

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

```
print('Import done')
```

```
Import done
```

```
# Link to the CSV file
```

```
url =
'https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/001/12
5/original/aerofit_treadmill.csv?1639992749'
df = pd.read_csv(url)
df
```

```
{"summary":{"\n  \"name\": \"df\",\n  \"rows\": 180,\n  \"fields\": [\n    {\n      \"column\": \"Product\",\n      \"properties\": {\n        \"dtype\": \"category\",\n        \"num_unique_values\": 3,\n        \"samples\": [\n          \"KP281\",\n          \"KP481\",\n          \"KP781\"\n        ],\n        \"semantic_type\": \"\",\n        \"description\": \"\",\n        \"column\": \"Age\",\n        \"properties\": {\n          \"dtype\": \"number\",\n          \"std\": 6,\n          \"min\": 18,\n          \"max\": 50,\n          \"num_unique_values\": 32,\n          \"samples\": [\n            45,\n            33,\n            43\n          ],\n          \"semantic_type\": \"\",\n          \"description\": \"\",\n          \"column\": \"Gender\",\n          \"properties\": {\n            \"dtype\": \"category\",\n            \"num_unique_values\": 2,\n            \"samples\": [\n              \"Female\",\n              \"Male\"\n            ],\n            \"semantic_type\": \"\",\n            \"description\": \"\",\n            \"column\": \"Education\",\n            \"properties\": {\n              \"dtype\": \"number\",\n              \"std\": 1,\n              \"min\": 12,\n              \"max\": 21,\n              \"num_unique_values\": 8,\n              \"samples\": [\n                15,\n                18\n              ],\n              \"semantic_type\": \"\",\n              \"description\": \"\",\n              \"column\": \"MaritalStatus\",\n              \"properties\": {\n                \"dtype\": \"category\",\n                \"num_unique_values\": 2,\n                \"samples\": [\n                  \"Partnered\",\n                  \"Single\"\n                ],\n                \"semantic_type\": \"\",\n                \"description\": \"\",\n                \"column\": \"Usage\",\n                \"properties\": {\n                  \"dtype\": \"number\",\n                  \"std\": 1,\n                  \"min\": 2,\n                  \"max\": 7,\n                  \"num_unique_values\": 6,\n                  \"samples\": [\n                    3,\n                    2\n                  ],\n                  \"semantic_type\": \"\",\n                  \"description\": \"\",\n                  \"column\": \"Fitness\",\n                  \"properties\": {\n                    \"dtype\": \"number\",\n                    \"std\": 0,\n                    \"min\": 1,\n                    \"max\": 5,\n                    \"num_unique_values\": 5,\n
```

```

{"samples": 3, "semantic_type": "Income", "description": "Income", "properties": {"dtype": "number", "std": 16506, "min": 29562, "max": 104581, "num_unique_values": 62, "samples": 88396}, {"samples": 5, "semantic_type": "Miles", "description": "Miles", "properties": {"dtype": "number", "std": 51, "min": 21, "max": 360, "num_unique_values": 37, "samples": 95}], "type": "dataframe", "variable_name": "df"}

```

```

# Calculate the mean of each numerical column

```

```

mean_income = df['Income'].mean()
mean_steps = df['Miles'].mean()
mean_age = df['Age'].mean()
mean_usage = df['Usage'].mean()
mean_fitness = df['Fitness'].mean()
mean_education = df['Education'].mean()

```

```

# Print the results

```

```

print("Mean Income:", mean_income)
print("Mean Steps Walked (Miles):", mean_steps)
print("Mean Age:", mean_age)
print("Mean Usage:", mean_usage)
print("Mean Fitness:", mean_fitness)
print("Mean Education:", mean_education)

```

```

Mean Income: 53719.57777777778
Mean Steps Walked (Miles): 103.19444444444444
Mean Age: 28.788888888888888
Mean Usage: 3.4555555555555557
Mean Fitness: 3.311111111111111
Mean Education: 15.572222222222223

```

## Observations After looking at the Dataset and calculating Mean

---

1. Mean Income: 53,719 USD
2. Mean Steps Walked (Miles): 103
3. Mean Age: 28.7 years
4. Mean Usage: 3.4 per week

5. Mean Fitness: 3.3/5.0
6. Mean Education: 15.6 years

## Checking for Missing Values and Outliers

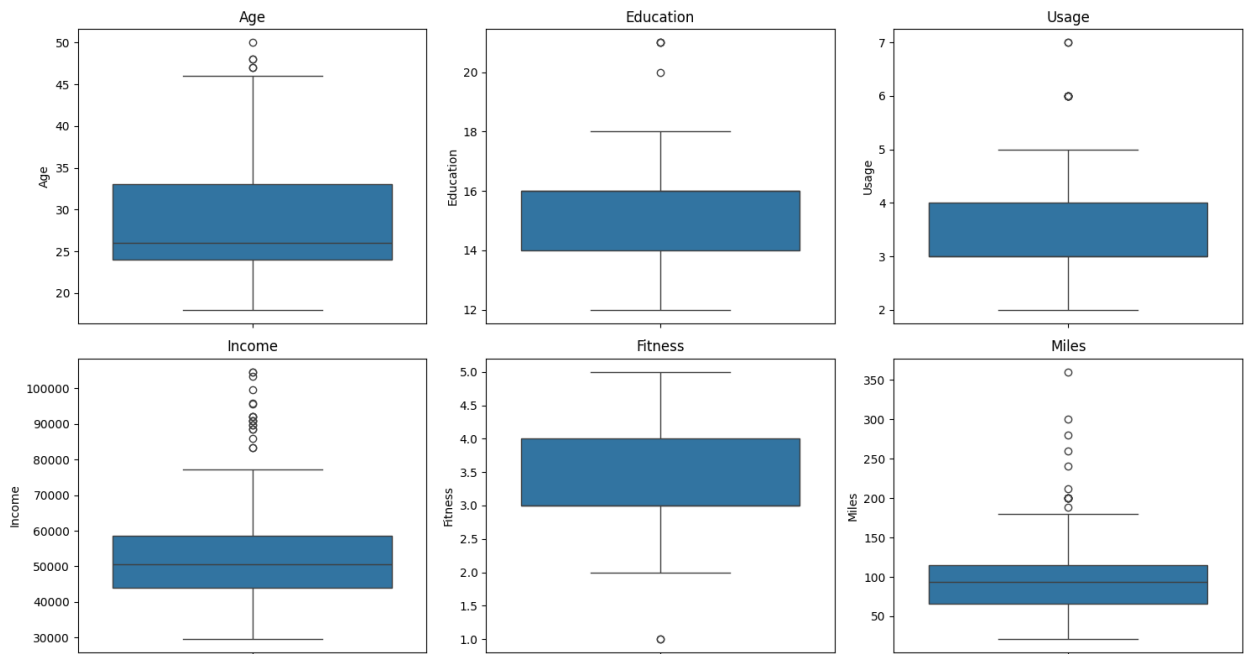
```
# Checking for missing values
missing_values = df.isnull().sum()
print("Missing Values:")
print(missing_values)

# Visualizing missing values
plt.figure(figsize=(10, 6))
sns.heatmap(df.isnull(), cmap='viridis', cbar=False)
plt.title('Missing Values Heatmap')
plt.show()

# Detecting outlier for continuous variables
continuous_vars = ['Age', 'Education', 'Usage', 'Income', 'Fitness',
                  'Miles']

plt.figure(figsize=(15, 8))
for i, col in enumerate(continuous_vars, 1):
    plt.subplot(2, 3, i)
    sns.boxplot(y=df[col])
    plt.title(col)
plt.tight_layout()
plt.show()

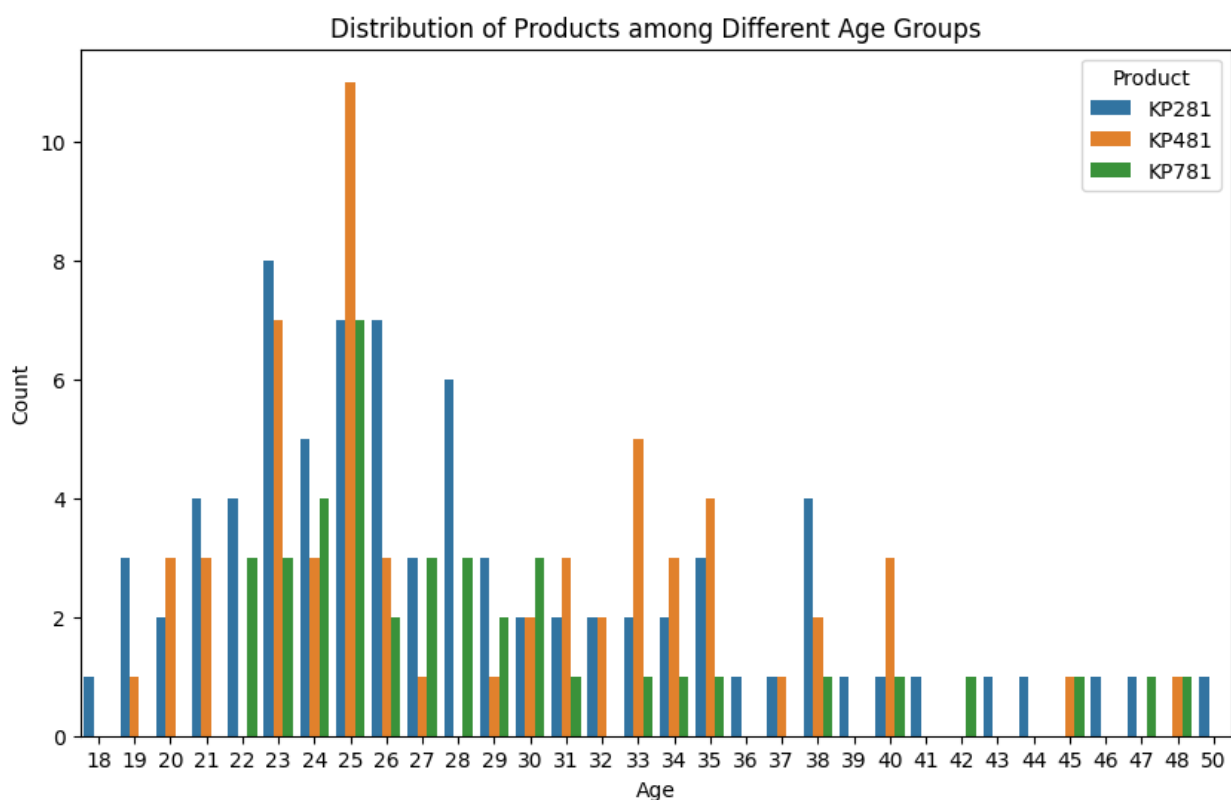
Missing Values:
Product      0
Age          0
Gender       0
Education    0
MaritalStatus 0
Usage        0
Fitness      0
Income       0
Miles        0
dtype: int64
```



