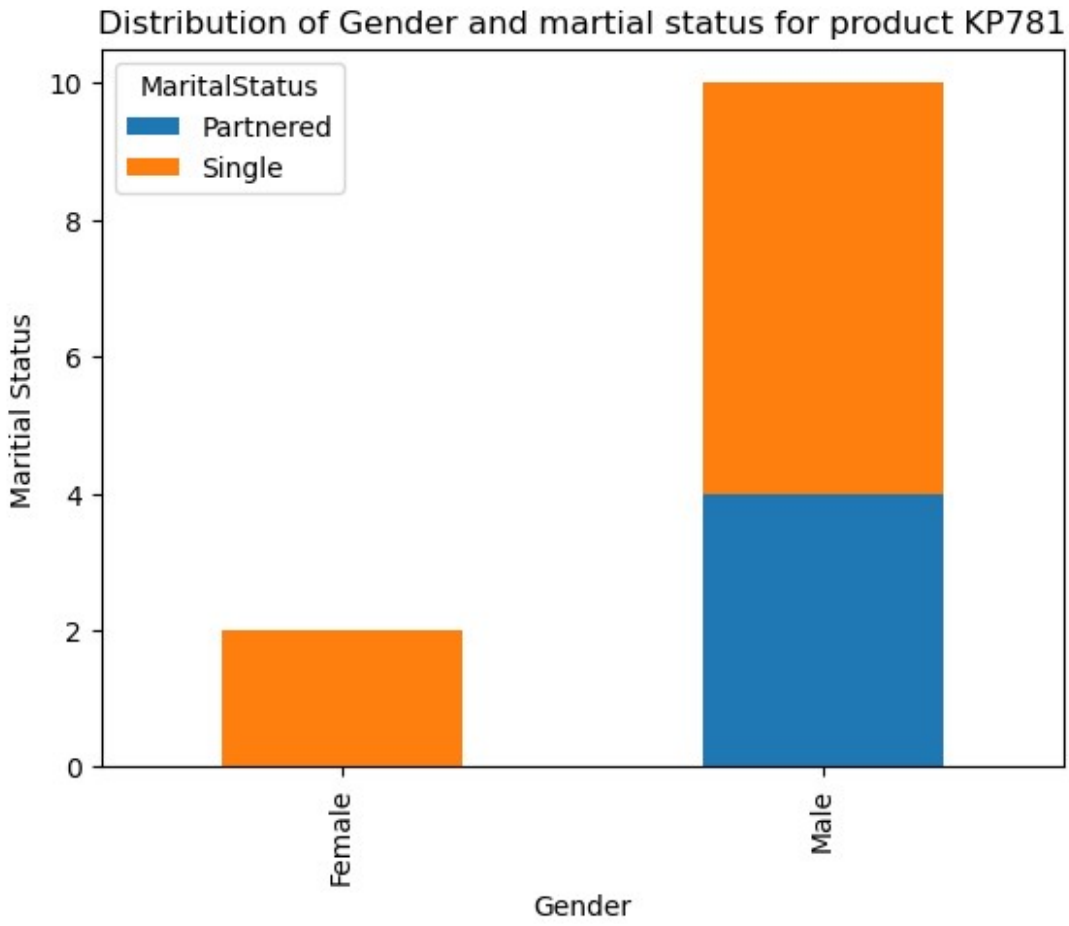



```
sns.countplot(x = 'MaritalStatus',data = KP781)
plt.title('Distribution based on Marital Status for product KP781')
```

```
Text(0.5, 1.0, 'Distribution based on Marital Status for product
KP781')
```

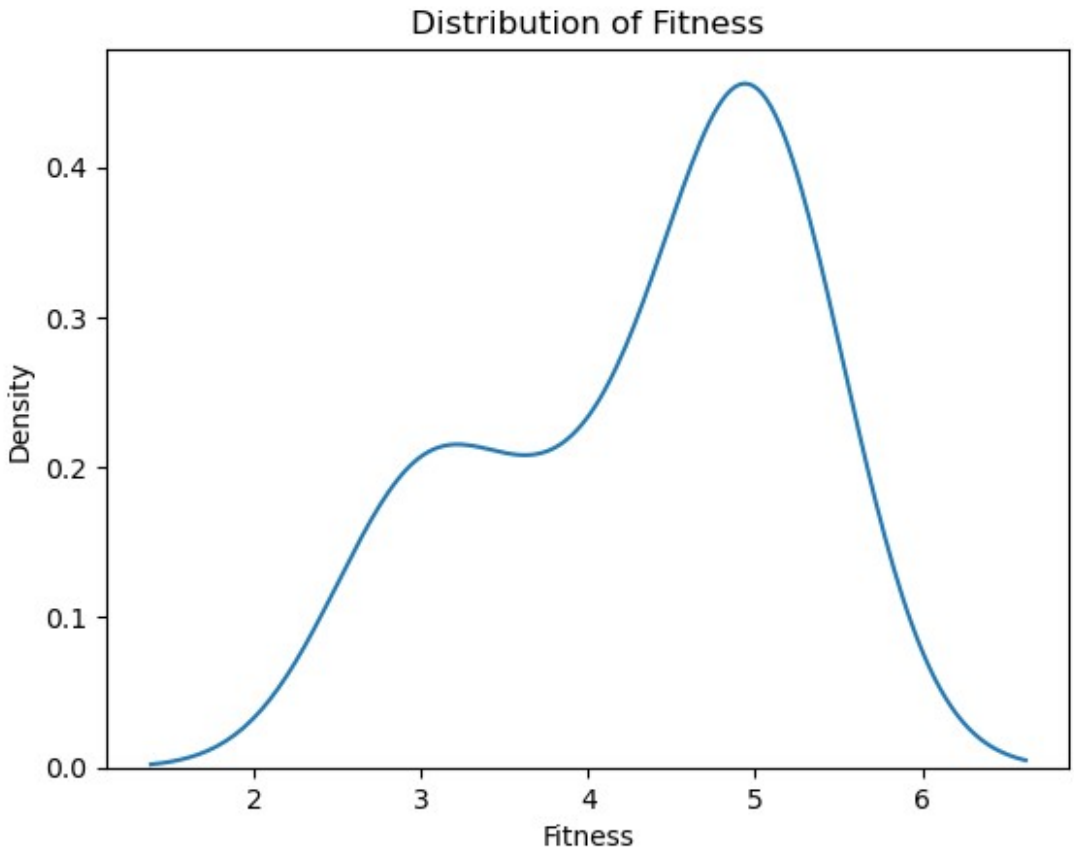



```
ctab = pd.crosstab(KP781.Gender,KP781.MaritalStatus,values =
KP781.Product,aggfunc = 'count').round(0)
ctab.plot(kind = 'bar',stacked = True)
plt.xlabel('Gender')
