Aerofit®

HELPING YOU FROM FIT-LESS TO FITNESS

SINCE 1986

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

df = pd.read_csv("aerofit_treadmill.txt")

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      }\n    },\n    {\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      }\n    },\n    {\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      }\
n    },\n    {\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      }\n    },\n    {\n      \"column\":
\"MaritalStatus\",\n      \"properties\": {\n        \"dtype\":
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[\n          \"Partnered\",\n          \"Single\"\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\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      }\
n    },\n    {\n      \"column\": \"Fitness\",\n      \"properties\":
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\"min\": 1,\n        \"max\": 5,\n        \"num_unique_values\": 5,\n
\"samples\": [\n          3,\n          5\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"Income\",\n      \"properties\":
{\n        \"dtype\": \"number\",\n        \"std\": 16506,\n
\"min\": 29562,\n        \"max\": 104581,\n
\"num_unique_values\": 62,\n        \"samples\": [\n          88396,\n
103336\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Miles\",\n      \"properties\": {\n        \"dtype\": \"number\",\n
\"std\": 51,\n        \"min\": 21,\n        \"max\": 360,\n
\"num_unique_values\": 37,\n        \"samples\": [\n          95,\n
169\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"df"}
```

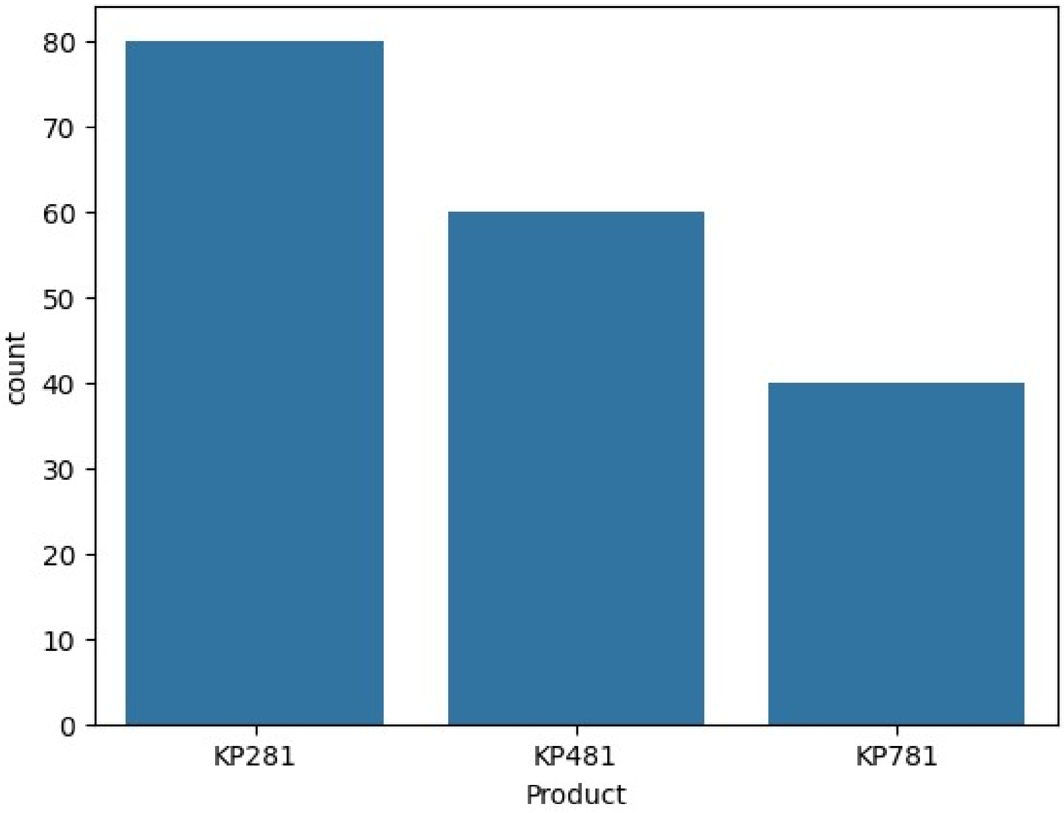
```
df["Product"].nunique()
```

```
3
```

```
df.groupby("Product")["Income"].mean()
```

```
Product
KP281    46418.025
KP481    48973.650
KP781    75441.575
Name: Income, dtype: float64
```

```
sns.countplot(data = df , x = "Product")
plt.show()
```



```
grouped_df = df.groupby("Product").agg(
    mean_age = ("Age" , "mean"),
    mean_education = ("Education" , "mean"),
    mean_fitness = ("Fitness" , "mean"),
    mean_income = ("Income" , "mean")
).reset_index()

grouped_df
```

```
{"summary":"{\n  \"name\": \"grouped_df\",\n  \"rows\": 3,\n
\"fields\": [\n    {\n      \"column\": \"Product\",\n
\"properties\": {\n        \"dtype\": \"string\",\n
\"num_unique_values\": 3,\n        \"samples\": [\n
\"KP281\",\n          \"KP481\",\n          \"KP781\"\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"mean_age\",\n      \"properties\":
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\"num_unique_values\": 3,\n        \"samples\": [\n          28.55,\n
28.9,\n          29.1\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
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15.0375,\n        \"max\": 17.325,\n        \"num_unique_values\": 3,\
n        \"samples\": [\n          15.0375,\n
15.116666666666667,\n          17.325\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"mean_fitness\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
0.9783862137894899,\n        \"min\": 2.9,\n        \"max\": 4.625,\n
\"num_unique_values\": 3,\n        \"samples\": [\n          2.9625,\n
2.9,\n          4.625\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"mean_income\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 16069.892799625586,\n        \"min\":
46418.025,\n        \"max\": 75441.575,\n
\"num_unique_values\": 3,\n        \"samples\": [\n
46418.025,\n          48973.65,\n          75441.575\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    }\n  ]\n}","type":"dataframe","variable_name":"grouped_df"}
```
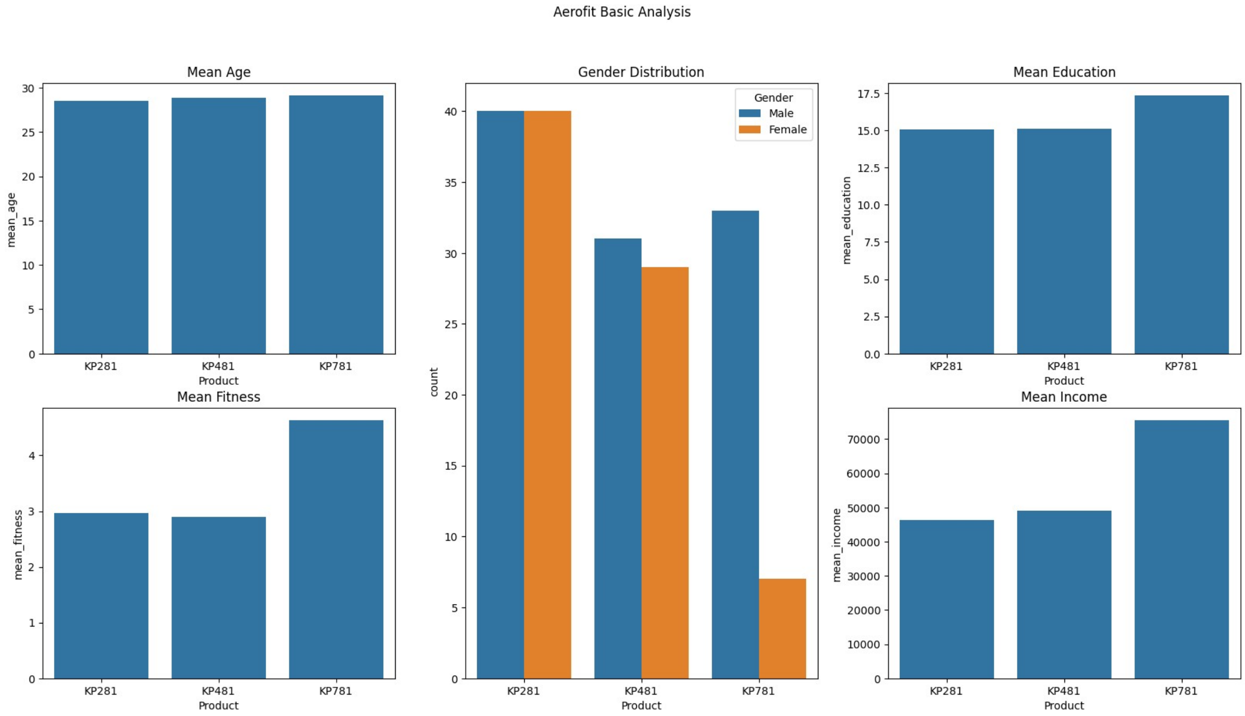
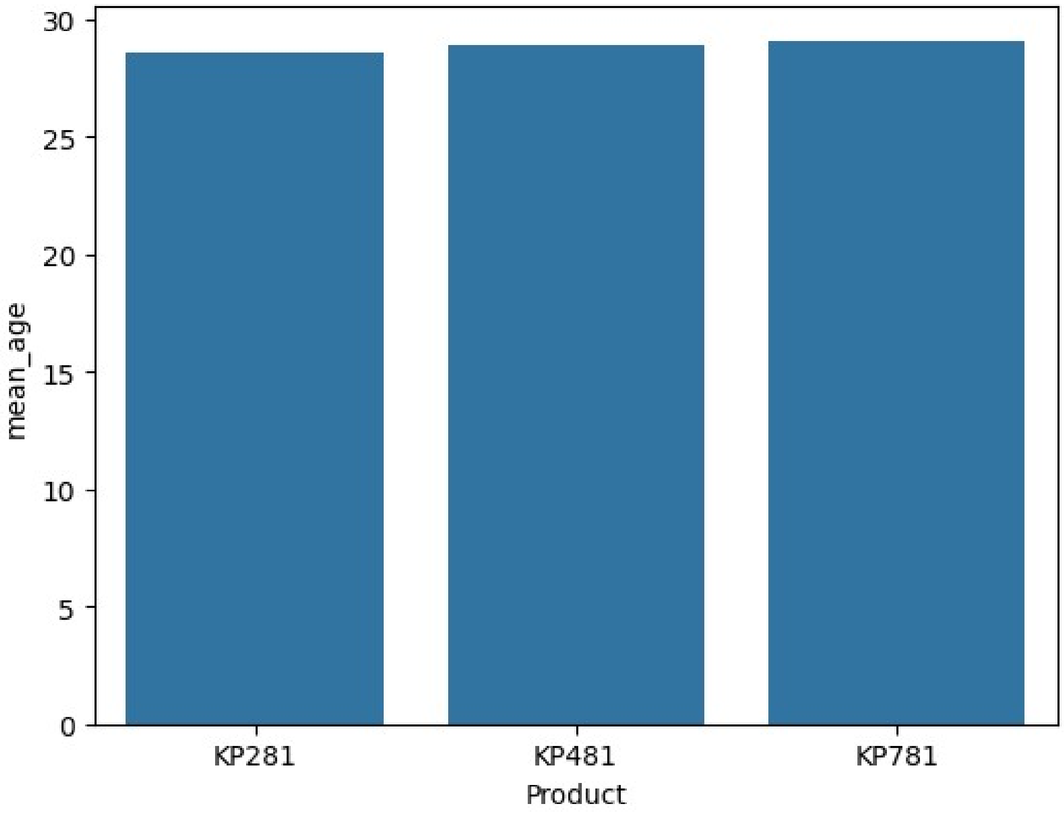

```
plt.figure(figsize = (20, 10)).suptitle("Aerofit Basic Analysis")

plt.subplot(2, 3, 1)
sns.barplot(data = grouped_df , x = "Product" , y = "mean_age")
plt.title("Mean Age")

plt.subplot(2, 3, 3)
sns.barplot(data = grouped_df , x = "Product" , y = "mean_education")
plt.title("Mean Education")

plt.subplot(2, 3, 4)
sns.barplot(data = grouped_df , x = "Product" , y = "mean_fitness")
plt.title("Mean Fitness")

plt.subplot(2, 3, 6)
sns.barplot(data = grouped_df , x = "Product" , y = "mean_income")
plt.title("Mean Income")

plt.subplot(1, 3, 2)
sns.countplot(data = df , x = "Product" , hue = "Gender")
plt.title("Gender Distribution")

plt.show()
```



```
sns.barplot(data = grouped_df , x = "Product" , y = "mean_age")
```

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