# Distrubution of products among Different Age Groups(Bar Plot)

```
# Distrubution of products among Different Age Groups(Bar Plot)

plt.figure(figsize=(10, 6))
sns.countplot(data = df, x = 'Age', hue = 'Product')
plt.title('Distribution of Products among Different Age Groups')
plt.xlabel('Age')
plt.ylabel('Count')
plt.legend(title='Product')
plt.show()
```



## No.of Unique Products in the Dataset

```
df['Product'].unique()

# Therefore, there are 3 unique products in the DataFrame

array(['KP281', 'KP481', 'KP781'], dtype=object)

df.describe(include = "all")
```

```
{
  "summary": {
    "name": "df",
    "rows": 11,
    "fields": [
      {
        "column": "Product",
        "properties": {
          "dtype": "category",
          "num_unique_values": 4,
          "samples": [
            3,
            "80",
            "180"
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Age",
        "properties": {
          "dtype": "number",
          "std": 55.58832332198464,
          "min": 6.943498135399795,
          "max": 180.0,
          "num_unique_values": 8,
          "samples": [
            28.788888888888888,
            26.0,
            180.0
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Gender",
        "properties": {
          "dtype": "category",
          "num_unique_values": 4,
          "samples": [
            2,
            "104",
            "180"
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Education",
        "properties": {
          "dtype": "number",
          "std": 59.04362112875324,
          "min": 1.6170548978065569,
          "max": 180.0,
          "num_unique_values": 7,
          "samples": [
            15.572222222222223,
            16.0,
            180.0
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "MaritalStatus",
        "properties": {
          "dtype": "category",
          "num_unique_values": 4,
          "samples": [
            2,
            "107",
            "180"
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Usage",
        "properties": {
          "dtype": "number",
          "std": 62.474604277313155,
          "min": 1.0847970343962436,
          "max": 180.0,
          "num_unique_values": 7,
          "samples": [
            3.455555555555557,
            4.0,
            180.0
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Fitness",
        "properties": {
          "dtype": "number",
          "std": 62.63086276036247,
          "min": 0.958868565619312,
          "max": 180.0,
          "num_unique_values": 7,
          "samples": [
            180.0,
            3.311111111111111,
            4.0
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Income",
        "properties": {
          "dtype": "number",
          "std": 31403.855763201762,
          "min": 180.0,
          "max": 104581.0,
          "num_unique_values": 8,
          "samples": [
            53719.57777777778,
            50596.5,
            180.0
          ],
          "semantic_type": "",
          "description": ""
        }
      },
      {
        "column": "Miles",
        "properties": {
          "dtype": "number",
          "std": 106.52090041797726,
          "min": 21.0,
          "max": 360.0,
          "num_unique_values": 8,
          "samples": [
            103.19444444444444,
            94.0,
            180.0
          ],
          "semantic_type": "",
          "description": ""
        }
      }
    ]
  }
}
```

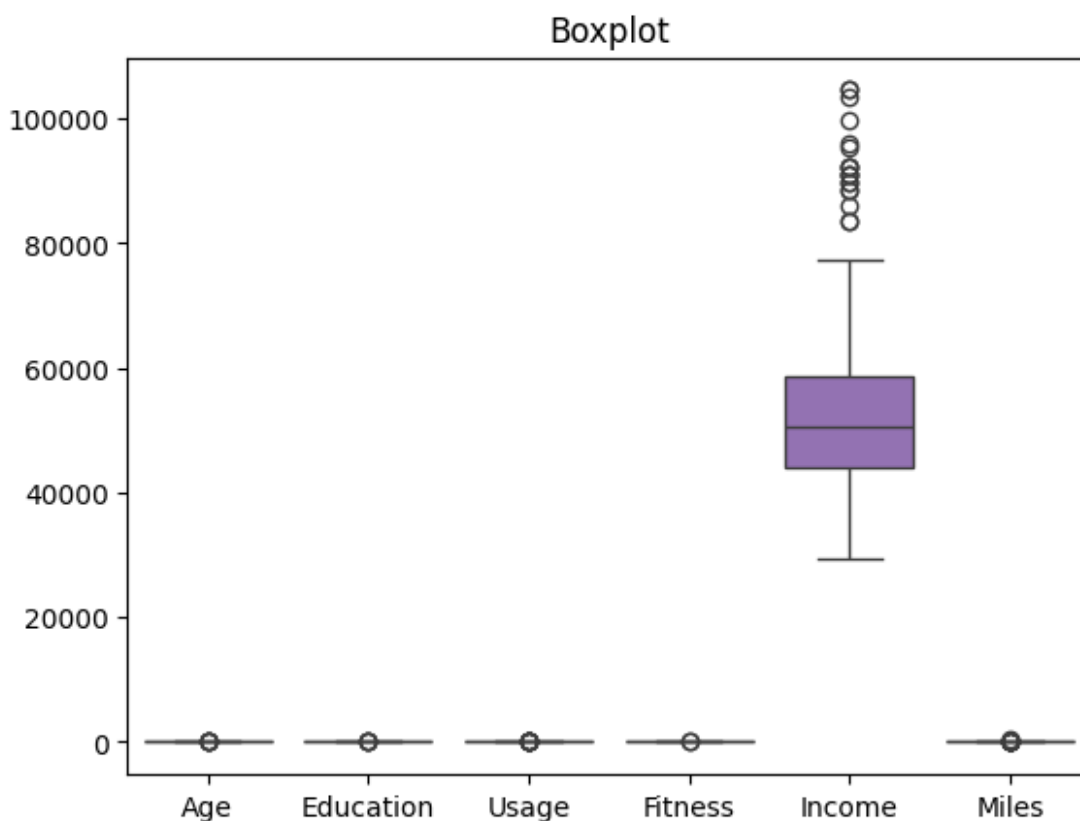
```
\"semantic_type\": \"\", \n      \"description\": \"\" \n    } \n  ] \n}", "type": "dataframe"}
```