plt.ylabel('Maritial Status')
plt.title('Distribution of Gender and martial status for product
KP781')
plt.show()
```

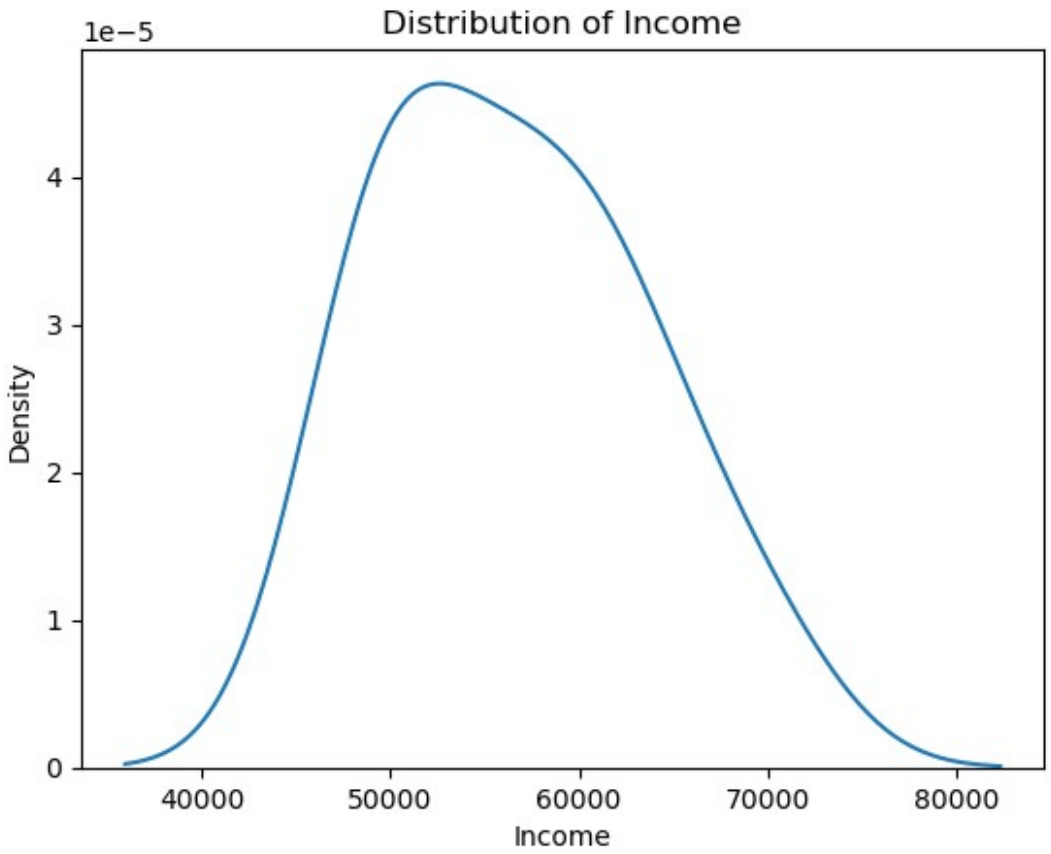



```
sns.kdeplot(data = KP781 , x = 'Fitness')
plt.title('Distribution of Fitness')
```

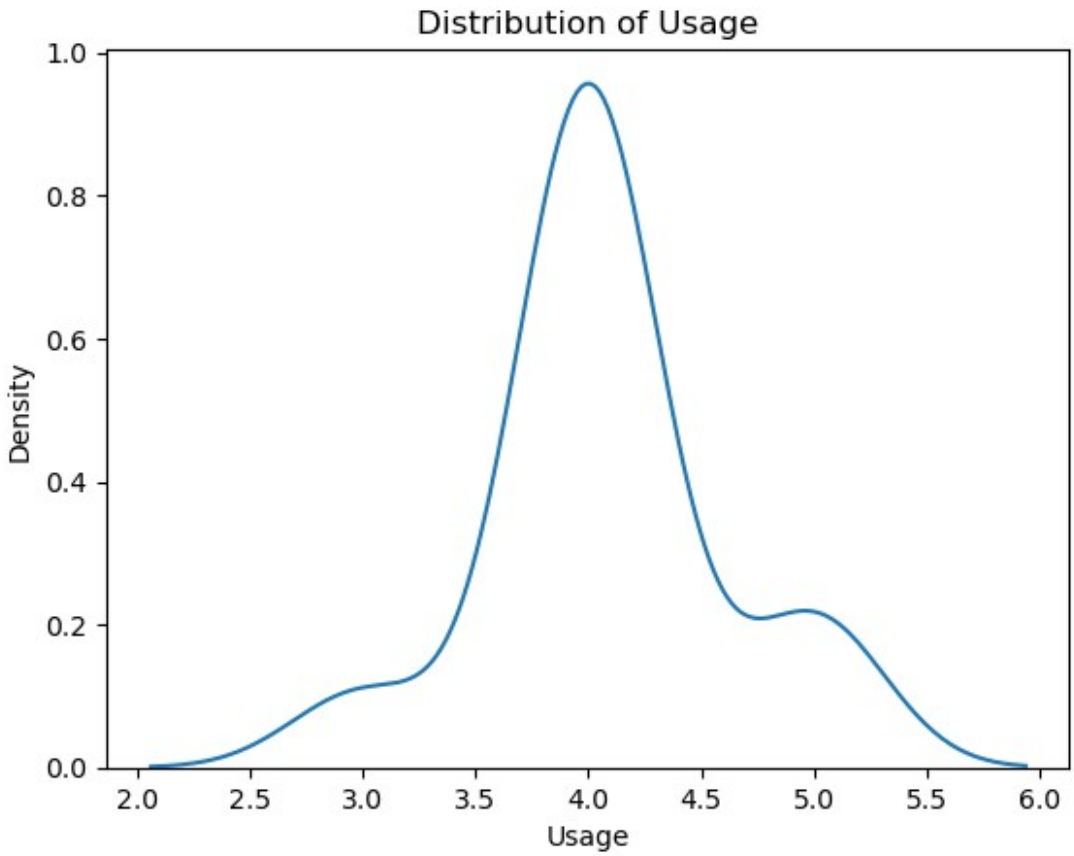
```
Text(0.5, 1.0, 'Distribution of Fitness')
```




```
sns.kdeplot(data = KP781 , x = 'Income')
plt.title('Distribution of Income')

Text(0.5, 1.0, 'Distribution of Income')