```
age_crosstab = pd.crosstab(index = df["Product"] , columns =
df["Gender"])

age_crosstab
```

```
{"summary":"{\n  \"name\": \"age_crosstab\",\n  \"rows\": 3,\n
\"fields\": [\n    {\n      \"column\": \"Product\",\n
\"properties\": {\n        \"dtype\": \"string\",\n
\"num_unique_values\": 3,\n        \"samples\": [\n
\"KP281\",\n          \"KP481\",\n          \"KP781\"\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"Female\",\n      \"properties\":
{\n        \"dtype\": \"number\",\n        \"std\": 16,\n
\"min\": 7,\n        \"max\": 40,\n        \"num_unique_values\": 3,\n
\"samples\": [\n          40,\n          29,\n          7\n        ],\
n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"Male\",\n      \"properties\":
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\"min\": 31,\n        \"max\": 40,\n        \"num_unique_values\": 3,\
n        \"samples\": [\n          40,\n          31,\n          33\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    }\n  ]\n}","type":"dataframe","variable_name":"age_crosstab"}
```
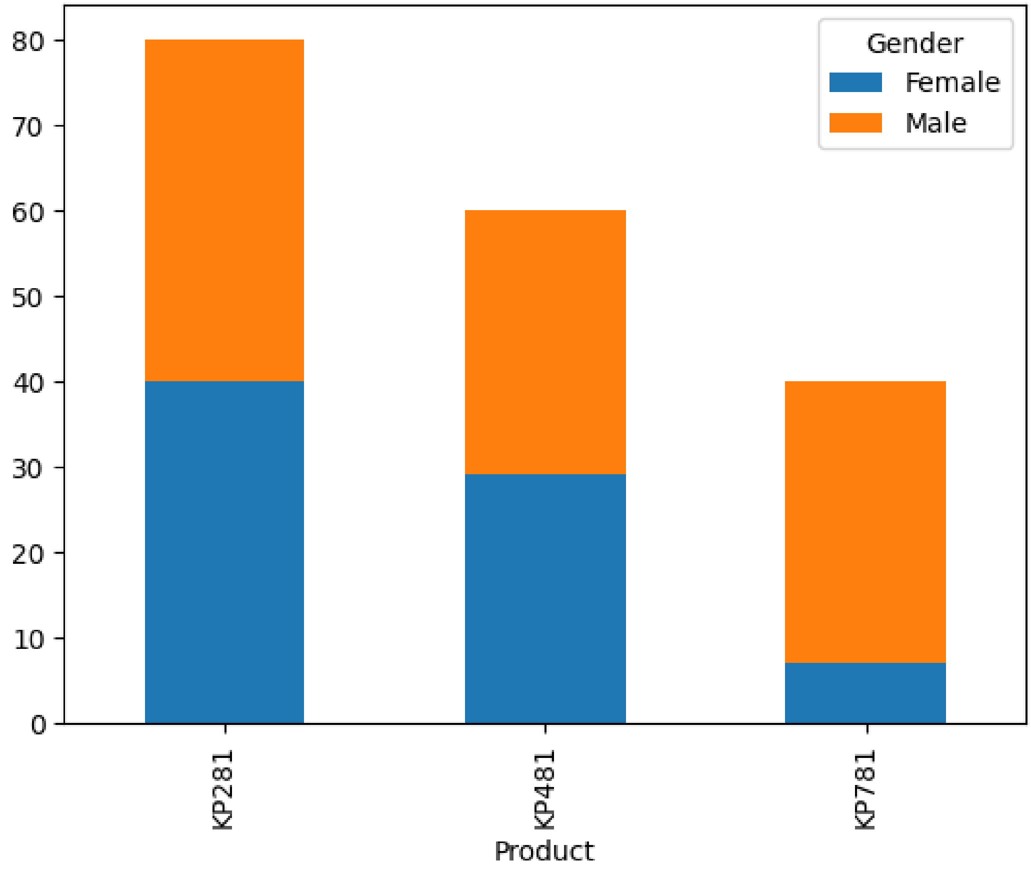
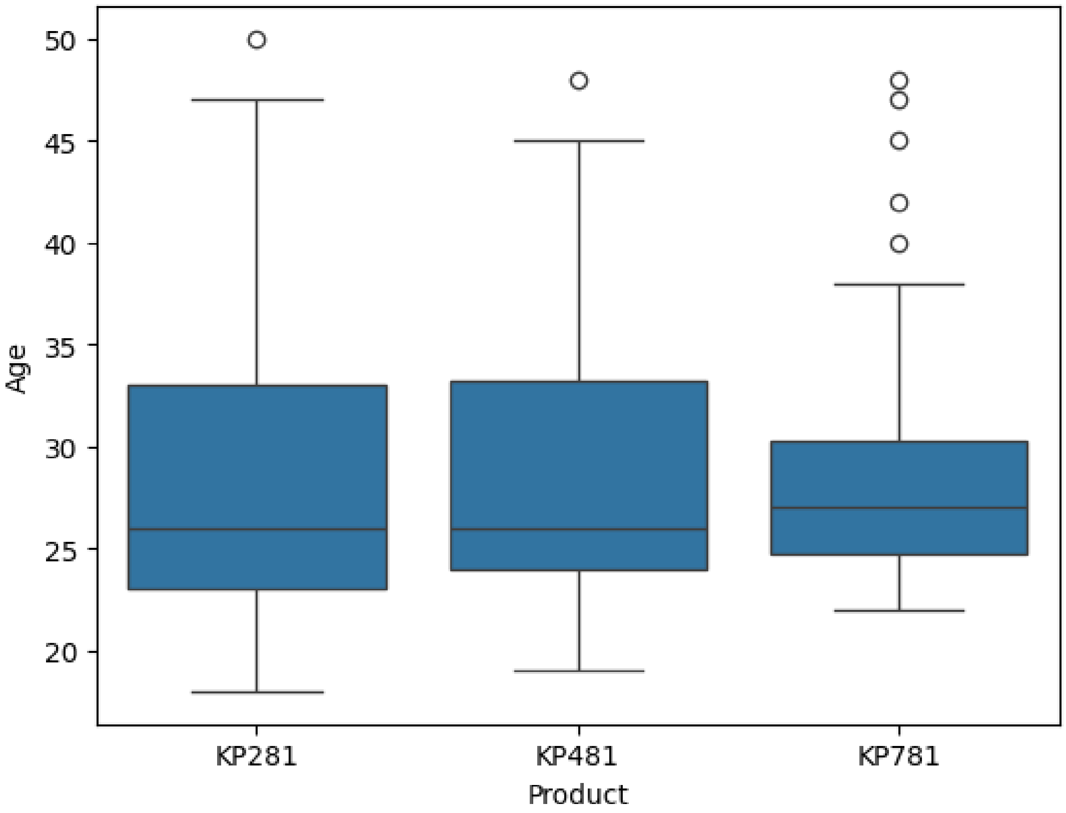

```
# prompt: Using dataframe age_crosstab: barplot
```

```
age_crosstab.plot(kind = "bar" , stacked = True)
1

1
```

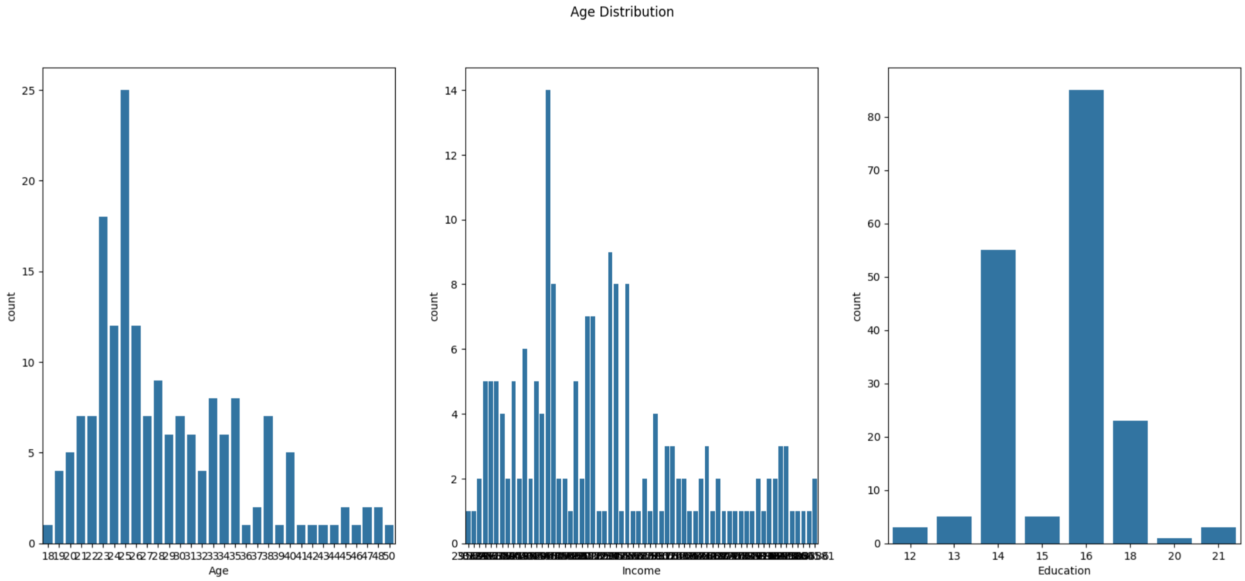


```
sns.boxplot(data = df , y = "Age" , x = "Product")

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



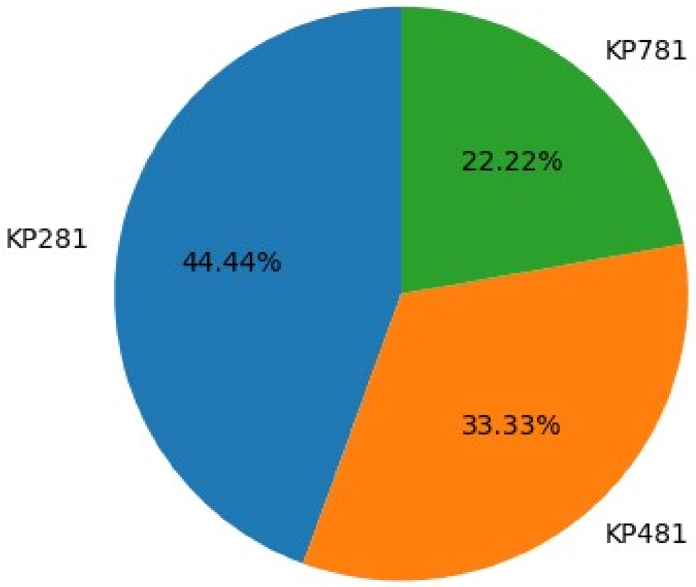
```
plt.figure(figsize = (20, 8)).suptitle("Age Distribution")


plt.subplot(1,3,1)
sns.countplot(data = df , x = "Age")

plt.subplot(1,3,2)
sns.countplot(data = df , x = "Income")

plt.subplot(1,3,3)
sns.countplot(data = df , x = "Education")
```

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



Pie Chart for sale of different product caterogy

```
piechart = df["Product"].value_counts()

piechart

Product
KP281    80
KP481    60
KP781    40
Name: count, dtype: int64

plt.pie(piechart , labels = piechart.index , autopct = "%.2f%%" ,
startangle = 90)
plt.xlabel("Product Category Sales Percentage")
plt.show()
```



Product Category Sales Percentage

```
df.head()
```

```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 180,\n  \"fields\": [\
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\"KP781\"\n        ],\n        \"semantic_type\": \"\",\n
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\"num_unique_values\": 32,\n        \"samples\": [\n          45,\n
33,\n          43\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\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      }\
n    },\n    {\n      \"column\": \"Education\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
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18\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\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      }\
n    },\n    {\n      \"column\": \"Usage\",\n      \"properties\": {\
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2,\n        \"max\": 7,\n        \"num_unique_values\": 6,\n
\"samples\": [\n          3,\n          2\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"Fitness\",\n      \"properties\":
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\"min\": 1,\n        \"max\": 5,\n        \"num_unique_values\": 5,\n
\"samples\": [\n          3,\n          5\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"Income\",\n      \"properties\":
{\n        \"dtype\": \"number\",\n        \"std\": 16506,\n
\"min\": 29562,\n        \"max\": 104581,\n
\"num_unique_values\": 62,\n        \"samples\": [\n          88396,\n
103336\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Miles\",\n      \"properties\": {\n        \"dtype\": \"number\",\n
\"std\": 51,\n        \"min\": 21,\n        \"max\": 360,\n
\"num_unique_values\": 37,\n        \"samples\": [\n          95,\n
169\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"df"}
```