## BoxPlot(Pair Plot) and the Difference in Mean and Median for each column

```
# BoxPlot(Pair Plot to check correlation among different factors)
sns.boxplot(data = df)
plt.title('Boxplot')
plt.show()

# Difference between MEAN and MEDIAN for each numerical column
summary_stats = df.describe()

difference = summary_stats.loc['mean'] - summary_stats.loc['50%']
print("Difference between the MEAN and MEDIAN : ")
print(difference)
```



```
Difference between the MEAN and MEDIAN :
Age          2.788889
Education    -0.427778
Usage        0.455556
Fitness      0.311111
Income       3123.077778
Miles        9.194444
dtype: float64
```

## Heat Map to check correlation among different factors

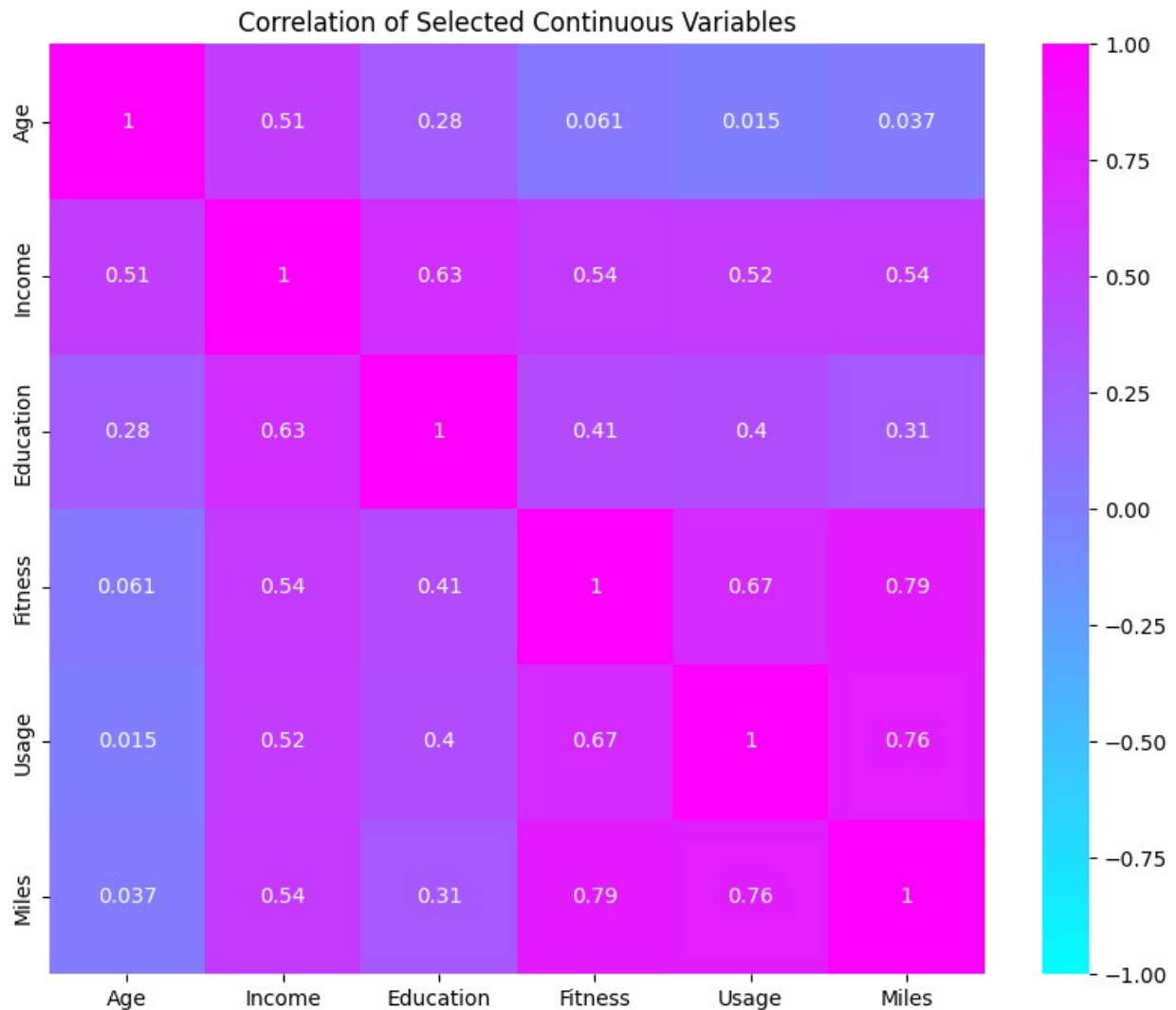
```
continuous_columns = ["Age", "Income", "Education", "Fitness",
                      "Usage", "Miles"]

# Calculating correlation matrix
correlation_matrix = df[continuous_columns].corr()

# Plotting the heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(data = correlation_matrix, annot = True, cmap = 'cool',
            vmin = -1, vmax = 1)
plt.title("Correlation of Selected Continuous Variables")
plt.show()

# vmin and vmax are used to set the MINIMUM and MAXIMUM values of the
color scale
```





