walmart_business_case

November 8, 2024

[1]:
```
!gdown https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/001/293/
 ↪original/walmart_data.csv?1641285094
```

```
Downloading…
From: https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/001/293/ori
ginal/walmart_data.csv?1641285094
To: /content/walmart_data.csv?1641285094
   0% 0.00/23.0M [00:00<?, ?B/s]  71% 16.3M/23.0M [00:00<00:00, 162MB/s] 100%
23.0M/23.0M [00:00<00:00, 181MB/s]
```

[2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[3]:
```
df = pd.read_csv('/content/walmart_data.csv?1641285094')
```

[4]:
```
df.head()
```

[4]:
```
   User_ID Product_ID Gender   Age  Occupation City_Category  \
0  1000001  P00069042      F  0-17          10             A
1  1000001  P00248942      F  0-17          10             A
2  1000001  P00087842      F  0-17          10             A
3  1000001  P00085442      F  0-17          10             A
4  1000002  P00285442      M   55+          16             C

  Stay_In_Current_City_Years  Marital_Status  Product_Category  Purchase
0                          2               0                 3      8370
1                          2               0                 1     15200
2                          2               0                12      1422
3                          2               0                12      1057
4                         4+               0                 8      7969
```

[5]:
```
len(df)
```

[5]:
```
550068
```

[6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 550068 entries, 0 to 550067
Data columns (total 10 columns):
 #   Column                      Non-Null Count   Dtype
---  ------                      --------------   -----
 0   User_ID                     550068 non-null  int64
 1   Product_ID                  550068 non-null  object
 2   Gender                      550068 non-null  object
 3   Age                         550068 non-null  object
 4   Occupation                  550068 non-null  int64
 5   City_Category               550068 non-null  object
 6   Stay_In_Current_City_Years  550068 non-null  object
 7   Marital_Status              550068 non-null  int64
 8   Product_Category            550068 non-null  int64
 9   Purchase                    550068 non-null  int64
dtypes: int64(5), object(5)
memory usage: 42.0+ MB
```

[7]:

```
df.describe()
```

[7]:

```
            User_ID     Occupation  Marital_Status  Product_Category  \
count  5.500680e+05  550068.000000   550068.000000     550068.000000
mean   1.003029e+06       8.076707        0.409653          5.404270
std    1.727592e+03       6.522660        0.491770          3.936211
min    1.000001e+06       0.000000        0.000000          1.000000
25%    1.001516e+06       2.000000        0.000000          1.000000
50%    1.003077e+06       7.000000        0.000000          5.000000
75%    1.004478e+06      14.000000        1.000000          8.000000
max    1.006040e+06      20.000000        1.000000         20.000000

            Purchase
count  550068.000000
mean     9263.968713
std      5023.065394
min        12.000000
25%      5823.000000
50%      8047.000000
75%     12054.000000
max     23961.000000
```

[8]:

```
df.describe(include='object')
```

[8]:

```
       Product_ID  Gender     Age City_Category Stay_In_Current_City_Years
count      550068  550068  550068        550068                     550068
unique       3631       2       7             3                          5
top     P00265242       M   26-35             B                          1
freq         1880  414259  219587        231173                     193821
```

[9]:

```
print(f"""
Unique age = {df['Age'].unique()}
NUnique age = {df['Age'].nunique()}
Unique Stay_In_Current_City_Years = {df['Stay_In_Current_City_Years'].unique()}
NUnique Stay_In_Current_City_Years = {df['Stay_In_Current_City_Years'].
 ↪nunique()}
Unique City_Category = {df['City_Category'].unique()}
NUnique City_Category = {df['City_Category'].nunique()}

""")

# Data already properly categorized
```

```
Unique age = ['0-17' '55+' '26-35' '46-50' '51-55' '36-45' '18-25']
NUnique age = 7
Unique Stay_In_Current_City_Years = ['2' '4+' '3' '1' '0']
NUnique Stay_In_Current_City_Years = 5
Unique City_Category = ['A' 'C' 'B']
NUnique City_Category = 3
```

[10]:

```
df.isna().sum()
# No null values
```

[10]:

```
User_ID                       0
Product_ID                    0
Gender                        0
Age                           0
Occupation                    0
City_Category                 0
Stay_In_Current_City_Years    0
Marital_Status                0
Product_Category              0
Purchase                      0
dtype: int64
```

[11]:

```
df.duplicated().sum()
```

[11]:

```
0
```

[12]:

```
# Univariate data analysis
```

[13]:

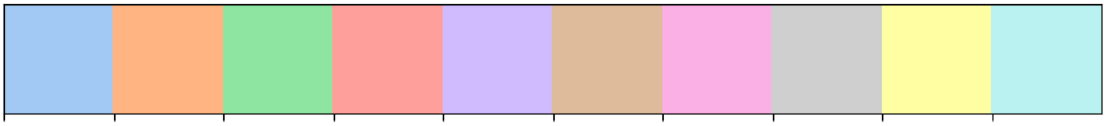
```
df.head()
```

[13]:

```
   User_ID Product_ID Gender   Age  Occupation City_Category  \
0  1000001  P00069042      F  0-17          10             A
1  1000001  P00248942      F  0-17          10             A
2  1000001  P00087842      F  0-17          10             A
3  1000001  P00085442      F  0-17          10             A
4  1000002  P00285442      M   55+          16             C

  Stay_In_Current_City_Years  Marital_Status  Product_Category  Purchase
0                          2               0                 3      8370
1                          2               0                 1     15200
2                          2               0                12      1422
3                          2               0                12      1057
4                         4+               0                 8      7969
```

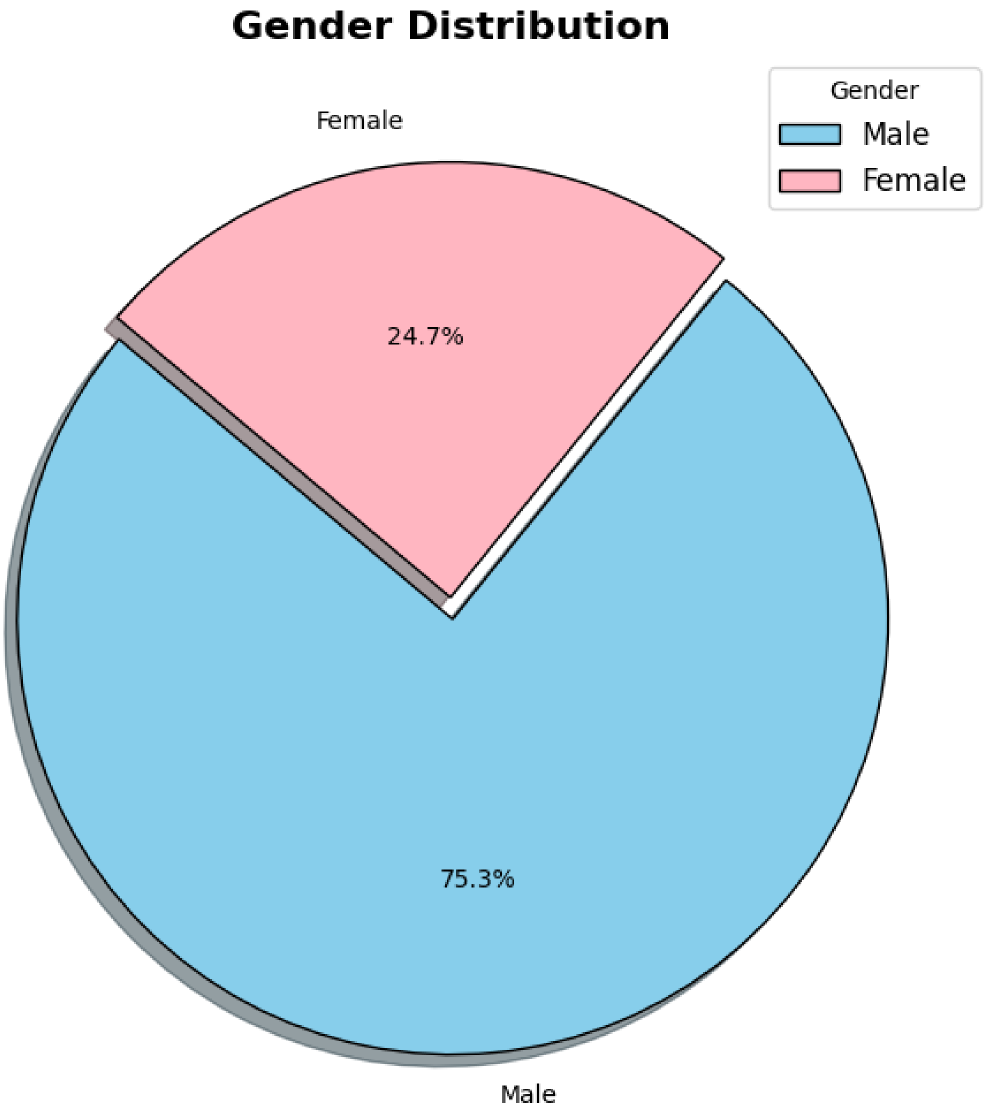
[14]:

```python
pastel_palette = sns.color_palette("pastel")

sns.set_palette(pastel_palette)