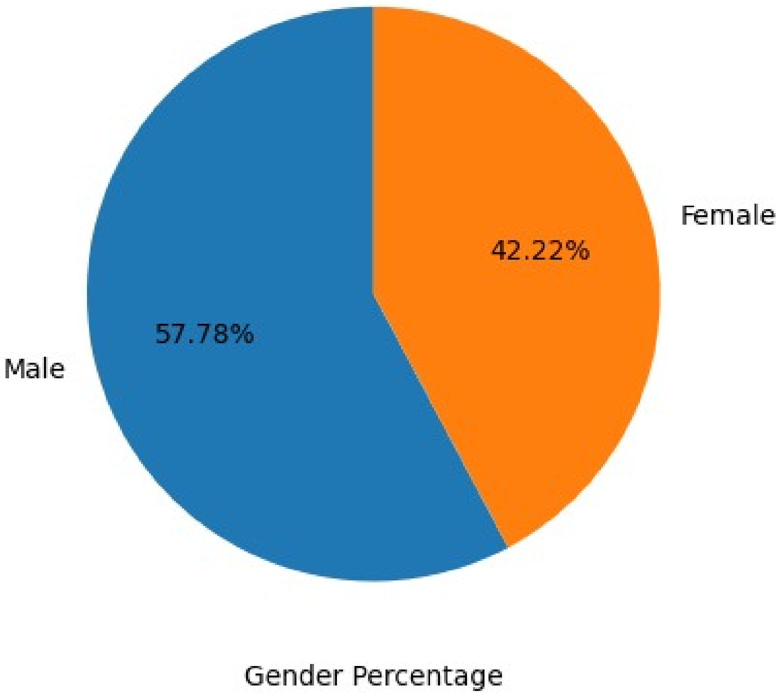
```
df["Fitness"].agg(["min" , "max"])
```

```
min    1
max    5
Name: Fitness, dtype: int64
```

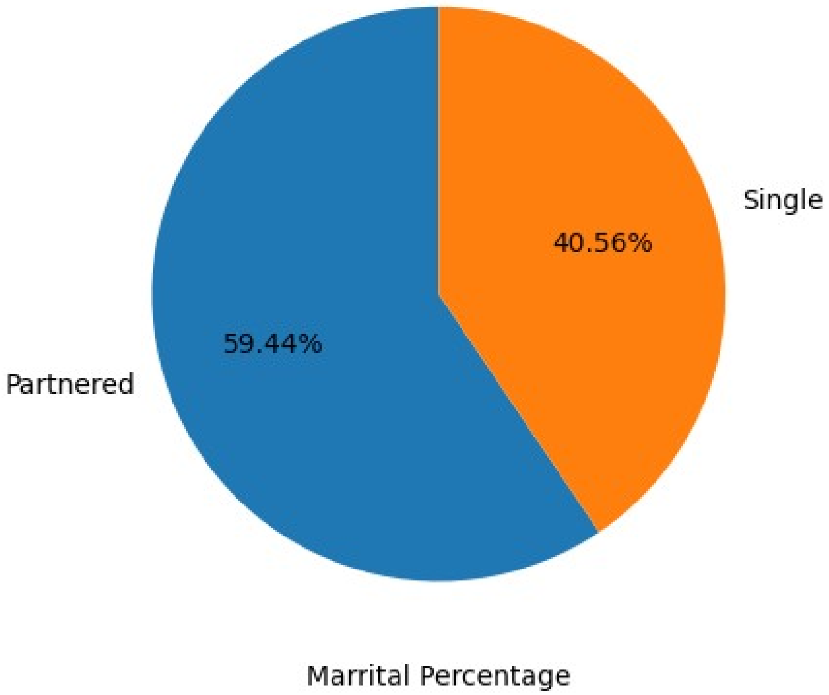
```
mar = df["MaritalStatus"].value_counts()
```

```
gender = df["Gender"].value_counts()
```

```
plt.pie(gender , labels = gender.index , autopct = "%.2f%%" ,
startangle = 90)
plt.xlabel("Gender Percentage")
plt.show()
```



```
plt.pie(mar , labels = mar.index , autopct = "%.2f%%" , startangle =
90)
plt.xlabel("Marrital Percentage")
plt.show()
```



```
df.head()
```

```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 180,\n  \"fields\": [\
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\"samples\": [\n          \"KP281\",\n          \"KP481\",\n
\"KP781\"\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\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      }\n    },\n    {\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      }\
n    },\n    {\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      }\n    },\n    {\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      }\
n    },\n    {\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      }\
n    },\n    {\n      \"column\": \"Fitness\",\n      \"properties\":
{\n        \"dtype\": \"number\",\n        \"std\": 0,\n
\"min\": 1,\n        \"max\": 5,\n        \"num_unique_values\": 5,\n
\"samples\": [\n          3,\n          5\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"Income\",\n      \"properties\":
{\n        \"dtype\": \"number\",\n        \"std\": 16506,\n
\"min\": 29562,\n        \"max\": 104581,\n
\"num_unique_values\": 62,\n        \"samples\": [\n          88396,\n
103336\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Miles\",\n      \"properties\": {\n        \"dtype\": \"number\",\n
\"std\": 51,\n        \"min\": 21,\n        \"max\": 360,\n
\"num_unique_values\": 37,\n        \"samples\": [\n          95,\n
169\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"df"}
```
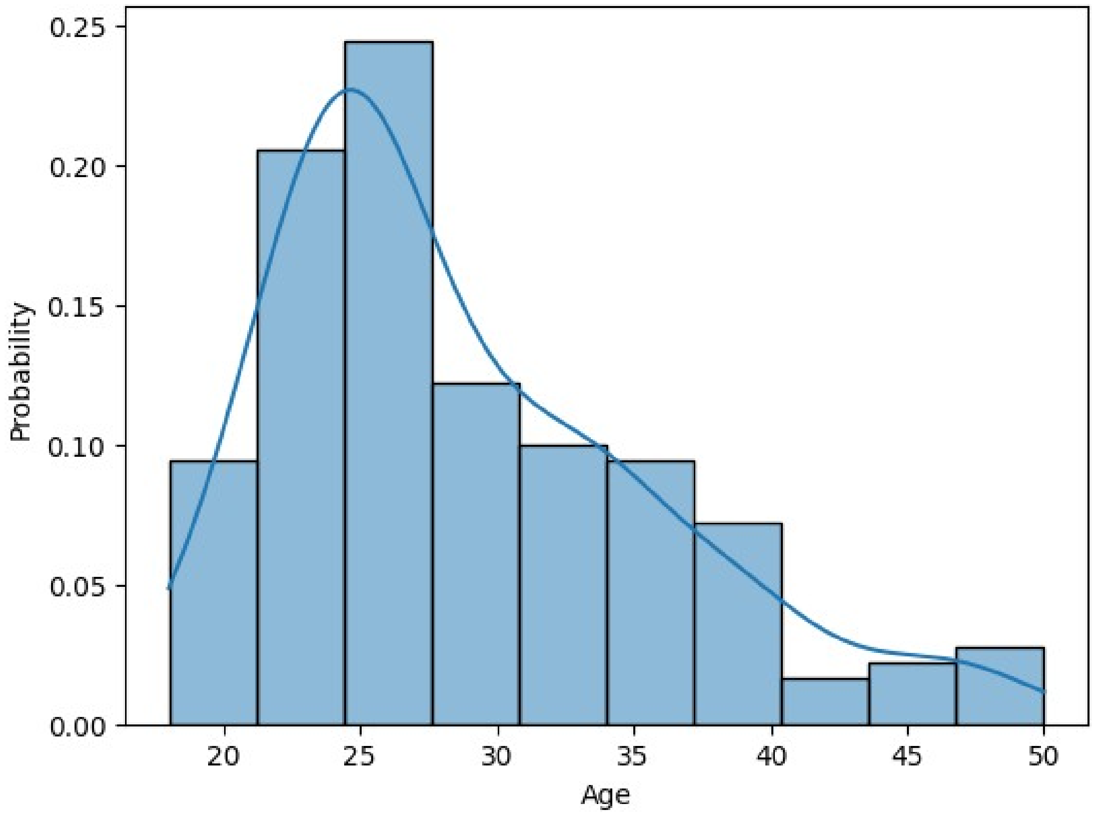
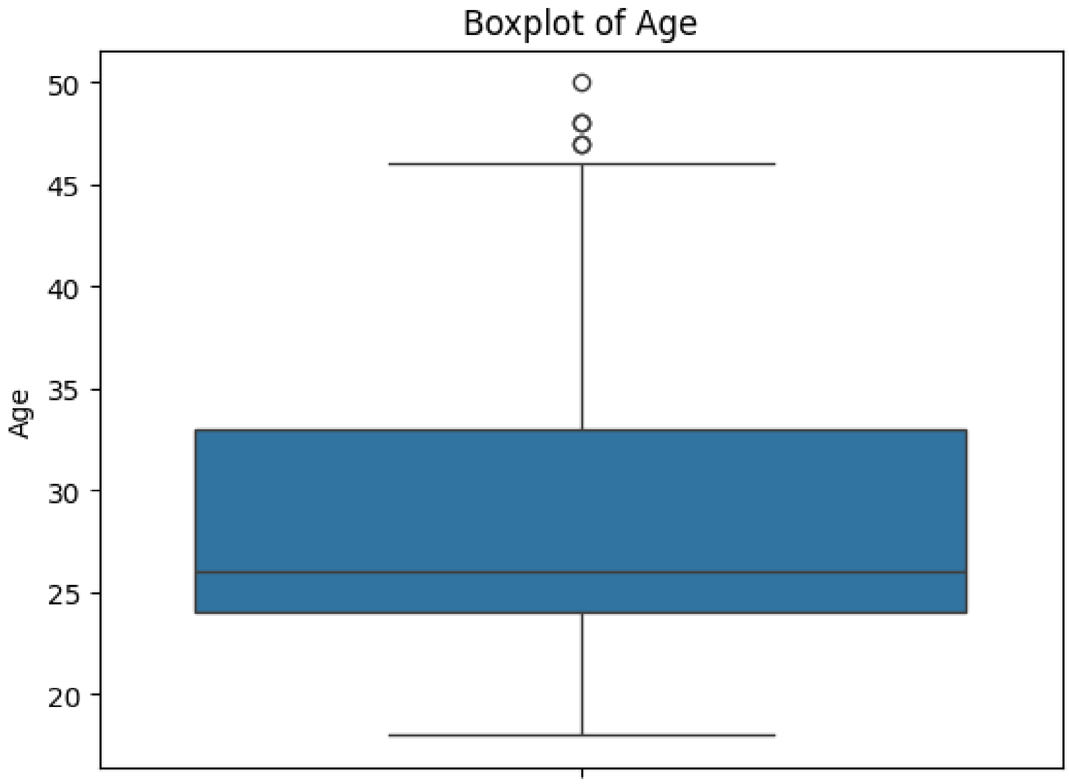
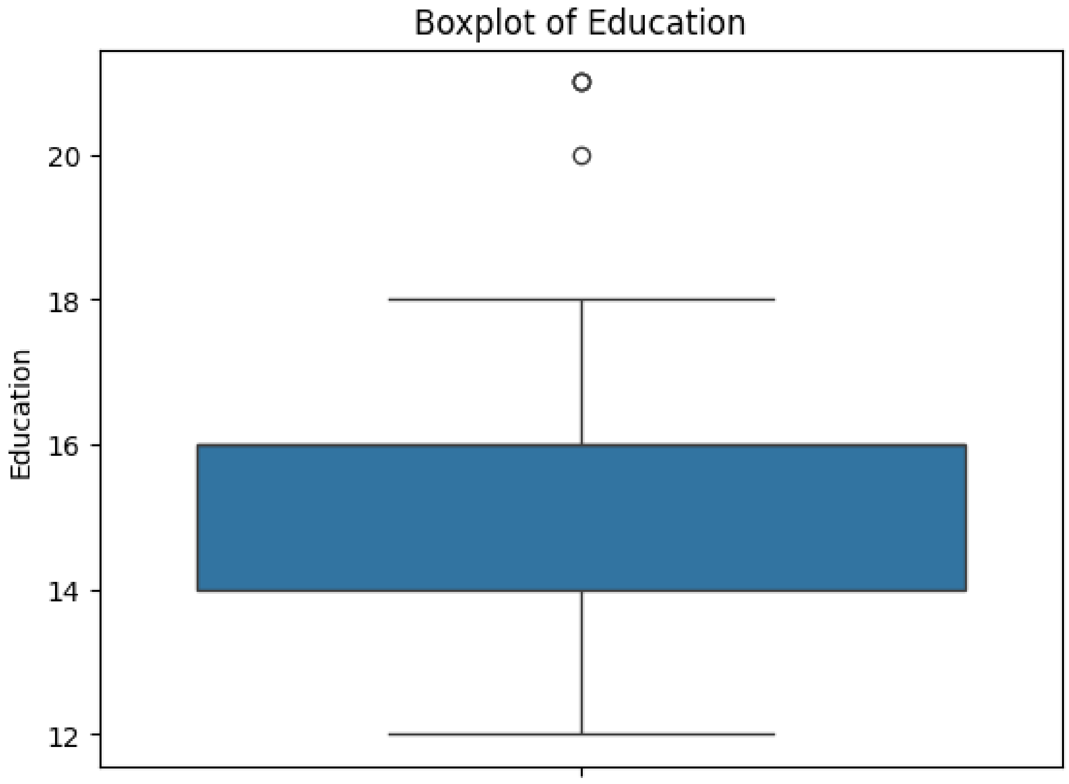

```python
sns.histplot(df["Age"] ,bins = 10 , stat = "probability" , kde = True)
```