## Individual Bar Plots for each product

```
# Individual Bar Plots for each product
plt.figure(figsize=(18, 6))

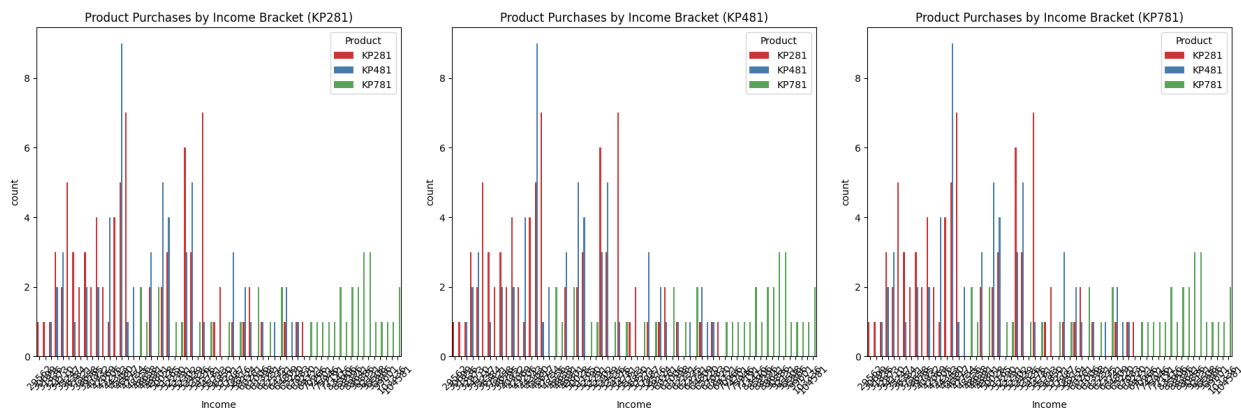
# Bar Plot for KP281
plt.subplot(1, 3, 1)
sns.countplot(data = df, x = 'Income', hue = 'Product', palette = 'Set1')
plt.title('Product Purchases by Income Bracket (KP281)')
plt.xticks(rotation=45)

# Bar Plot for KP481
plt.subplot(1, 3, 2)
sns.countplot(data = df, x = 'Income', hue = 'Product', palette = 'Set1')
```

```
plt.title('Product Purchases by Income Bracket (KP481)')
plt.xticks(rotation=45)

# Bar Plot for KP781
plt.subplot(1, 3, 3)
sns.countplot(data = df, x = 'Income', hue = 'Product', palette =
'Set1')
plt.title('Product Purchases by Income Bracket (KP781)')
plt.xticks(rotation=45)

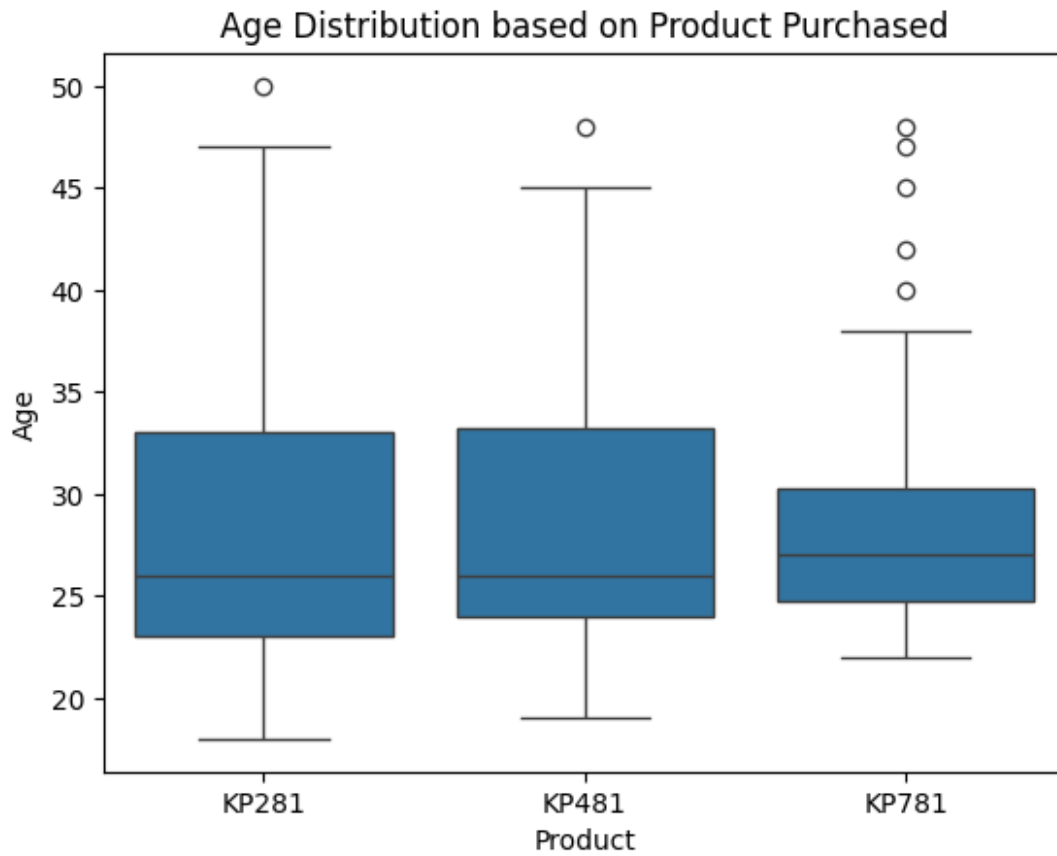
# Display
plt.tight_layout()
plt.show()
```



## BoxPlot for Age

```
# BoxPlot for Age

sns.boxplot(x = 'Product', y = 'Age', data = df)
plt.title('Age Distribution based on Product Purchased')
plt.show()
```