```

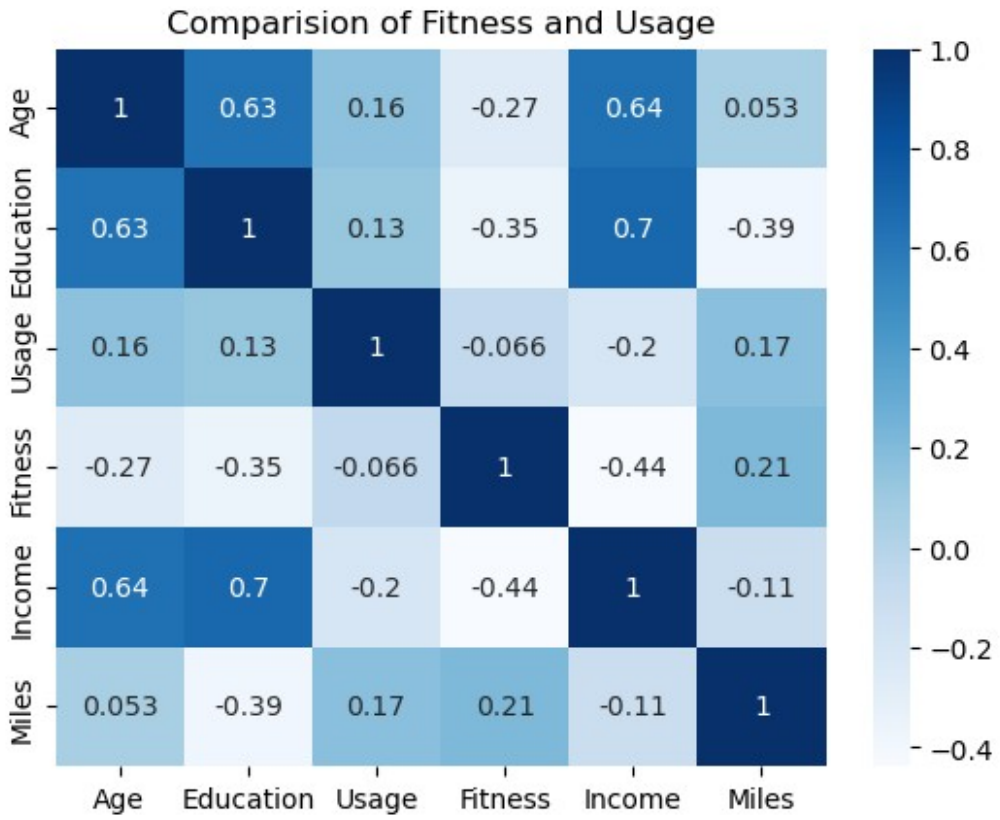



```
sns.kdeplot(data = KP781 , x = 'Usage')
plt.title('Distribution of Usage')

Text(0.5, 1.0, 'Distribution of Usage')
```




```
sns.heatmap(KP781.select_dtypes('number').corr(), cmap =
'Blues',annot=True)
plt.title('Comparision of Fitness and Usage')
```

```
Text(0.5, 1.0, 'Comparision of Fitness and Usage')
```



Conditional and marginal probabilities

```
pd.crosstab(df.Product,df.Gender,values = df.Miles,aggfunc =
['min','max','mean']).round(0)
```

	min		max		mean	
Gender	Female	Male	Female	Male	Female	Male
Product						
KP281	38	47	113	141	74.0	87.0
KP481	21	42	127	127	83.0	84.0
KP781	100	80	100	160	100.0	119.0

```
df['Product'].value_counts(normalize=True)
```

```
Product
KP281    0.527778
KP481    0.388889
KP781    0.083333
Name: proportion, dtype: float64
```

```
#Whats the probability of a new customer to be a Male.