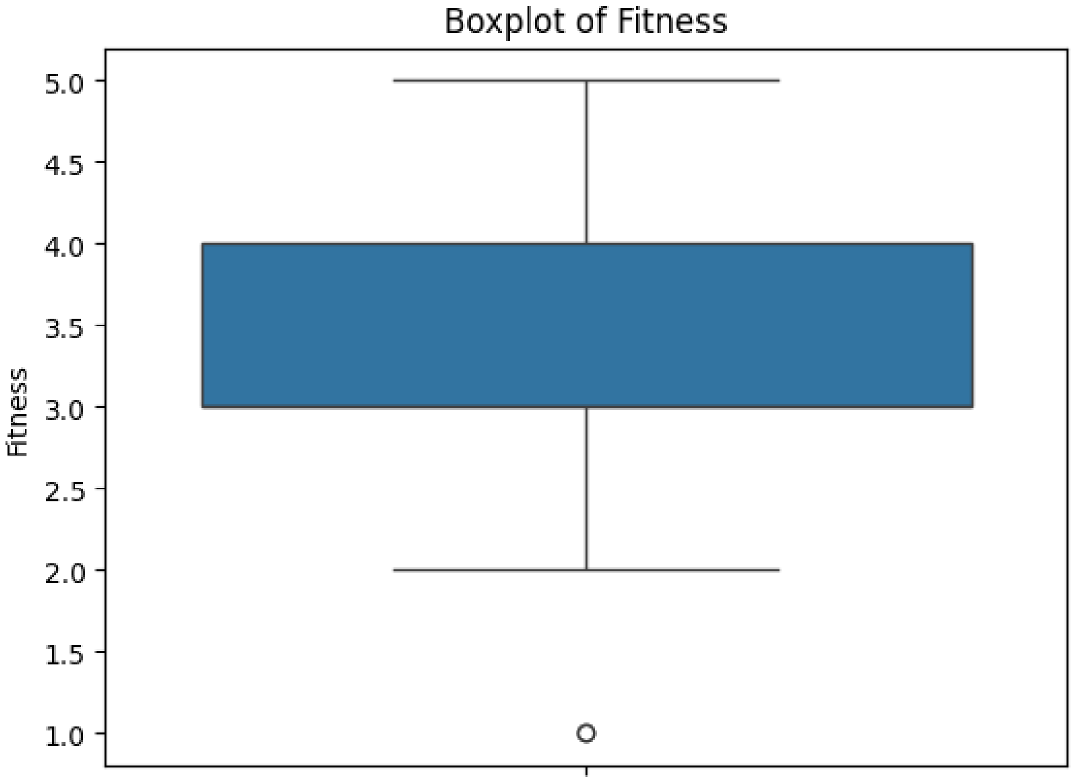
```
<Axes: xlabel='Age', ylabel='Probability'>
```

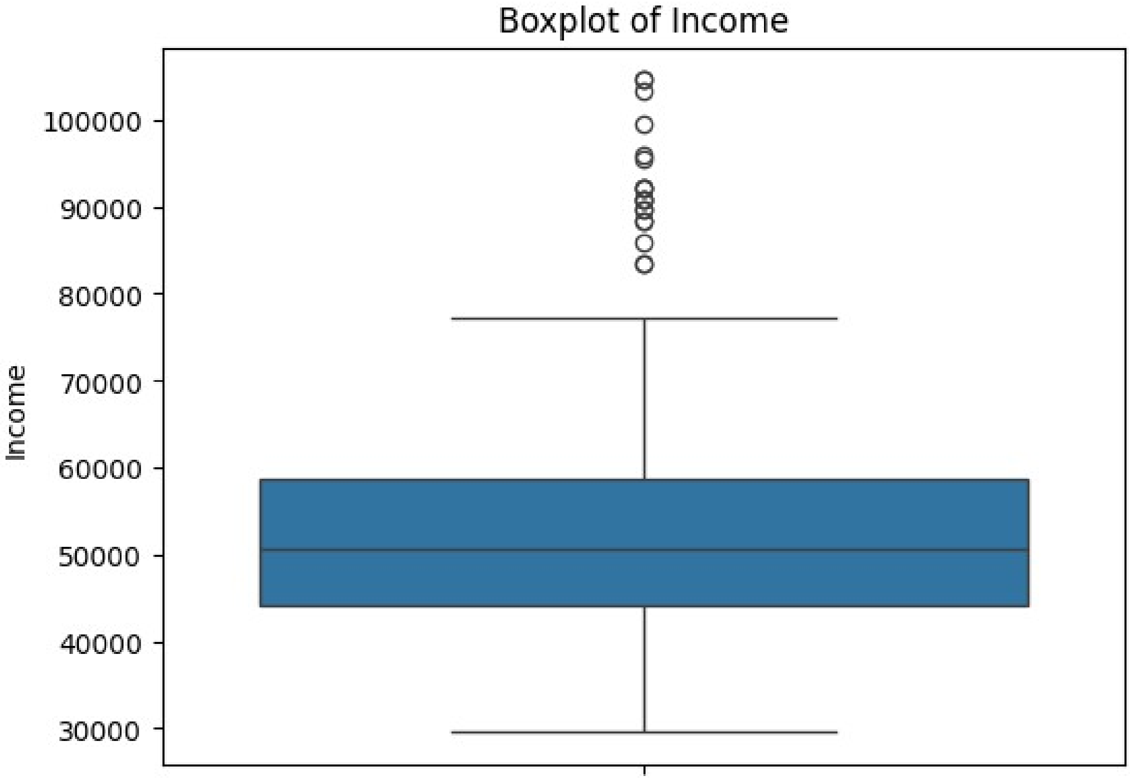


```
df1 = df[["Age" , "Education" , "Fitness" , "Income"]]

for col in df1.columns:
    plt.figure()  # Create a new figure for each plot
    sns.boxplot(data=df, y=col)
    plt.title(f"Boxplot of {col}")
    plt.show()
```


Boxplot of Age
Age
50
45
40
35
30
25
20

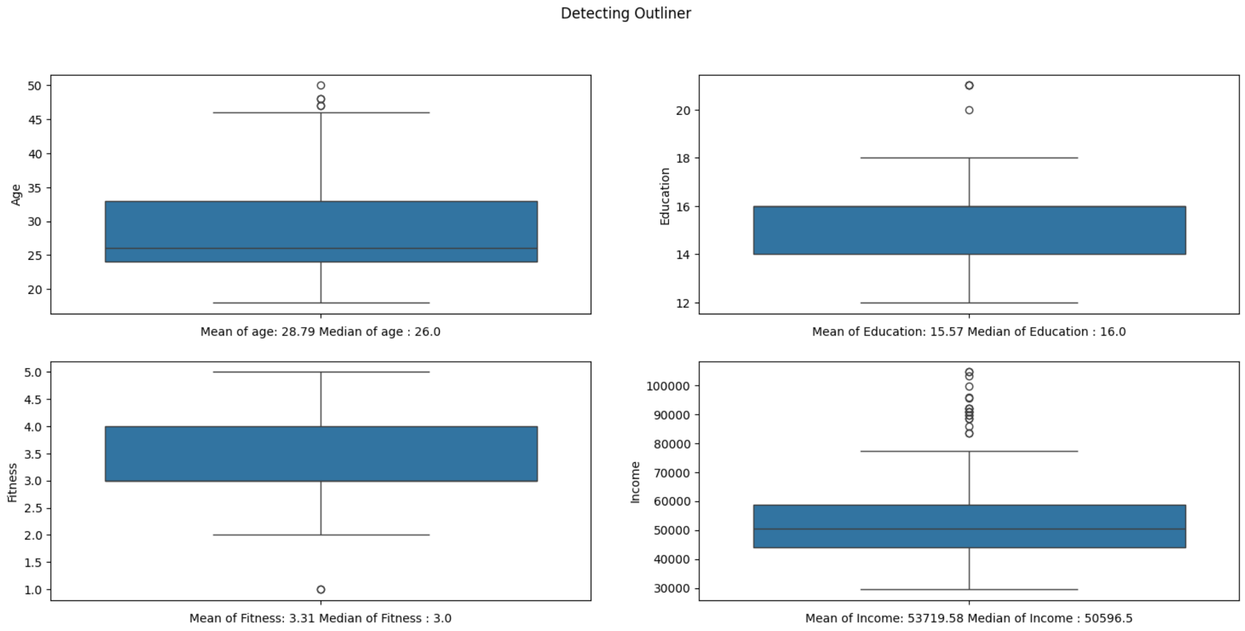

Boxplot of Education
Education
20
18
16
14
12


Boxplot of Fitness
Fitness
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0


Boxplot of Income
Income
100000
90000
80000
70000
60000
50000
40000
30000

```
plt.figure(figsize = (18,8)).suptitle("Detecting Outliner")

plt.subplot(2,2,1)
sns.boxplot(data = df["Age"])
plt.xlabel(f"Mean of age: {df['Age'].mean():.2f} Median of age : 
{df['Age'].median()}")

plt.subplot(2,2,2)
sns.boxplot(data = df["Education"])
plt.xlabel(f"Mean of Education: {df['Education'].mean():.2f} Median of 
Education : {df['Education'].median()}")

plt.subplot(2,2,3)
sns.boxplot(data = df["Fitness"])
plt.xlabel(f"Mean of Fitness: {df['Fitness'].mean():.2f} Median of 
Fitness : {df['Fitness'].median()}")

plt.subplot(2,2,4)
sns.boxplot(data = df["Income"])
plt.xlabel(f"Mean of Income: {df['Income'].mean():.2f} Median of 
Income : {df['Income'].median()}")
```