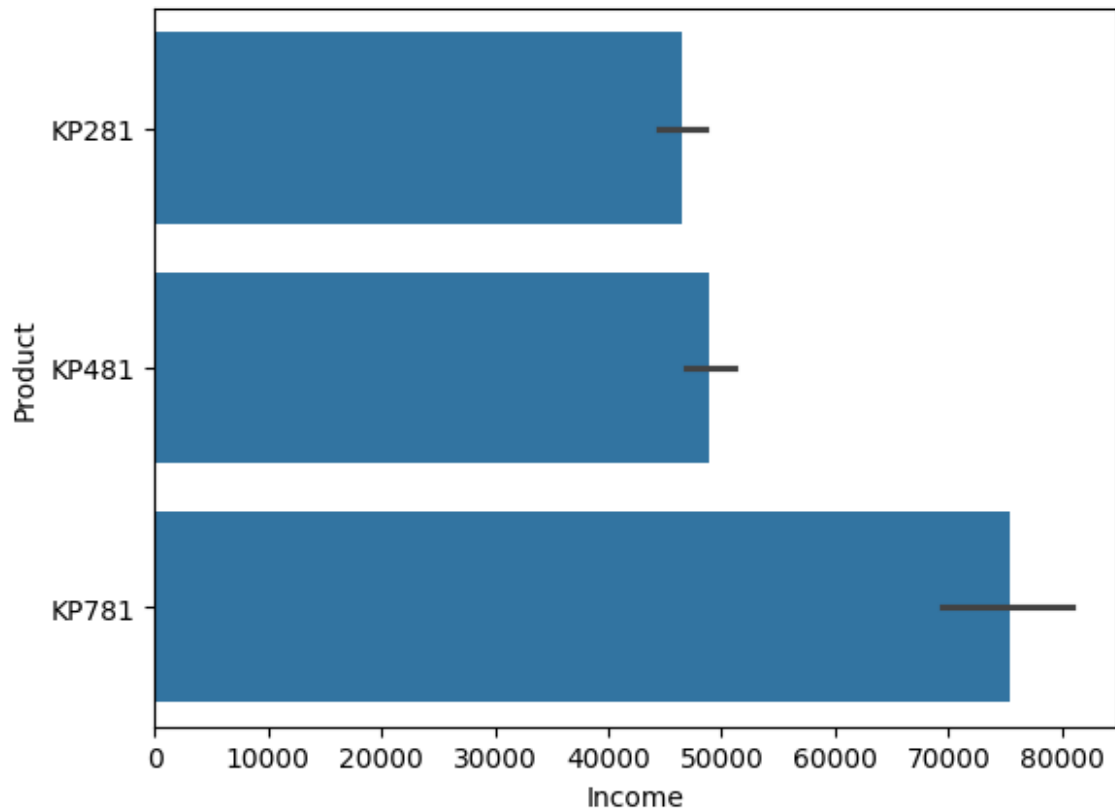


## Income-Product Plot

*# Different Plots*

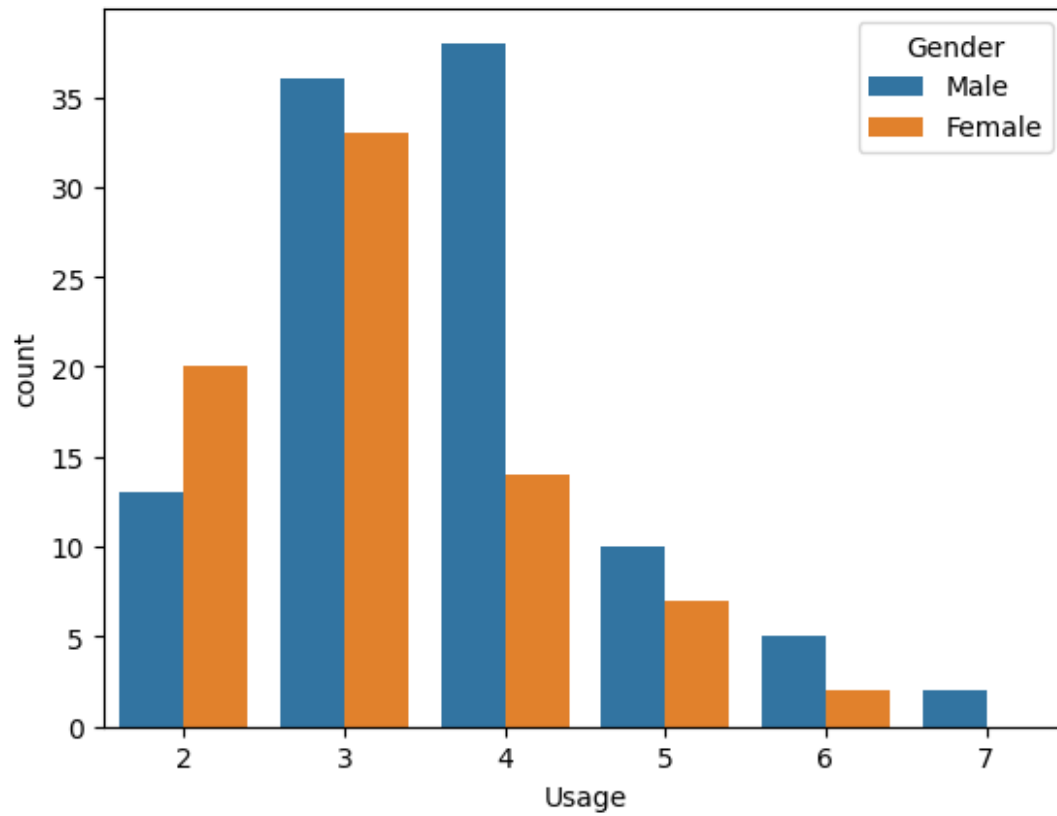
*# 1.) Income-Product Plot*

```
sns.barplot(data = df, x='Income', y='Product')  
plt.show()
```



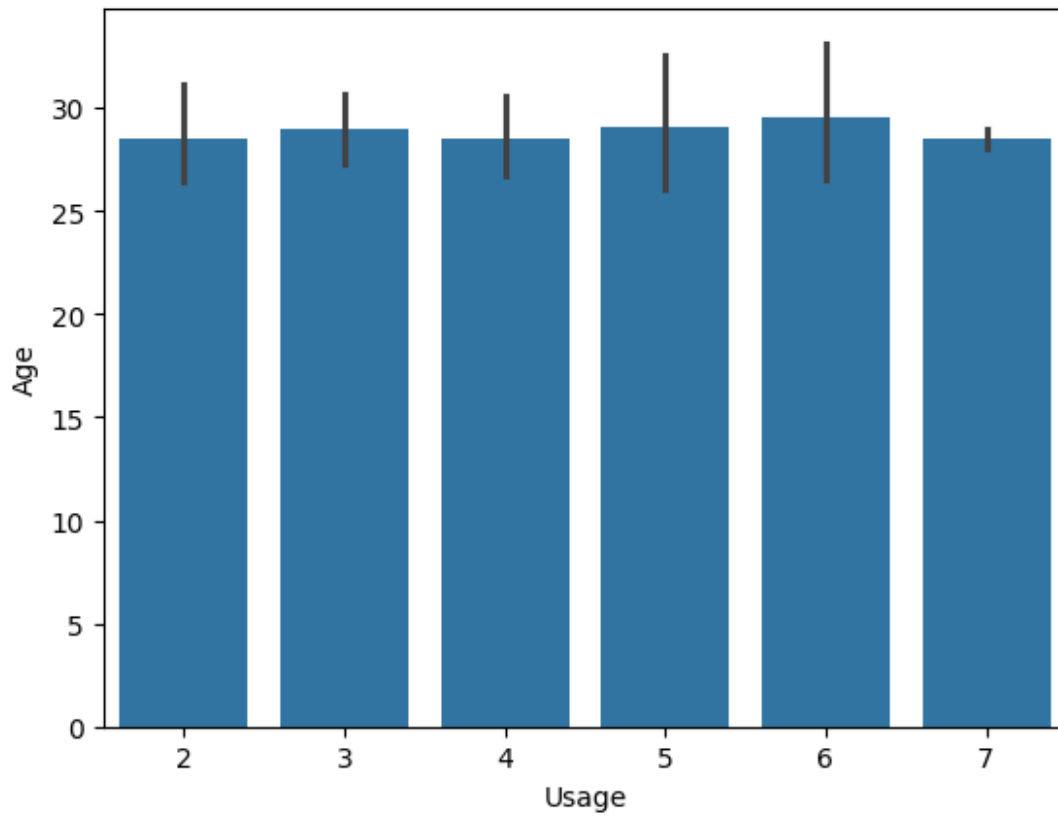
## Product-Gender

```
# 2.) Product-Gender Plot  
sns.countplot(data = df, x = 'Usage', hue = 'Gender')  
plt.show()
```



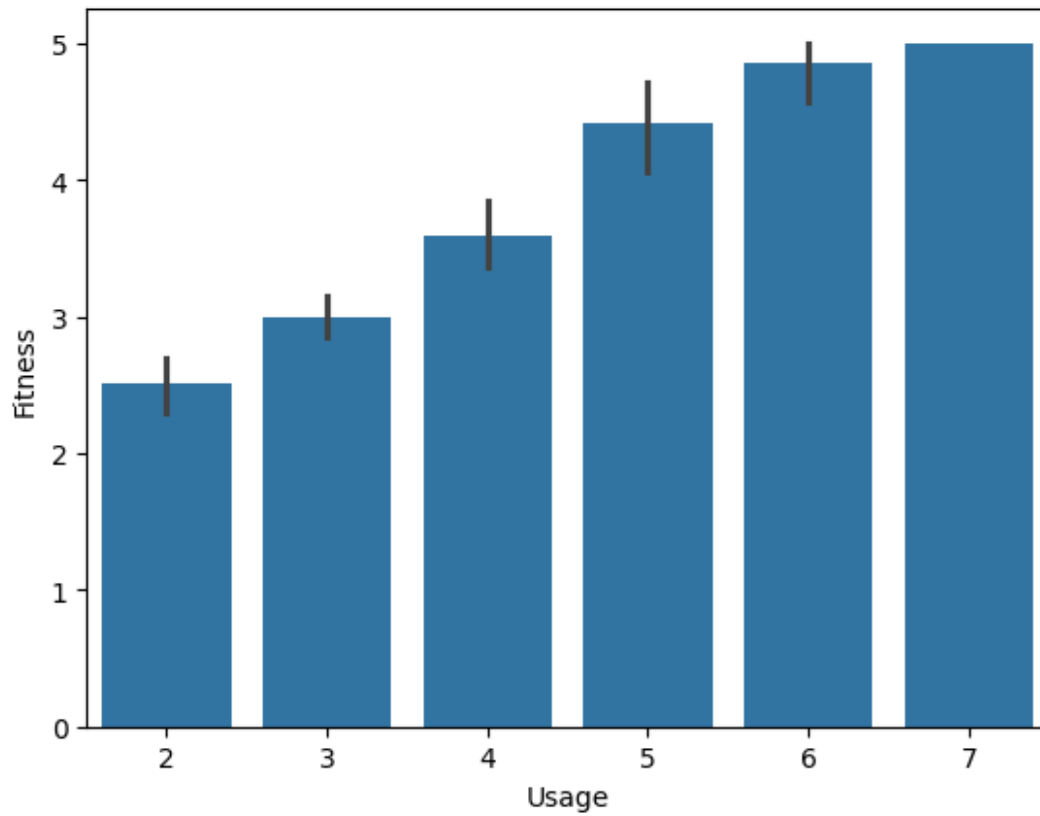
## Usage-Age Plot

```
# 3.) Usage-Age Plot  
sns.barplot(data = df, x = 'Usage', y = 'Age')  
plt.show()
```