sns.palplot(pastel_palette)
plt.show()
```



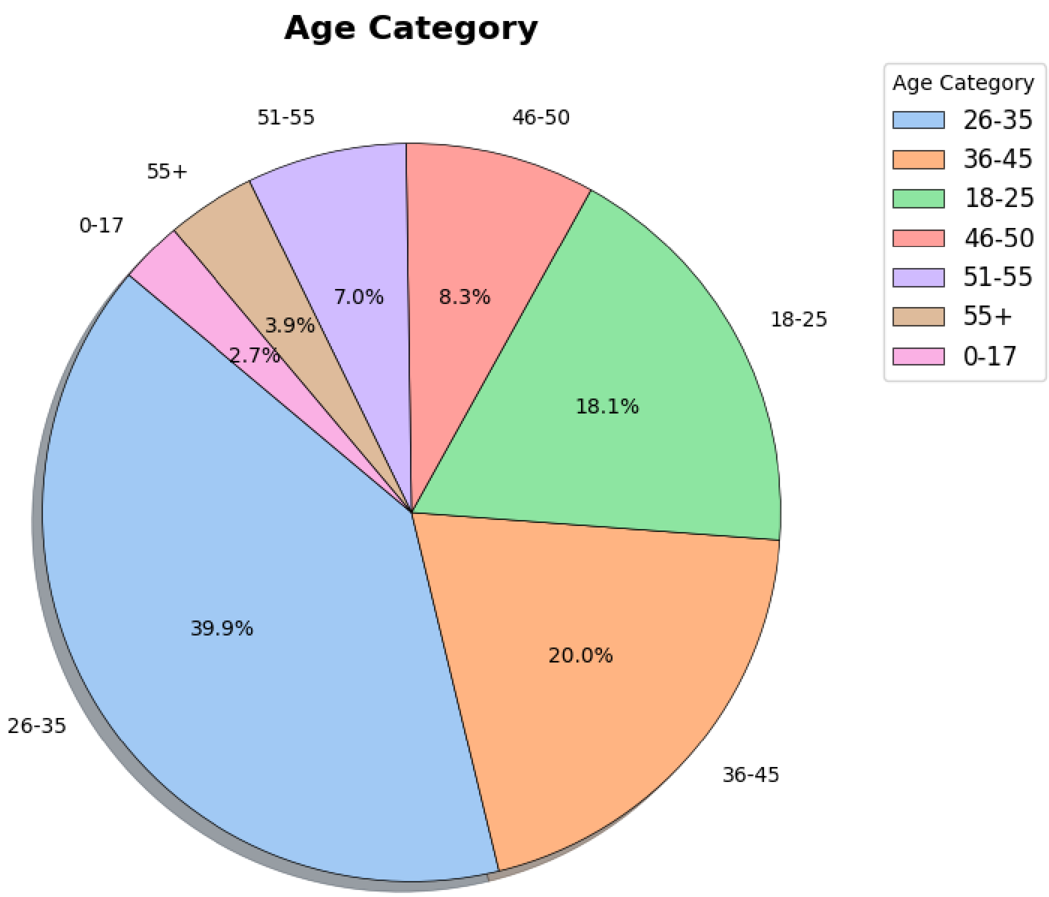
[15]:

```python
gender_counts = df['Gender'].value_counts().reset_index()
gender_counts['Gender'] = gender_counts['Gender'].apply(lambda x: 'Male' if x␣
 ↪== "M" else 'Female')

colors = ['skyblue', 'lightpink']
explode = [0.05, 0]

plt.figure(figsize=(8, 8))
plt.title("Gender Distribution", fontsize=16, fontweight='bold')

plt.pie(
    gender_counts['count'],
    labels=gender_counts['Gender'],
    autopct='%1.1f%%',
    startangle=140,
    colors=colors,
    explode=explode,
    shadow=True,
    wedgeprops={'edgecolor': 'black'}
)

plt.legend(title="Gender", loc="upper right", fontsize=12)
plt.show()
```



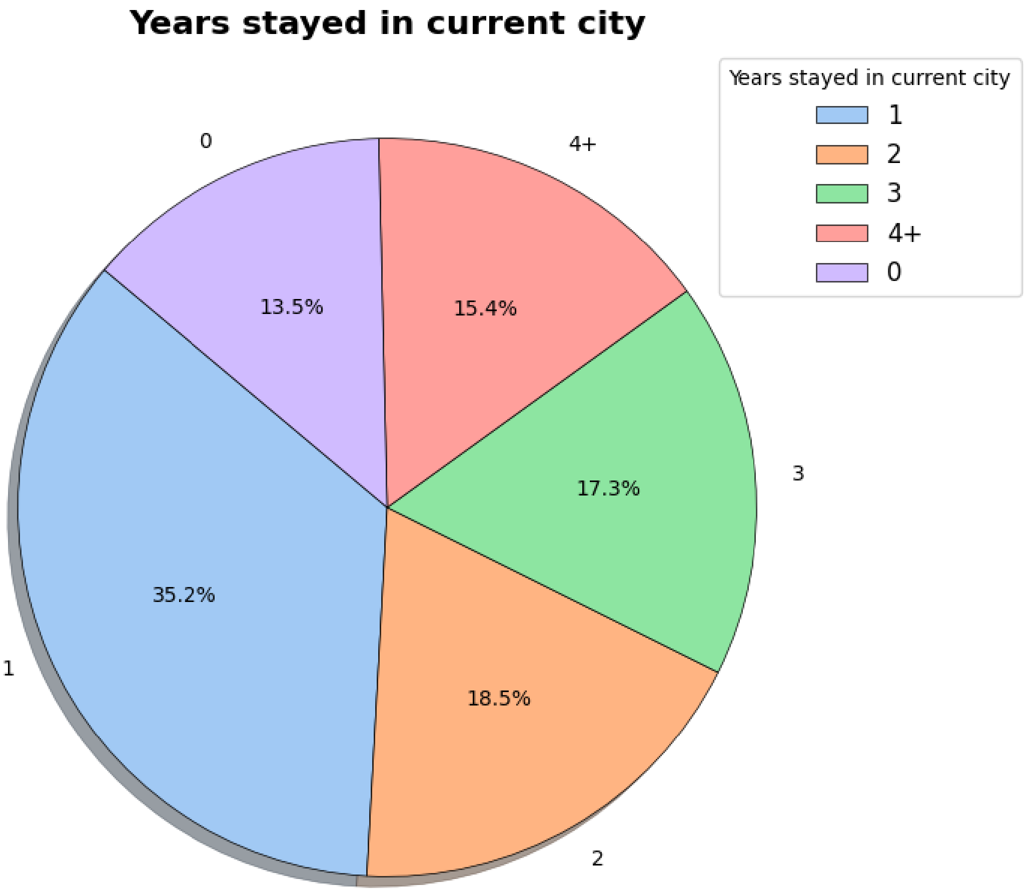
[16]:

```
age_counts = df['Age'].value_counts().reset_index()

plt.figure(figsize=(8, 8))
plt.title("Age Category", fontsize=16, fontweight='bold')

plt.pie(
    age_counts['count'],
    labels=age_counts['Age'],
    autopct='%1.1f%%',
    startangle=140,
    shadow=True,
    wedgeprops={'edgecolor': 'black', 'linewidth': 0.5}
)

plt.legend(title="Age Category", loc="upper right", fontsize=12,␣
 ↪bbox_to_anchor=(1.2,1))
plt.show()
```



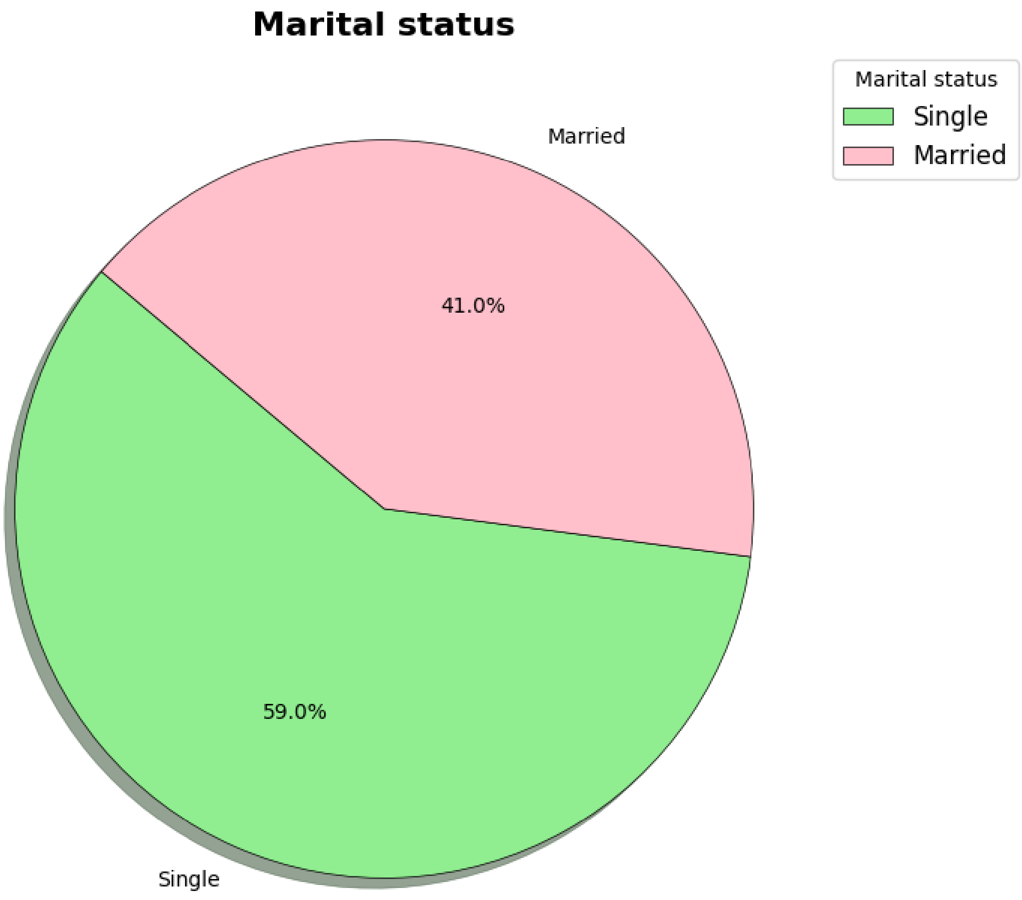
[17]:

```
stay = df['Stay_In_Current_City_Years'].value_counts().reset_index()

plt.figure(figsize=(8, 8))
plt.title("Years stayed in current city", fontsize=16, fontweight='bold')
plt.pie(
    stay['count'],
    labels=stay['Stay_In_Current_City_Years'],
    autopct='%1.1f%%',
    startangle=140,
    shadow=True,
    wedgeprops={'edgecolor': 'black','linewidth': 0.5}
)

plt.legend(title="Years stayed in current city", loc="upper right",␣
 ↪fontsize=12, bbox_to_anchor=(1.2,1))
plt.show()
```



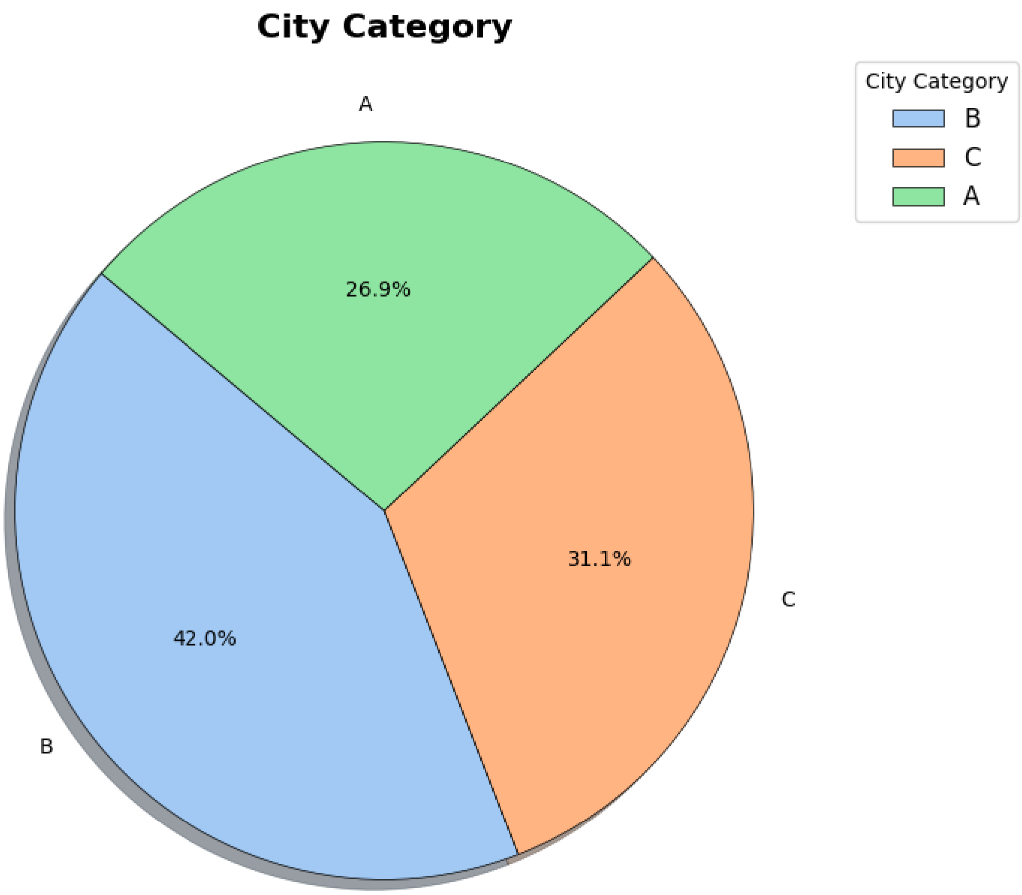
[18]:
```
marital_status = df['Marital_Status'].value_counts().reset_index()
marital_status['Marital_Status'] = marital_status['Marital_Status'].
 ↪apply(lambda x : "Married" if x == 1 else "Single")
```

```
plt.figure(figsize=(8, 8))
plt.title("Marital status", fontsize=16, fontweight='bold')

colors=['lightgreen','pink']

plt.pie(
    marital_status['count'],
    labels=marital_status['Marital_Status'],
    autopct='%1.1f%%',
    startangle=140,
    shadow=True,
    colors=colors ,
    wedgeprops={'edgecolor': 'black','linewidth': 0.5}
)