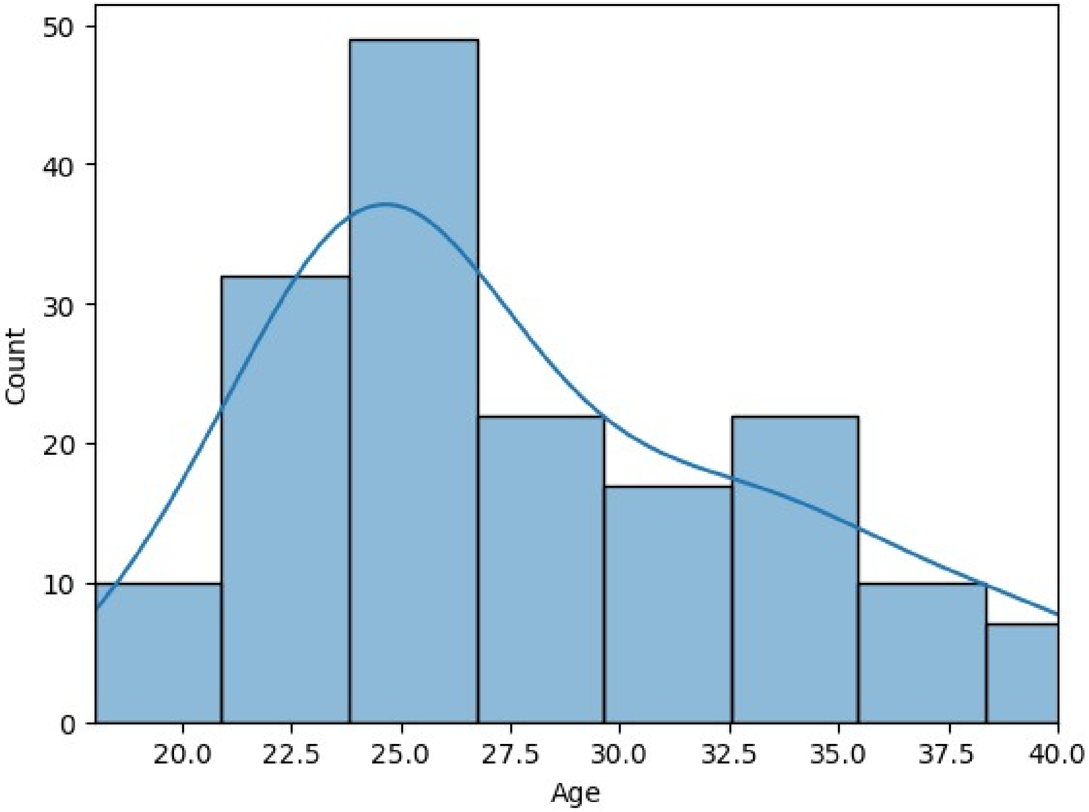
```
Text(0.5, 0, 'Mean of Income: 53719.58 Median of Income : 50596.5')
```



```
sns.histplot(df["Age"] , kde = True)
plt.xlim(18,40)

mu = df["Age"].mean()
std = df["Age"].std()
```

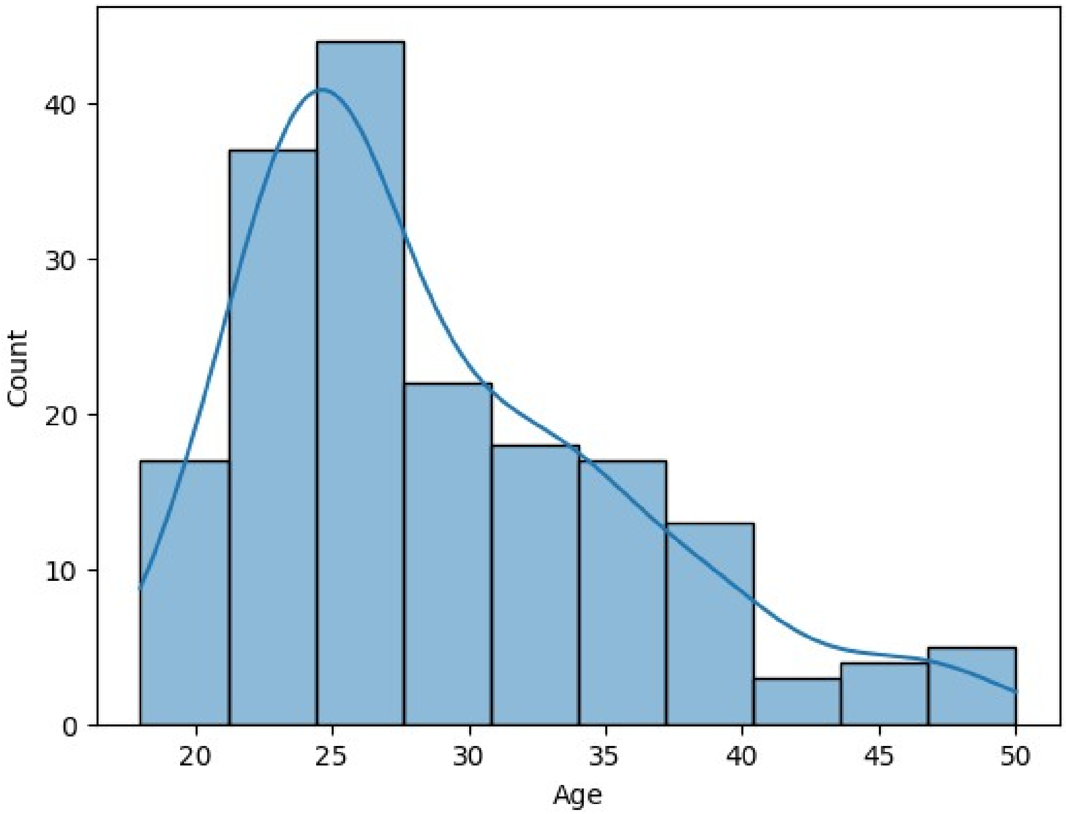
```
print(f"Mean --> {mu:.2f}\nStd. Devaition --> {std:.2f}")
```

```
Mean --> 28.79
Std. Devaition --> 6.94
```

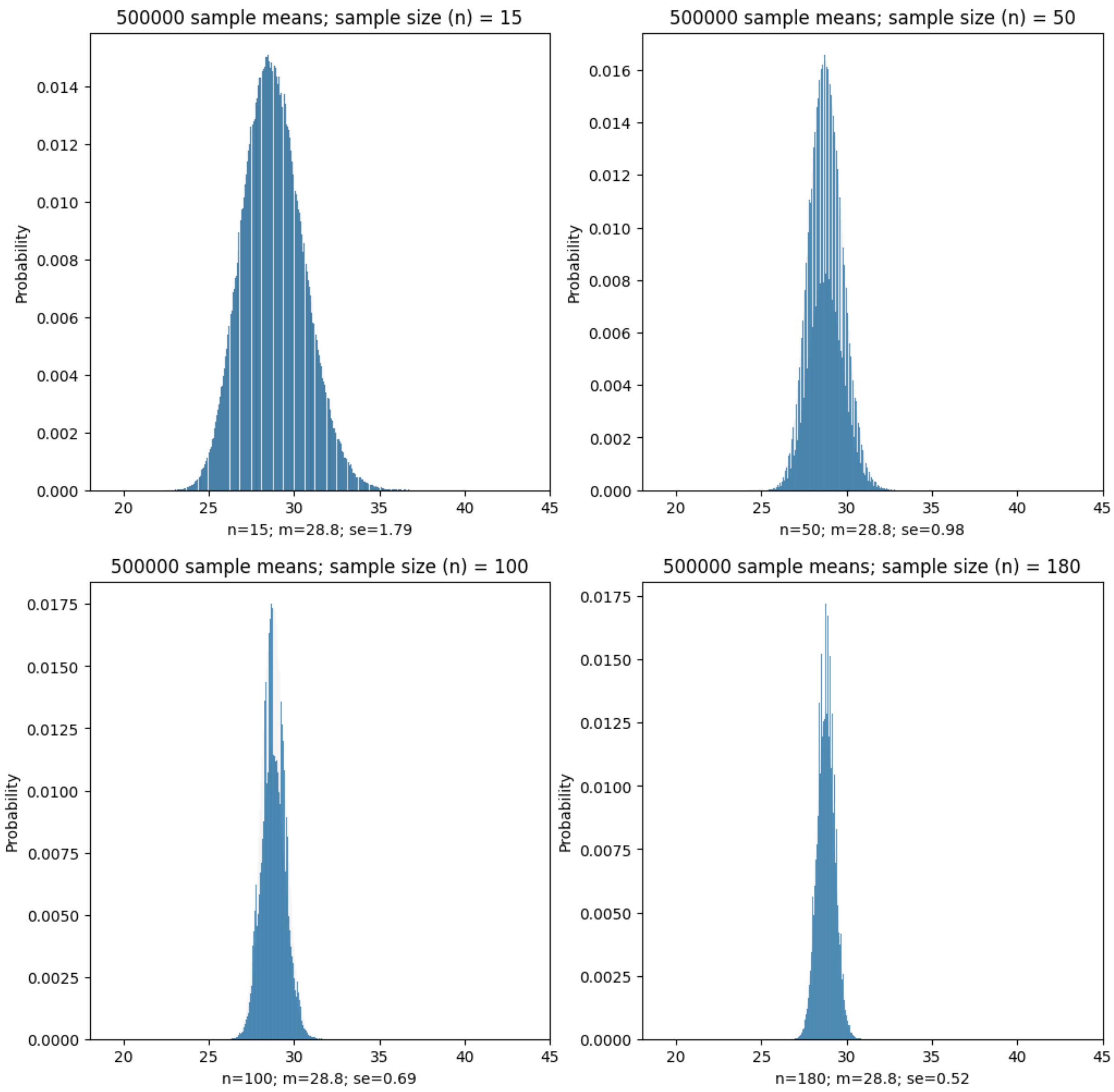


```
sns.histplot(df["Age"] , bins = 10 , kde = True)
```

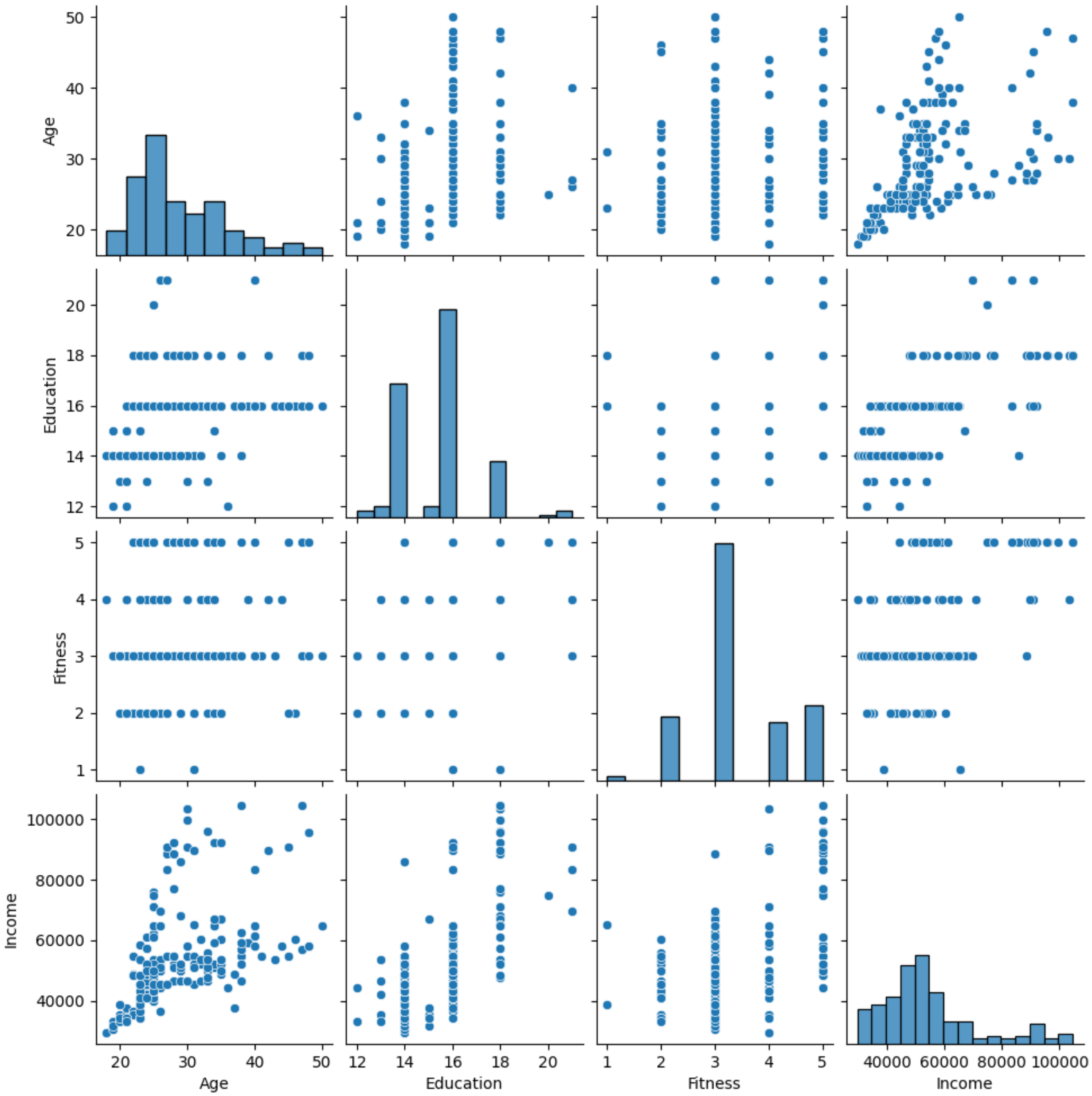
```
<Axes: xlabel='Age', ylabel='Count'>
```



```
no_of_samples = 500000

pop_data = df['Age']

plt.figure(figsize=(12,12))
subplot_no = 1
for n in [15, 50, 100 , 180]:
  new_sample = np.random.choice(a=pop_data, size=(no_of_samples,n))
#(rows,cols)
  sample_means = new_sample.mean(axis=1)

  plt.subplot(2,2,subplot_no)
  plt.title(f"{no_of_samples} sample means; sample size (n) = {n}")
  plt.xlim(18,45)
  #plt.xlabel(f"'Mean' of sample means={sample_means.mean():.1f}")
  plt.xlabel(f"n={n}; m={sample_means.mean():.1f};
se={sample_means.std():.2f}")
  sns.histplot(x=sample_means, stat="probability")

  subplot_no += 1
```