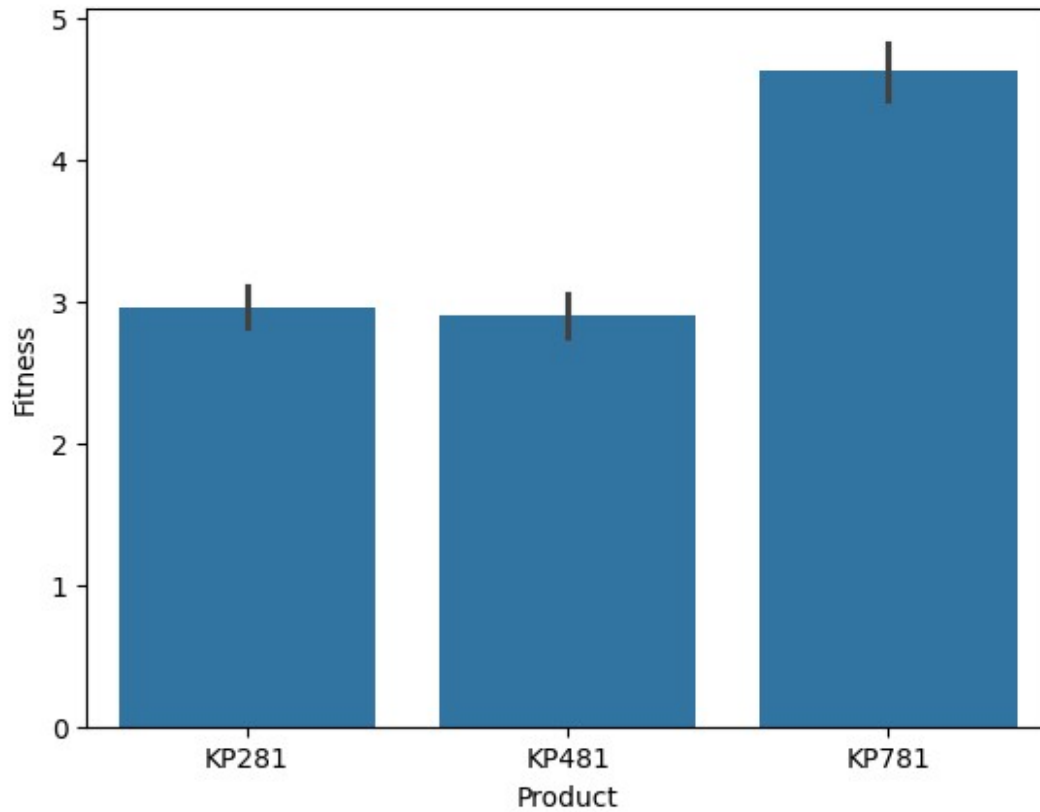
## Usage-Fitness Plot

```
# 4.) Usage-Fitness Plot  
sns.barplot(data = df, x = 'Usage', y = 'Fitness')  
plt.show()
```



## Product-Fitness Plot

```
# 5.) Product-Fitness Plot  
sns.barplot(data = df, x = 'Product', y = 'Fitness')  
plt.show()
```

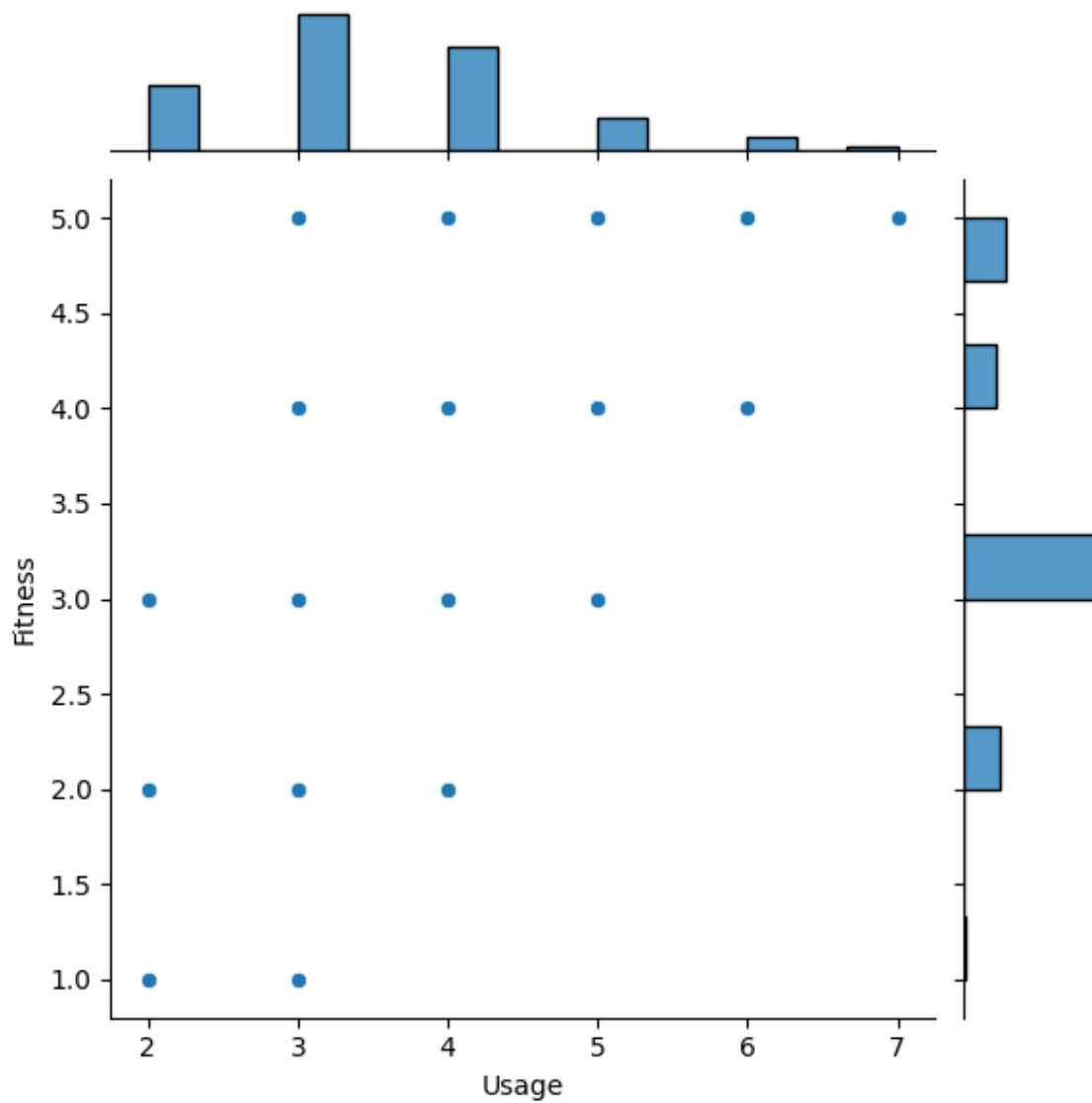


## Usage-Fitness Scatter Plot

*# 6.) Usage-Fitness Scatter Plot*

```
sns.jointplot(data = df, x = 'Usage', y = 'Fitness', kind = 'scatter')  
plt.show()
```





## HistPlots for different types of Products(Treadmills - KP218, KP418, KP718)

```
# HistPlots for different Treadmills
```

```
# KP-281
```

```
sns.histplot(data = df[df['Product'] == 'KP281'], x = 'Age', hue =  
'MaritalStatus', multiple = 'stack', bins=20)  
plt.show()
```