plt.legend(title="Marital status", loc="upper right", fontsize=12,␣
 ↪bbox_to_anchor=(1.2,1))
plt.show()
```



[19]:

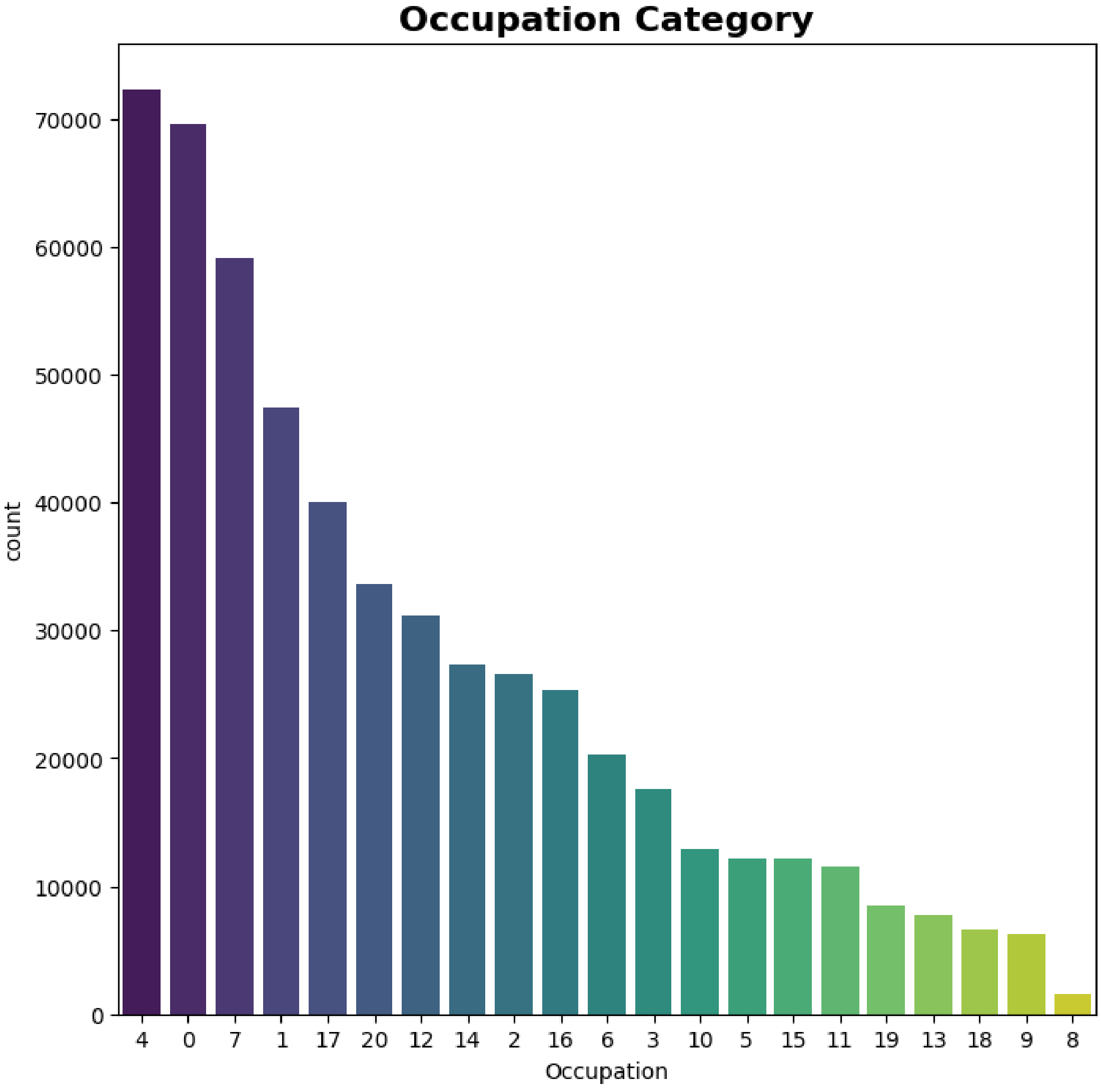
```
city_category = df['City_Category'].value_counts().reset_index()

plt.figure(figsize=(8, 8))
plt.title("City Category", fontsize=16, fontweight='bold')



plt.pie(
    city_category['count'],
    labels=city_category['City_Category'],
    autopct='%1.1f%%',
    startangle=140,
    shadow=True,
    wedgeprops={'edgecolor': 'black','linewidth': 0.5}
)