Total_samples = len(df)
Male_Customers = len(df[df['Gender']=='Male'])
```

```
Probablity_Male_Customers = Male_Customers/Total_samples
print('Probability of a customer to be Male is :
',round(Probablity_Male_Customers,4)*100,'%')
```

```
Probability of a customer to be Male is :  52.78 %
```

```
#Whats the probability of a new customer to be a Female.
Total_samples = len(df)
Female_Customers = len(df[df['Gender']=='Female'])

Probablity_Female_Customers = Female_Customers/Total_samples
print('Probability of a  customer to be Female is :
',round(Probablity_Female_Customers,4)*100,'%')
```

```
Probability of a  customer to be Female is :  47.22 %
```

```
# Probability of a new customer to be Male is :  54.43 % what is the
probability if a customer is Male then he is Married
Total_Male_Customers = len(df[df['Gender']=='Male'])
Married_Male_Customers = len(df[(df['Gender']=='Male') &
(df['MaritalStatus']=='Partnered')])

Probablity_Married_Male_Customers =
Married_Male_Customers/Total_Male_Customers
print('Probability of a  customer to be Male and married is :
',round(Probablity_Married_Male_Customers,4)*100,'%')

print('Probability of a  customer to be Male and Unmarried is :
',round(1-Probablity_Married_Male_Customers,4)*100,'%')
```

```
Probability of a  customer to be Male and married is :  55.26 %
Probability of a  customer to be Male and Unmarried is :  44.74 %
```

```
# Probability of a new customer to be Female is :  45.57 % what is the
probability if a customer is Male then he is Married
Total_Female_Customers = len(df[df['Gender']=='Female'])
Married_Female_Customers = len(df[(df['Gender']=='Female') &
(df['MaritalStatus']=='Partnered')])

Probablity_Married_Female_Customers =
round(Married_Female_Customers/Total_Female_Customers,4)
print('Probability of a  customer to be Female and married is :
',round(Probablity_Married_Female_Customers*100,2),'%')

print('Probability of a  customer to be Female and Unmarried is :
',round(100-Probablity_Married_Female_Customers*100,2),'%')
```

```
Probability of a  customer to be Female and married is :  57.35 %
Probability of a  customer to be Female and Unmarried is :  42.65 %
```

Hence we can say from the above calculations that the probability of a male customer is more then female and for both male and female customers over all probability of being Married is more then single. We can conclude that Married people are bying this product more then their unmarried counterparts.

```
df1 = pd.crosstab(index=df['Gender'], columns=[df['Product']])

print("P(Male) : ",round(df1.loc['Male'].sum()/len(df),2))
print("P(Female) : ",round(df1.loc['Female'].sum()/len(df),2))
print('')


KP281 = df1['KP281']['Male']/df1.loc['Male'].sum()
KP481 = df1['KP481']['Male']/df1.loc['Male'].sum()
KP781 = df1['KP781']['Male']/df1.loc['Male'].sum()

print('KP281 - Male Customers : ',round(KP281,2))
print('KP481 - Male Customers : ',round(KP481,2))
print('KP781 - Male Customers : ',round(KP781,2))
print('')

KP281 = df1['KP281']['Female']/df1.loc['Female'].sum()
KP481 = df1['KP481']['Female']/df1.loc['Female'].sum()
KP781 = df1['KP781']['Female']/df1.loc['Female'].sum()

print('KP281 - Female Customers : ',round(KP281,2))
print('KP481 - Female Customers : ',round(KP481,2))
print('KP781 - Female Customers : ',round(KP781,2))
```

```
P(Male) :  0.53
P(Female) :  0.47

KP281 - Male Customers :  0.5
KP481 - Male Customers :  0.37
KP781 - Male Customers :  0.13

KP281 - Female Customers :  0.56
KP481 - Female Customers :  0.41
KP781 - Female Customers :  0.03
```