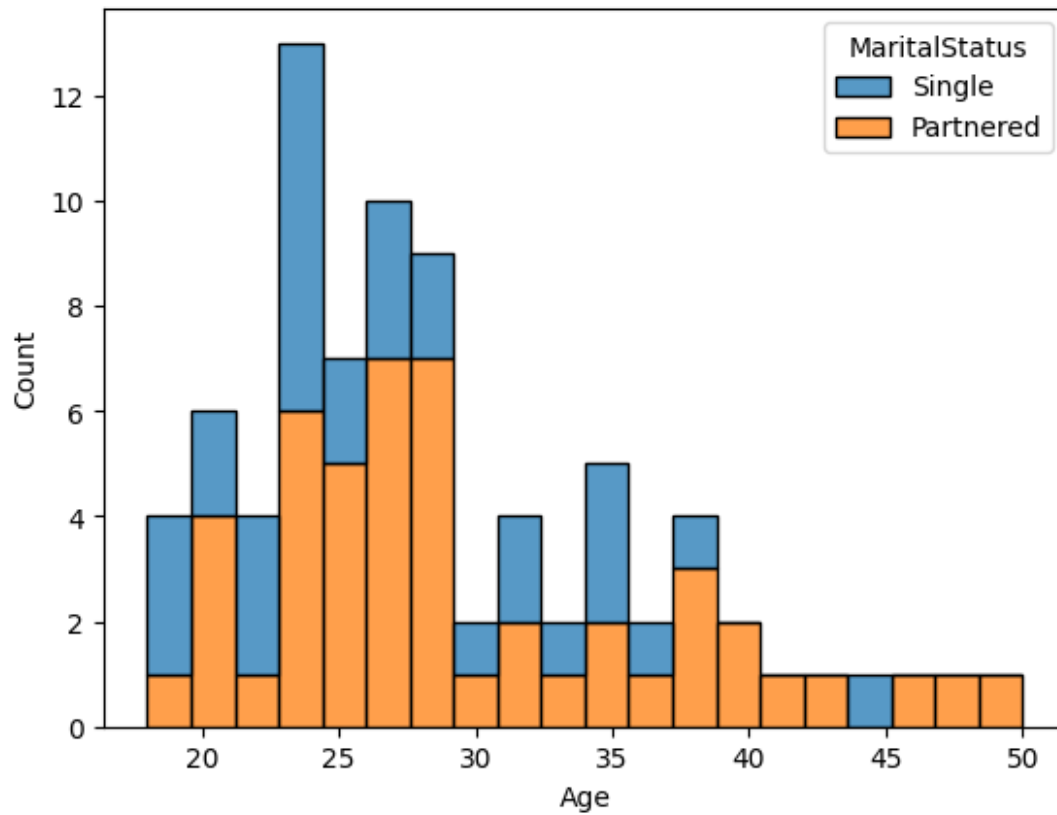
```
# KP-481
```

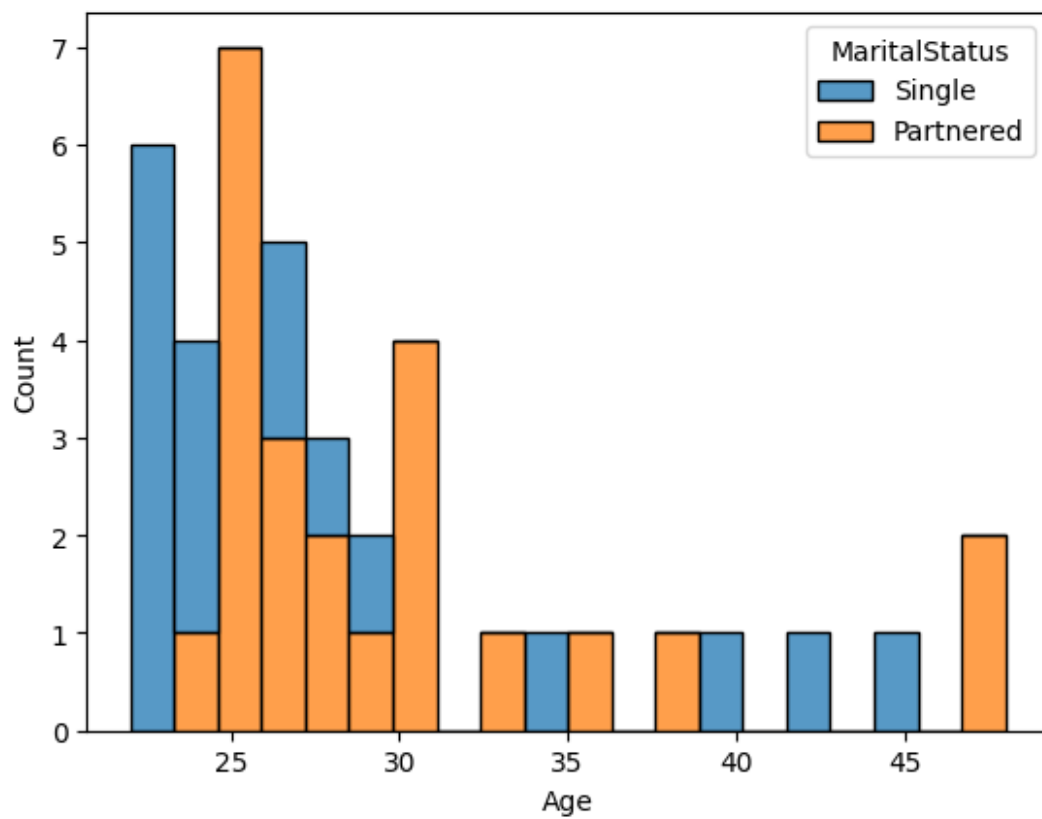
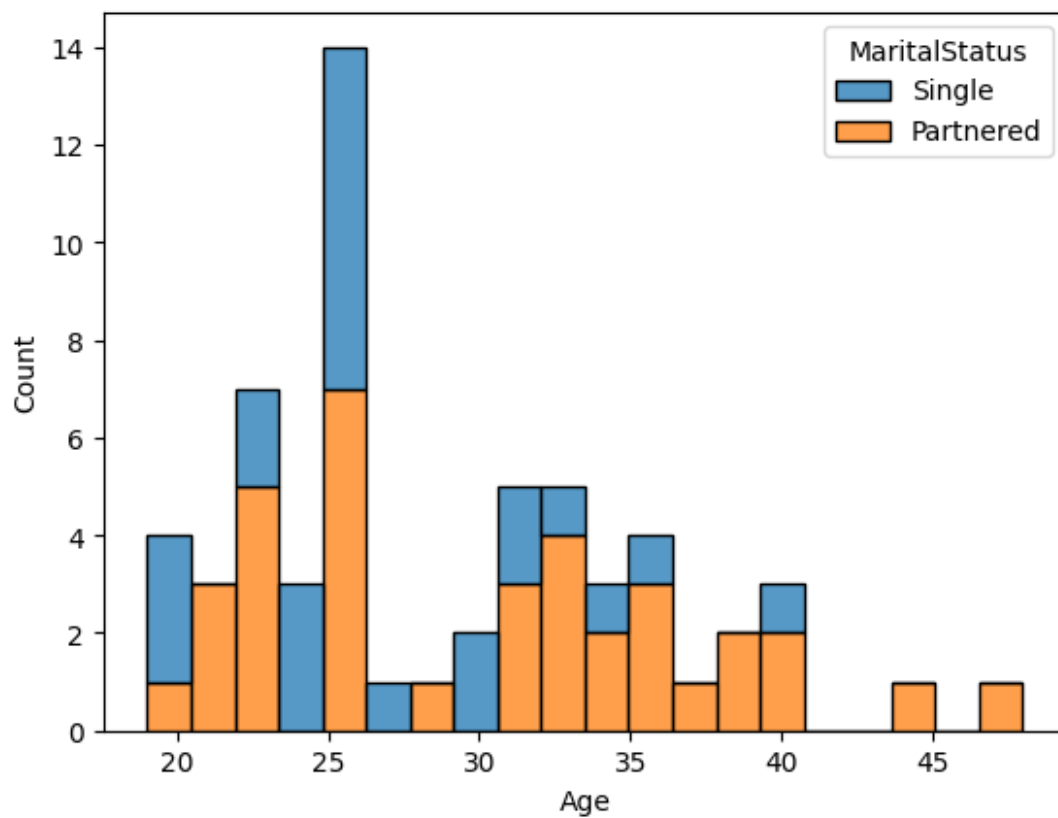
```
sns.histplot(data = df[df['Product'] == 'KP481'], x = 'Age', hue =  
'MaritalStatus', multiple = 'stack', bins=20)
```

```
plt.show()
```

```
# KP-781
```

```
sns.histplot(data = df[df['Product'] == 'KP781'], x = 'Age', hue =  
'MaritalStatus', multiple = 'stack', bins=20)  
plt.show()
```