plt.legend(title="City Category", loc="upper right", fontsize=12,␣
 ↪bbox_to_anchor=(1.2,1))
plt.show()
```



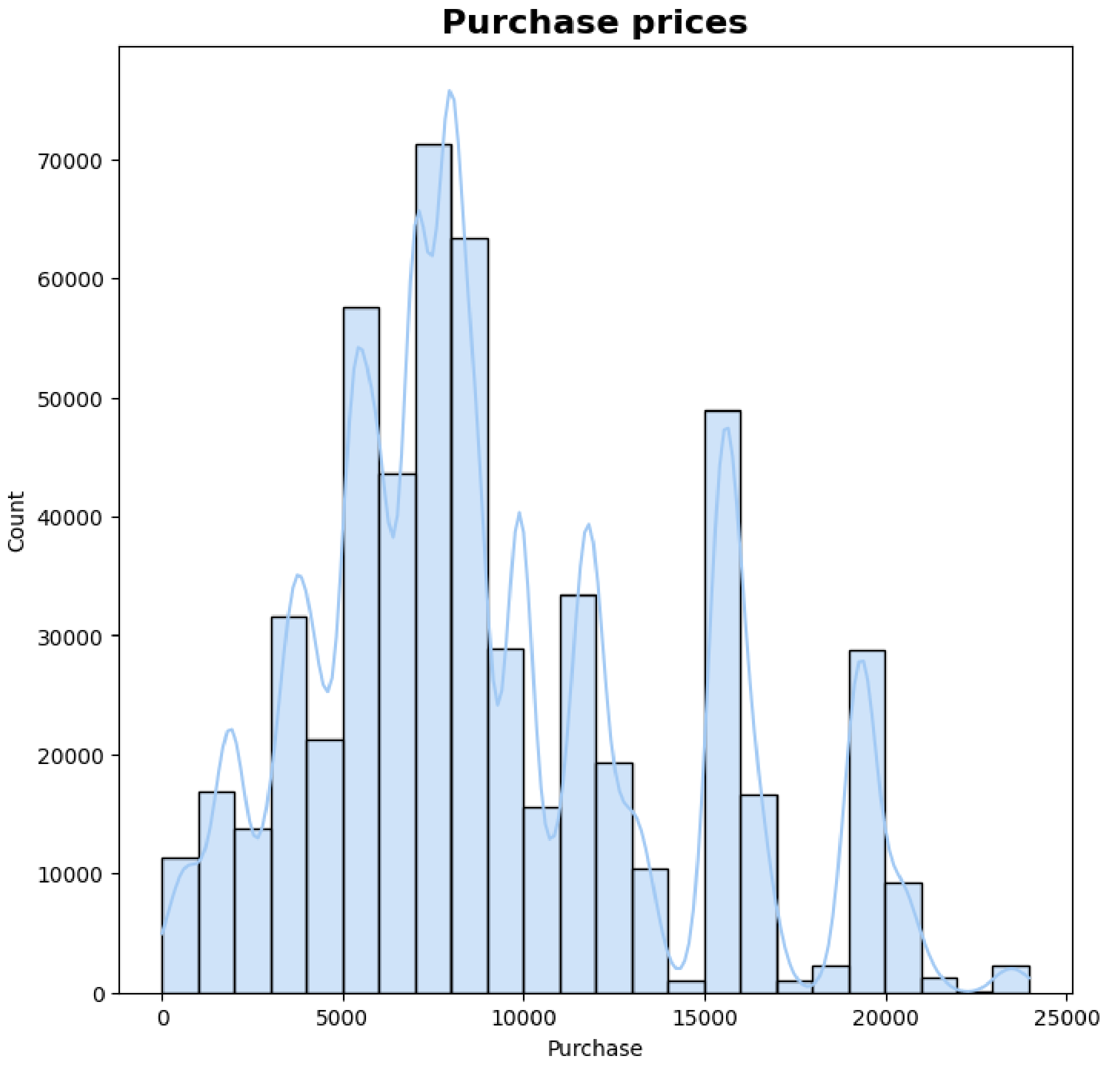
```
[20]: occupation_category = df['Occupation'].value_counts().reset_index()
      occupation_category = occupation_category.sort_values(by='count',␣
       ↪ascending=False)
      viridis_palette = sns.color_palette("viridis",␣
       ↪n_colors=len(occupation_category))

      plt.figure(figsize=(8, 8))
      plt.title("Occupation Category", fontsize=16, fontweight='bold')


      sns.barplot(data=occupation_category, x='Occupation',␣
       ↪y='count',order=occupation_category['Occupation'],palette=viridis_palette);
      plt.legend=False
      plt.show();
```

```
<ipython-input-20-c0ed9f263f13>:9: FutureWarning:
```

```
Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.barplot(data=occupation_category, x='Occupation',
y='count',order=occupation_category['Occupation'],palette=viridis_palette);
```



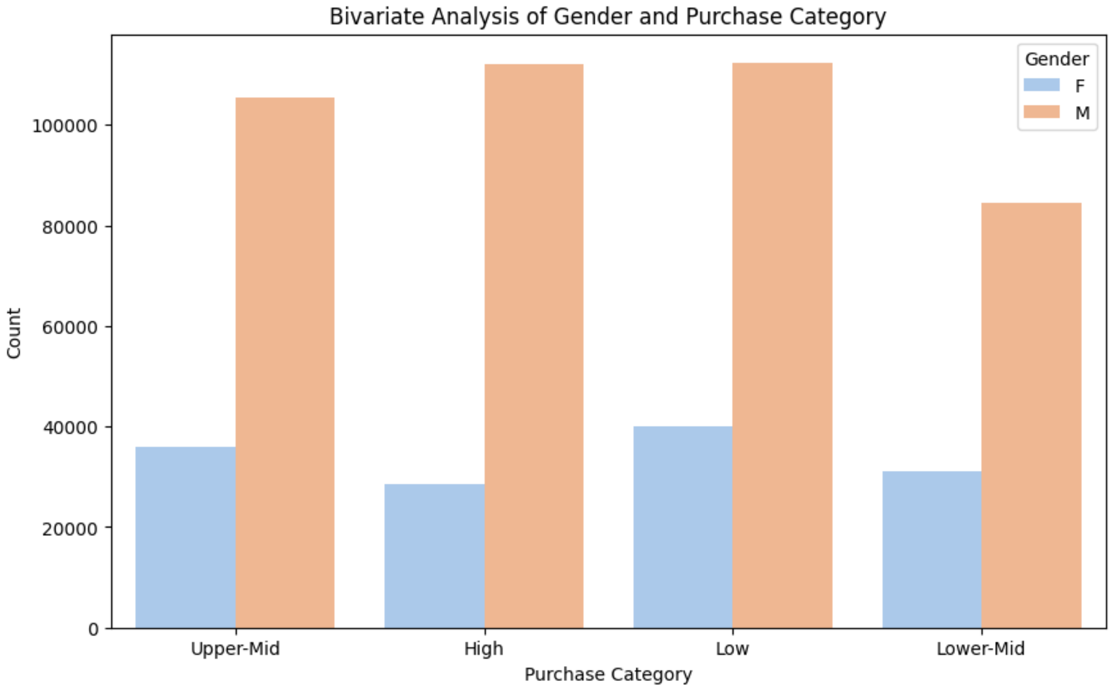
[21]:
```
plt.figure(figsize=(8, 8))
plt.title("Purchase prices", fontsize=16, fontweight='bold')