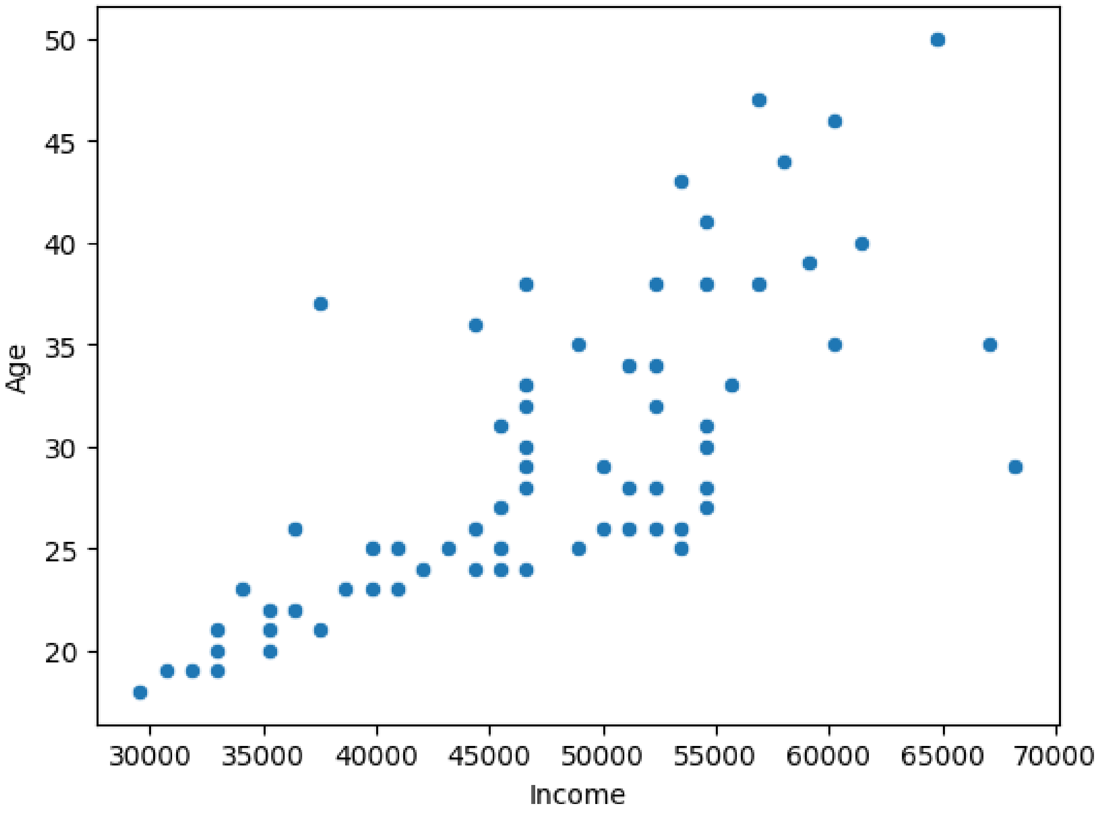


```
df_1 = df[df["Product"] == "KP281"]

plt.figure(figsize = (10,5))
sns.pairplot(data = df1)

<seaborn.axisgrid.PairGrid at 0x7ca813a26860>

<Figure size 1000x500 with 0 Axes>
```



```
sns.scatterplot(data = df_1 , x = df_1["Income"] , y = df_1["Age"])
```

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



```
len(df)

180

mu = df_1["Age"].mean()
inc = df_1["Income"].mean()

M = (df_1[df_1["Gender"] == "Male"]["Gender"].count()/180)*100
#percentage of male buying KP281
m_a = df_1[(df_1["Gender"] == "Male") & (df_1["Age"] > mu)]
["Gender"].count()/len(df)*100 #percentage of buyer that are male
above mean age
m_a_i = df_1[(df_1["Gender"] == "Male") & (df_1["Age"] > mu) &
(df_1["Income"] > inc)]["Gender"].count()/len(df)*100 #percentage of
buyer that are male above mean age and above mean salary
A = (df_1[df_1["Age"] > mu]["Age"].count()/len(df))*100 #percentage of
buyer above 28 year.

print(f"percentage of male buying KP281 ---> {M:.2f}")
print(f"percentage of buyer that are male above mean age --->
{m_a:.2f}")
print(f"percentage of buyer that are male above mean age and above
mean salary ---> {m_a_i:.2f}")
print(f"percentage of buyer above 28 year ---> {A:.2f}")
```

```
percentage of male buying KP281 ---> 22.22
percentage of buyer that are male above mean age ---> 8.89
percentage of buyer that are male above mean age and above mean salary
---> 8.33
percentage of buyer above 28 year ---> 16.67
```

```python
df_1[(df_1["Gender"] == "male") & (df_1["Age"] > mu)]
["Gender"].count()
```

```
0
```

```python
male = df_1[df["Gender"] == "Male"]
```

```
<ipython-input-48-454167ca03ca>:1: UserWarning: Boolean Series key
will be reindexed to match DataFrame index.
  male = df_1[df["Gender"] == "Male"]
```

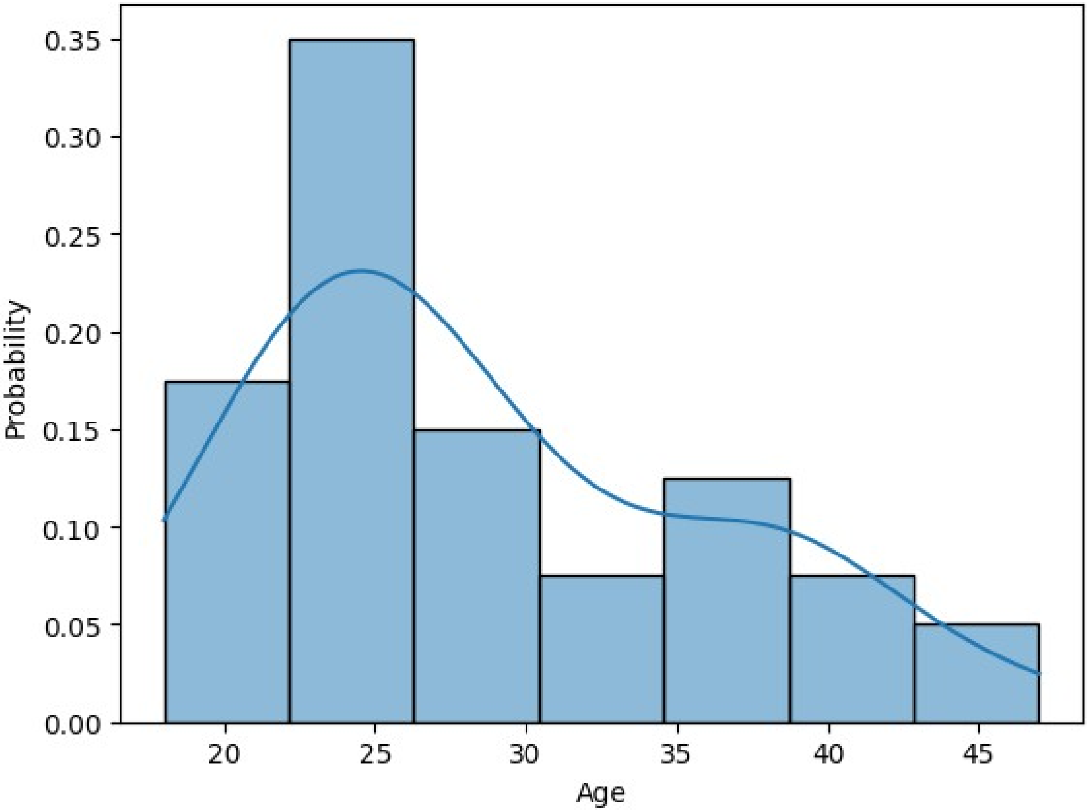
```python
male["Age"].value_counts()
```

```
Age
23    5
26    4
25    3
38    3
30    2
21    2
24    2
28    2
19    2
35    1
43    1
41    1
40    1
39    1
36    1
18    1
34    1
32    1
31    1
29    1
27    1
22    1
20    1
47    1
Name: count, dtype: int64
```

```python
sns.histplot(data =male , x = "Age" , stat="probability" , kde = True)
```

```python
mu = male["Age"].mean()
std = male["Age"].std()
```

```
print(f"Mean --> {mu:.2f}\nStd. Devaition --> {std:.2f}")

Mean --> 28.65
Std. Devaition --> 7.42
```

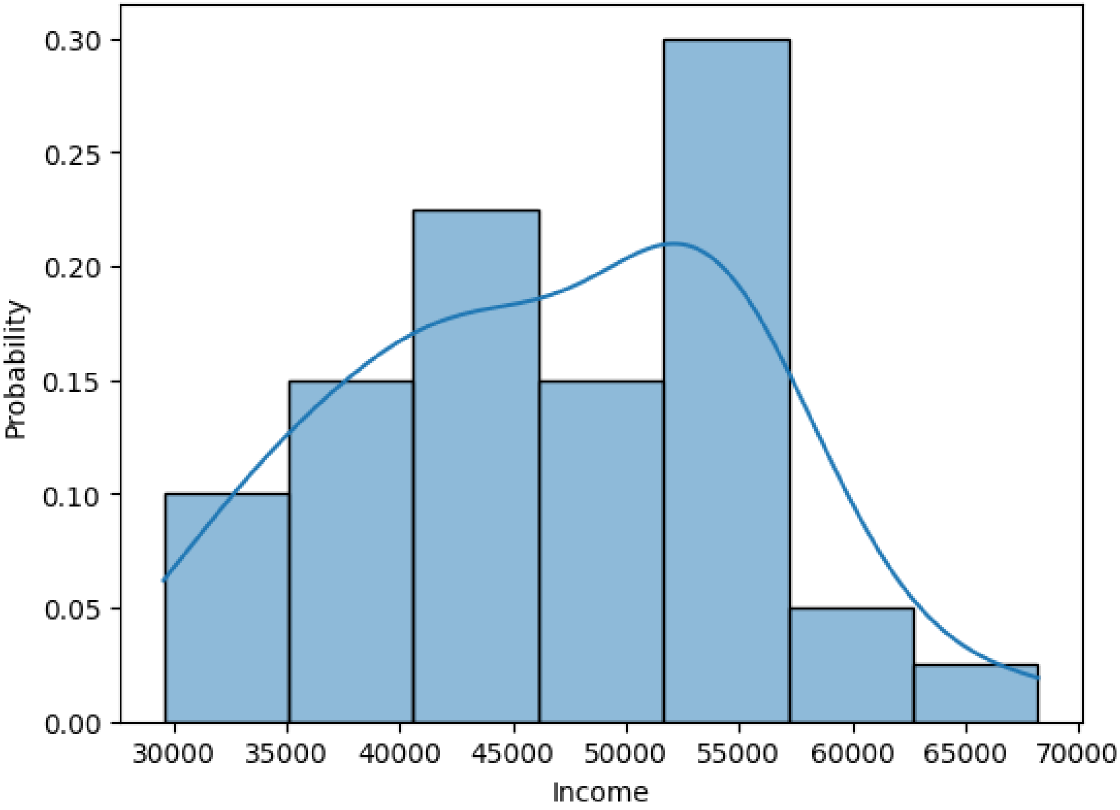


```
male["Age"].mode()

0    23
Name: Age, dtype: int64

male[(male["Age"] <= 27) &(male["Income"]>47000)].shape

(4, 9)
```