## 2-Way Contingency Table

```
# 2-Way Contingency Table
genderProduct_table = pd.crosstab(index=df['Gender'],
columns=df['Product'], margins=True)

print("2-Way Contingency Gender-Product Table :")
print()
print(genderProduct_table)
```

2-Way Contingency Gender-Product Table :

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

## Marginal Probabilities

```
# Marginal Probabilities(using pandas.crosstab)

marginal_probability = pd.crosstab(index=df['Product'],
columns='Count(in %)', normalize=True) * 100

print("Marginal Probability of Each Product :")
print()
print(marginal_probability)
```

Marginal Probability of Each Product :

col_0	Count(in %)
Product	
KP281	44.444444
KP481	33.333333
KP781	22.222222

## Probability of a Male customer buying a KP-718 Treadmill

```
# Finding the probability of a male customer buying a KP718 Treadmill

# No. of Male customers who bought the KP781 Treadmills
male_kp781_count = df[(df['Gender'] == 'Male') & (df['Product'] ==
'KP781')].shape[0]
```

```

print("No.of Males who bought KP781 Treadmill :", male_kp781_count)

# Total No.of Male customers who bought ANY Treadmills
total_male_count = df[df['Gender'] == 'Male'].shape[0]
print("Total No.of Males :", total_male_count)

# Probability of a male customer buying a KP781 treadmill
probability_male_kp781 = male_kp781_count / total_male_count
probability_male_kp781 = probability_male_kp781 * 100 # In Percentage
print()

print("Probability(in %) of a Male customer buying a KP781
Treadmill:", probability_male_kp781, "%")

No.of Males who bought KP781 Treadmill : 33
Total No.of Males : 104

Probability(in %) of a Male customer buying a KP781 Treadmill:
31.73076923076923 %

```

## Non-Graphical Analysis

```

# Non-Graphical Analysis
# Iterates over all columns and prints all unique values and lists
them

for col in df.columns:
    print(f"Column: {col}")
    print(df[col].value_counts())
    print("Unique values:", df[col].unique())
    print()

# Unique values and value counts for each column
unique_values_counts = {col: {'unique_values': df[col].unique(),
'value_counts': df[col].value_counts()} for col in df.columns}
print("Unique Values and Value Counts for Each Column:")
print(unique_values_counts)

Column: Product
KP281      80
KP481      60
KP781      40
Name: Product, dtype: int64
Unique values: ['KP281' 'KP481' 'KP781']

Column: Age
25      25
23      18
24      12

```

26	12
28	9
35	8
33	8
30	7
38	7
21	7
22	7
27	7
31	6
34	6
29	6
20	5
40	5
32	4
19	4
48	2
37	2
45	2
47	2
46	1
50	1
18	1
44	1
43	1
41	1
39	1
36	1
42	1

Name: Age, dtype: int64

Unique values: [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]

Column: Gender

Male 104

Female 76

Name: Gender, dtype: int64

Unique values: ['Male' 'Female']

Column: Education

16 85

14 55

18 23

15 5

13 5

12 3

21 3

20 1

Name: Education, dtype: int64  
Unique values: [14 15 12 13 16 18 20 21]

Column: MaritalStatus  
Partnered 107  
Single 73  
Name: MaritalStatus, dtype: int64  
Unique values: ['Single' 'Partnered']

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

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

Column: Income  
45480 14  
52302 9  
46617 8  
54576 8  
53439 8  
..  
65220 1  
55713 1  
68220 1  
30699 1  
95508 1  
Name: Income, Length: 62, dtype: int64  
Unique values: [ 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]

Column: Miles

85	27
95	12
66	10
75	10
47	9
106	9
94	8
113	8
53	7
100	7
180	6
200	6
56	6
64	6
127	5
160	5
42	4
150	4
38	3
74	3
170	3
120	3
103	3
132	2
141	2
280	1
260	1
300	1
240	1
112	1
212	1
80	1
140	1
21	1
169	1
188	1
360	1

Name: Miles, dtype: int64

Unique values: [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]

Unique Values and Value Counts for Each Column:

```
{'Product': {'unique_values': array(['KP281', 'KP481', 'KP781'],  
dtype=object), 'value_counts': KP281      80  
KP481      60  
KP781      60}}
```



```

KP781      40
Name: Product, dtype: int64}, 'Age': {'unique_values': 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]),
'value_counts': 25      25
23      18
24      12
26      12
28       9
35       8
33       8
30       7
38       7
21       7
22       7
27       7
31       6
34       6
29       6
20       5
40       5
32       4
19       4
48       2
37       2
45       2
47       2
46       1
50       1
18       1
44       1
43       1
41       1
39       1
36       1
42       1
Name: Age, dtype: int64}, 'Gender': {'unique_values': array(['Male',
'Female'], dtype=object), 'value_counts': Male      104
Female      76
Name: Gender, dtype: int64}, 'Education': {'unique_values': array([14,
15, 12, 13, 16, 18, 20, 21]), 'value_counts': 16      85
14      55
18      23
15       5
13       5
12       3
21       3
20       1
Name: Education, dtype: int64}, 'MaritalStatus': {'unique_values':

```

```

array(['Single', 'Partnered'], dtype=object), 'value_counts':
Partnered    107
Single       73
Name: MaritalStatus, dtype: int64}, 'Usage': {'unique_values':
array([3, 2, 4, 5, 6, 7]), 'value_counts': 3    69
4    52
2    33
5    17
6     7
7     2
Name: Usage, dtype: int64}, 'Fitness': {'unique_values': array([4, 3,
2, 1, 5]), 'value_counts': 3    97
5    31
2    26
4    24
1     2
Name: Fitness, dtype: int64}, 'Income': {'unique_values':
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]),
'value_counts': 45480    14
52302     9
46617     8
54576     8
53439     8
..
65220     1
55713     1
68220     1
30699     1
95508     1
Name: Income, Length: 62, dtype: int64}, 'Miles': {'unique_values':
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]),
'value_counts': 85    27
95    12
66    10
75    10
47     9
106     9
94     8

```

113	8
53	7
100	7
180	6
200	6
56	6
64	6
127	5
160	5
42	4
150	4
38	3
74	3
170	3
120	3
103	3
132	2
141	2
280	1
260	1
300	1
240	1
112	1
212	1
80	1
140	1
21	1
169	1
188	1
360	1

Name: Miles, dtype: int64}}

## General Comments/Observations

### Range of Attributes:

1. Has different attributes like age, gender, income, education, usage(per week), marital status, etc.
2. Age ranges from 18 to 48 yrs
3. Education ranges from 12 to 21 yrs
4. Usage(per week) ranges from 2 to 6
5. Income(in USD) ranges from 29,562 to 104,581
6. Fitness(level on a scale of 5) ranges from 2 to 5
7. No.of miles(per week) ranges from 47 to 200

## Distribution of Variables and Relationships:

1. There's a wide distribution across age, education and income ranges
2. There's direct correlation between income and no.of miles run per week. Greater the income, the more no.of miles were run in a week. Thus, it can be said that the wealthy focus a lot on physical health
3. Gender distribution is relatively balanced
4. Different people prefer different products

## Recommendations

### - KP218

1. Target both genders equally.
2. Prioritize customers who use the product 3 days/week.
3. Focus on Partnered customers.
4. Target customers with 16 years of education.

### - KP418

1. Target both genders equally.
2. Prioritize customers with 14-16 years of education.
3. Focus on Partnered customers.
4. Target customers with 16 years of education.

### - KP718

1. Focus on male customers.
2. Target customers with 18 years of education.
3. Prioritize customers who use the product 4 days/week.
4. Focus on Partnered customers.