Income

```
sns.histplot(data =male , x = "Income" , stat="probability" , kde =
True)

mu = male["Income"].mean()
me = male["Income"].median()
std = male["Income"].std()
```

```
print(f"Mean --> {mu:.2f}\nStd. Devaition --> {std:.2f}\nMedian -->
{me:.2f}")

Mean --> 46815.97
Std. Devaition --> 9022.41
Median --> 46617.00
```



For KP281

Male Caculation

```
male = df_1[df_1["Gender"] == "Male"]["Gender"].count()
m_ag = df_1[(df_1["Gender"] == "Male") & (df_1["Age"]>27)]
["Gender"].count()
m_al = df_1[(df_1["Gender"] == "Male") & (df_1["Age"]<=27)]
["Gender"].count()
m_al_ig = df_1[(df_1["Gender"] == "Male") & (df_1["Age"]<=27) &
(df_1["Income"] > 47000)]["Gender"].count()
m_al_il = df_1[(df_1["Gender"] == "Male") & (df_1["Age"]<=27) &
(df_1["Income"] <= 47000)]["Gender"].count()

print(f"percentage of male : {male/len(df_1)*100:.2f}")
print(f"percentage of male above 27 : {(m_ag/male)*100:.2f}")
print(f"percentage of male below 27 : {(m_al/male)*100:.2f}")
print(f"percentage of male below 27 and income above 47000 :
{(m_al_ig/m_al)*100:.2f}")
print(f"percentage of male below 27 and income below 47000 :
{(m_al_il/m_al)*100:.2f}")

percentage of male : 50.00
percentage of male above 27 : 45.00
percentage of male below 27 : 55.00
percentage of male below 27 and income above 47000 : 18.18
percentage of male below 27 and income below 47000 : 81.82
```

Female calulation

```
male = df_1[df_1["Gender"] == "Female"]["Gender"].count()
m_ag = df_1[(df_1["Gender"] == "Female") & (df_1["Age"]>27)]
["Gender"].count()
m_al = df_1[(df_1["Gender"] == "Female") & (df_1["Age"]<=27)]
["Gender"].count()
m_al_ig = df_1[(df_1["Gender"] == "Female") & (df_1["Age"]<=27) &
(df_1["Income"] > 47000)]["Gender"].count()
m_al_il = df_1[(df_1["Gender"] == "Female") & (df_1["Age"]<=27) &
(df_1["Income"] <= 47000)]["Gender"].count()

print(f"percentage of Female : {male/len(df_1)*100:.2f}")
print(f"percentage of Female above 27 : {(m_ag/male)*100:.2f}")
print(f"percentage of Female below 27 : {(m_al/male)*100:.2f}")
print(f"percentage of Female below 27 and above 47000 :
{(m_al_ig/m_al)*100:.2f}")
print(f"percentage of Female below 27 and below 47000 :
{(m_al_il/m_al)*100:.2f}")

percentage of Female : 50.00
percentage of Female above 27 : 45.00
percentage of Female below 27 : 55.00
percentage of Female below 27 and above 47000 : 13.64
percentage of Female below 27 and below 47000 : 86.36
```

For KP481

```
df_2 = df[df["Product"] == "KP481"]
```

Male calulation

```
male = df_2[df_2["Gender"] == "Male"]["Gender"].count()
m_ag = df_2[(df_2["Gender"] == "Male") & (df_2["Age"]>27)]
["Gender"].count()
m_al = df_2[(df_2["Gender"] == "Male") & (df_2["Age"]<=27)]
["Gender"].count()
m_al_ig = df_2[(df_2["Gender"] == "Male") & (df_2["Age"]<=27) &
(df_2["Income"] > 47000)]["Gender"].count()
m_al_il = df_2[(df_2["Gender"] == "Male") & (df_2["Age"]<=27) &
(df_2["Income"] <= 47000)]["Gender"].count()

print(f"percentage of male : {male/len(df_2)*100:.2f}")
print(f"percentage of male above 27 yr. : {(m_ag/male)*100:.2f}")
print(f"percentage of male below 27 yr. : {(m_al/male)*100:.2f}")
print(f"percentage of male below 27 yr. and above $47000 :
{(m_al_ig/m_al)*100:.2f}")
print(f"percentage of male below 27 yr. and below $47000 :
{(m_al_il/m_al)*100:.2f}")
```

```
percentage of male : 51.67
percentage of male above 27 yr. : 41.94
percentage of male below 27 yr. : 58.06
percentage of male below 27 yr. and above $47000 : 27.78
percentage of male below 27 yr. and below $47000 : 72.22
```

Female

```
male = df_2[df_2["Gender"] == "Female"]["Gender"].count()
m_ag = df_2[(df_2["Gender"] == "Female") & (df_2["Age"]>27)]
["Gender"].count()
m_al = df_2[(df_2["Gender"] == "Female") & (df_2["Age"]<=27)]
["Gender"].count()
m_al_ig = df_2[(df_2["Gender"] == "Female") & (df_2["Age"]<=27) &
(df_2["Income"] > 47000)]["Gender"].count()
m_al_il = df_2[(df_2["Gender"] == "Female") & (df_2["Age"]<=27) &
(df_2["Income"] <= 47000)]["Gender"].count()

print(f"percentage of Female : {male/len(df_2)*100:.2f}")
print(f"percentage of Female above 27 yr. : {(m_ag/male)*100:.2f}")
print(f"percentage of Female below 27 yr.: {(m_al/male)*100:.2f}")
print(f"percentage of Female below 27 yr. and above $47000 :
{(m_al_ig/m_al)*100:.2f}")
print(f"percentage of Female below 27 yr. and below $47000 :
{(m_al_il/m_al)*100:.2f}")
```

```
percentage of Female : 48.33
percentage of Female above 27 yr. : 51.72
percentage of Female below 27 yr.: 48.28
percentage of Female below 27 yr. and above $47000 : 21.43
percentage of Female below 27 yr. and below $47000 : 78.57
```

for KP781

```
df_3 = df[df["Product"] == "KP781"]
```

Male Calculation

```
male = df_3[df_3["Gender"] == "Male"]["Gender"].count()
m_ag = df_3[(df_3["Gender"] == "Male") & (df_3["Age"]>27)]
["Gender"].count()
m_al = df_3[(df_3["Gender"] == "Male") & (df_3["Age"]<=27)]
["Gender"].count()
m_al_ig = df_3[(df_3["Gender"] == "Male") & (df_3["Age"]<=27) &
(df_3["Income"] > 47000)]["Gender"].count()
m_al_il = df_3[(df_3["Gender"] == "Male") & (df_3["Age"]<=27) &
(df_3["Income"] <= 47000)]["Gender"].count()

print(f"percentage of male : {male/len(df_3)*100:.2f}")
print(f"percentage of male above 27 : {(m_ag/male)*100:.2f}")
print(f"percentage of male below 27 : {(m_al/male)*100:.2f}")
print(f"percentage of male below 27 and above 47000 :
{(m_al_ig/m_al)*100:.2f}")
print(f"percentage of male below 27 and below 47000 :
{(m_al_il/m_al)*100:.2f}")
```

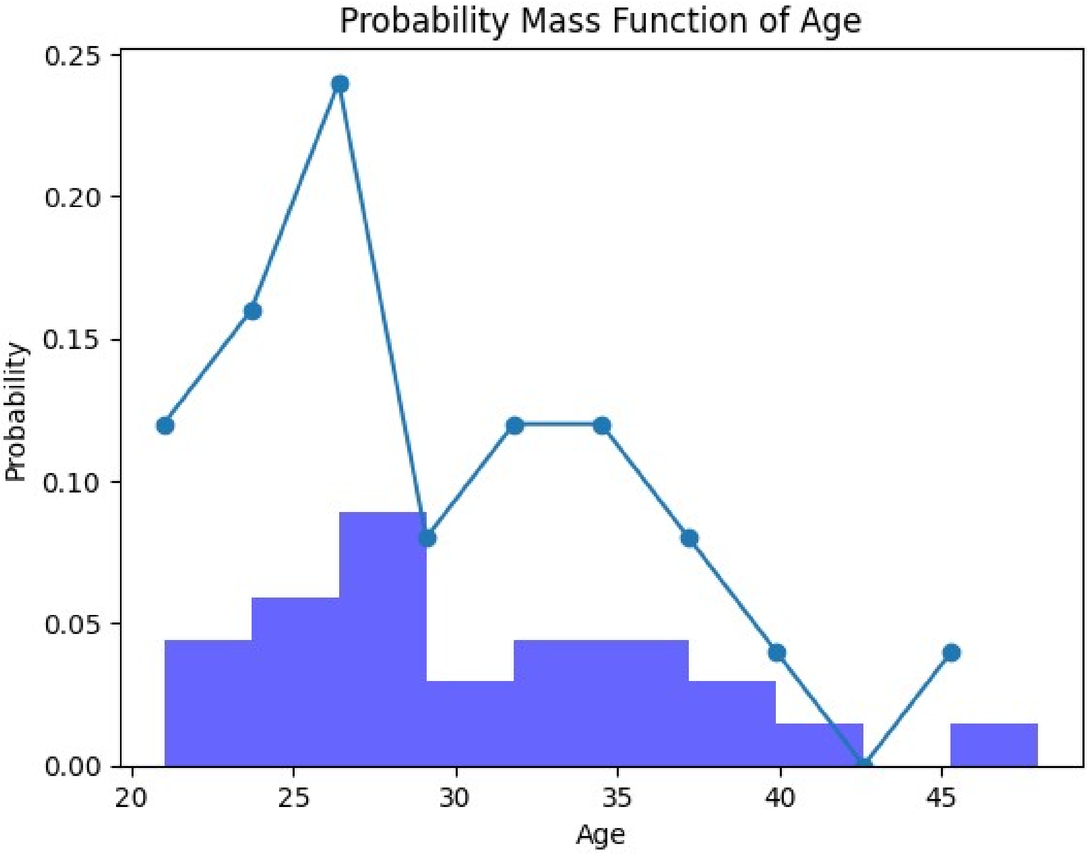
```
percentage of male : 82.50
percentage of male above 27 : 45.45
percentage of male below 27 : 54.55
percentage of male below 27 and above 47000 : 100.00
percentage of male below 27 and below 47000 : 0.00
```

```
male = df_3[df_3["Gender"] == "Female"]["Gender"].count()
m_ag = df_3[(df_3["Gender"] == "Female") & (df_3["Age"]>27)]
["Gender"].count()
m_al = df_3[(df_3["Gender"] == "Female") & (df_3["Age"]<=27)]
["Gender"].count()
m_al_ig = df_3[(df_3["Gender"] == "Female") & (df_3["Age"]<=27) &
(df_3["Income"] > 47000)]["Gender"].count()
m_al_il = df_3[(df_3["Gender"] == "Female") & (df_3["Age"]<=27) &
(df_3["Income"] <= 47000)]["Gender"].count()

print(f"percentage of Female : {male/len(df_3)*100:.2f}")
print(f"percentage of Female above 27 : {(m_ag/male)*100:.2f}")
print(f"percentage of Female below 27 : {(m_al/male)*100:.2f}")
print(f"percentage of Female below 27 and above 47000 :
{(m_al_ig/m_al)*100:.2f}")
print(f"percentage of Female below 27 and below 47000 :
{(m_al_il/m_al)*100:.2f}")
```

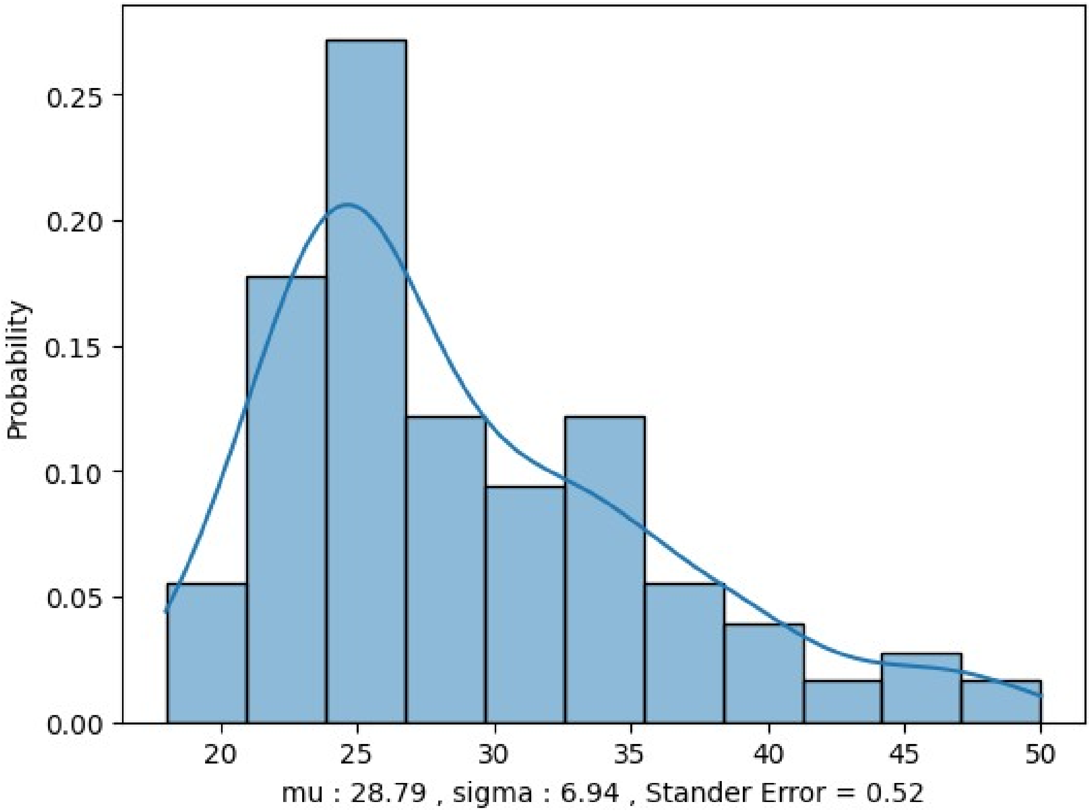
```
percentage of Female : 17.50
percentage of Female above 27 : 42.86
percentage of Female below 27 : 57.14
percentage of Female below 27 and above 47000 : 100.00
percentage of Female below 27 and below 47000 : 0.00
```

```
import numpy as np
import pandas as pd
```

```python
import matplotlib.pyplot as plt
from scipy.stats import norm

# Sample Data (Use your actual data here)
ages = [21, 22, 23, 24, 25, 25, 26, 27, 27, 28, 28, 28, 29, 30, 31,
32, 33, 34, 35, 36, 37, 38, 39, 40, 48]

# Convert to DataFrame
df1 = pd.DataFrame(ages, columns=['Age'])

# Plot Histogram
count, bins, ignored = plt.hist(df1['Age'], bins=10, density=True,
alpha=0.6, color='b')

# Normalize to create PMF
pmf = count / sum(count)

# Plot PMF
plt.plot(bins[:-1], pmf, marker='o')
plt.xlabel('Age')
plt.ylabel('Probability')
plt.title('Probability Mass Function of Age')
plt.show()
```



```
mu = df["Age"].mean()
std = df["Age"].std()
SE = std/np.sqrt(len(df))

sns.histplot(df , x = "Age" , stat = "probability" , kde = True)
plt.xlabel(f"mu : {mu:.2f} , sigma : {std:.2f} , Stander Error =
{SE:.2f}")
plt.ylabel("Probability")
plt.show()
```



```
from scipy.stats import norm
from scipy.stats import binom

mu = 28.8
SE = 0.52

z = norm.cdf(0.95)

age = mu + (z*SE)
age
```

```
29.23105081431959
```

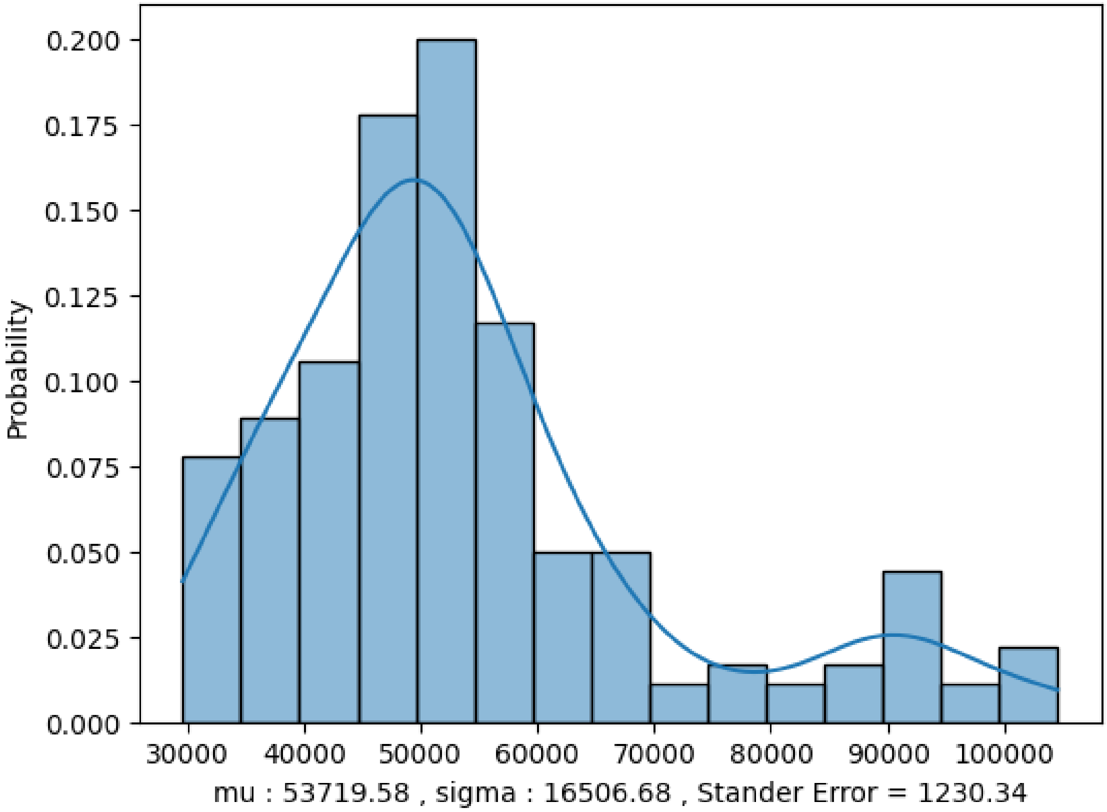
```python
age1 = mu - (2*SE)
age2 = mu + (2+SE)

print(age1 , age2)
```

```
27.76 31.32
```

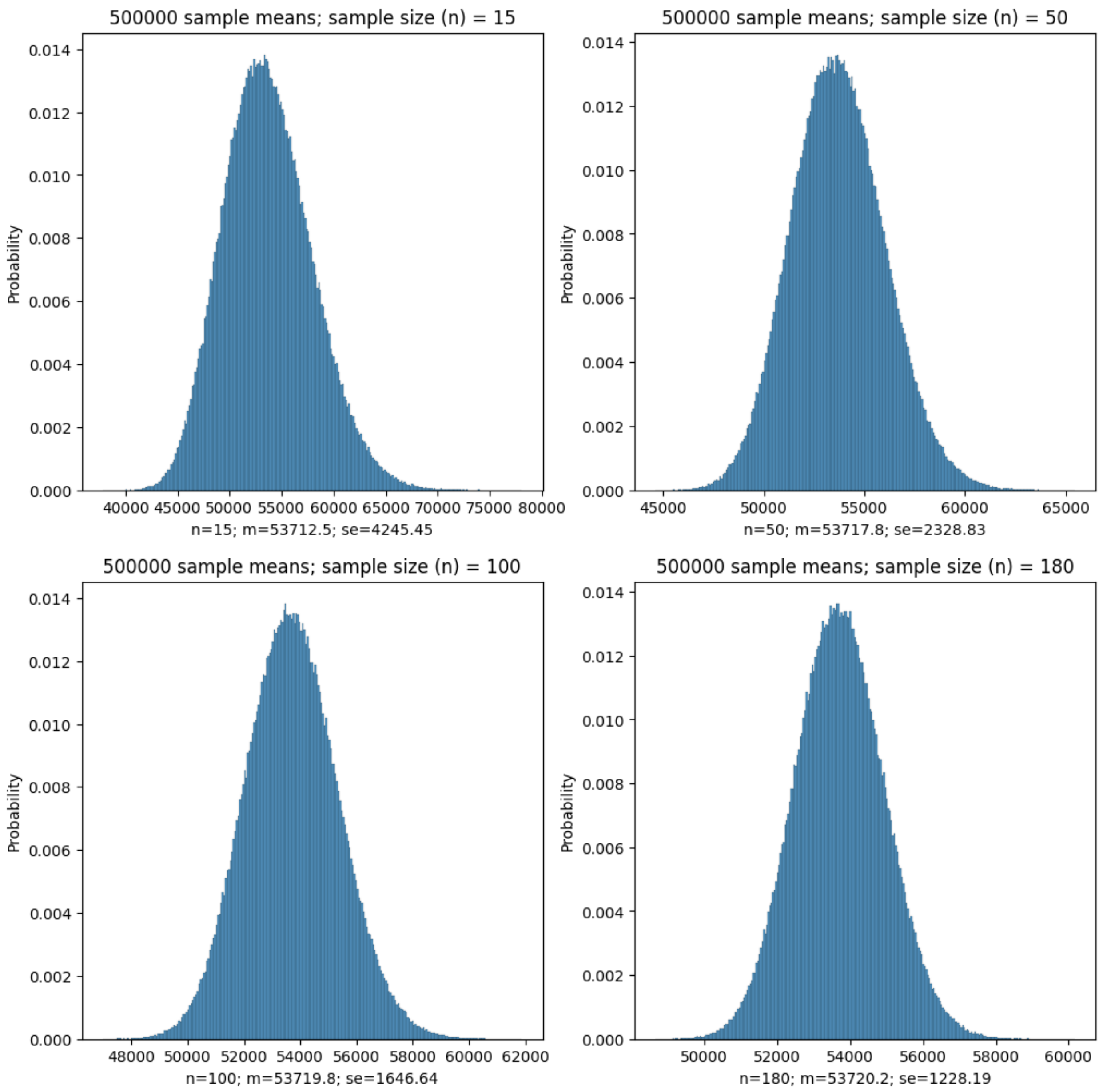
```python
mu = 28.8
SE = 0.52
x = 29

z = (x-mu)/SE

norm.cdf(z)
```

```
0.6497388029480752
```

```python
mu = df["Income"].mean()
std = df["Income"].std()
SE = std/np.sqrt(len(df))

sns.histplot(df , x = "Income" , stat = "probability" , kde = True)
plt.xlabel(f"mu : {mu:.2f} , sigma : {std:.2f} , Stander Error = {SE:.2f}")
plt.ylabel("Probability")
plt.show()
```



```
no_of_samples = 500000

pop_data = df['Income']

plt.figure(figsize=(12,12))
subplot_no = 1
for n in [15, 50, 100 , 180]:
  new_sample = np.random.choice(a=pop_data, size=(no_of_samples,n))
#(rows,cols)
  sample_means = new_sample.mean(axis=1)

  plt.subplot(2,2,subplot_no)
  plt.title(f"{no_of_samples} sample means; sample size (n) = {n}")
  #plt.xlabel(f"'Mean' of sample means={sample_means.mean():.1f}")
  plt.xlabel(f"n={n}; m={sample_means.mean():.1f};
se={sample_means.std():.2f}")
  sns.histplot(x=sample_means, stat="probability")

  subplot_no += 1
```



```
mu = 53719
SE = 1230

z = norm.cdf(0.95)

Income = mu + (z*SE)
Income

54738.600964640566

Income1 = mu - (2*SE)
Income2 = mu + (2+SE)
```

```
print(Income1 , Income2)

51259 54951

mu = 53719
SE = 1230
x = 52500

z = (x-mu)/SE

norm.cdf(z)

0.16082889590124477
```