sns.histplot(df['Purchase'], binwidth=1000, kde=True);
plt.show()
```



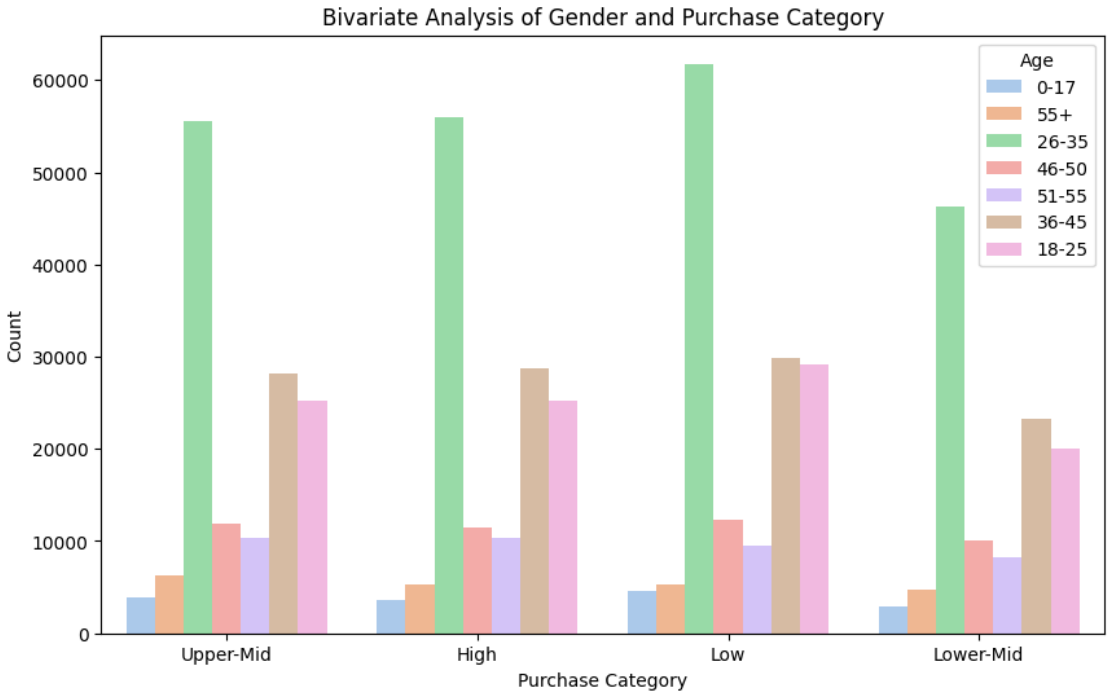
[22]:
```
# Categorize purchase amount
def categorize_price(price):
    if price < 6000:
        return 'Low'
    elif 6000 <= price < 8000:
        return 'Lower-Mid'
    elif 8000 <= price < 12000:
        return 'Upper-Mid'
    else:
        return 'High'


df['Purchase_Category'] = df['Purchase'].apply(categorize_price)
df.head()
```

```
[22]:    User_ID Product_ID Gender   Age  Occupation City_Category  \
      0  1000001  P00069042      F  0-17          10             A
      1  1000001  P00248942      F  0-17          10             A
      2  1000001  P00087842      F  0-17          10             A
      3  1000001  P00085442      F  0-17          10             A
      4  1000002  P00285442      M   55+          16             C

        Stay_In_Current_City_Years  Marital_Status  Product_Category  Purchase  \
      0                          2               0                 3      8370
      1                          2               0                 1     15200
      2                          2               0                12      1422
      3                          2               0                12      1057
      4                         4+               0                 8      7969

        Purchase_Category
      0         Upper-Mid
      1              High
      2               Low
      3               Low
      4         Lower-Mid
```

```
[47]: # Bivariate analysis
      # Gender vs Purchase category
      plt.figure(figsize=(10, 6))
      sns.countplot(data=df, x='Purchase_Category', hue='Gender')
      plt.title('Bivariate Analysis of Gender and Purchase Category')
      plt.xlabel('Purchase Category')
      plt.ylabel('Count')
      plt.show()
```

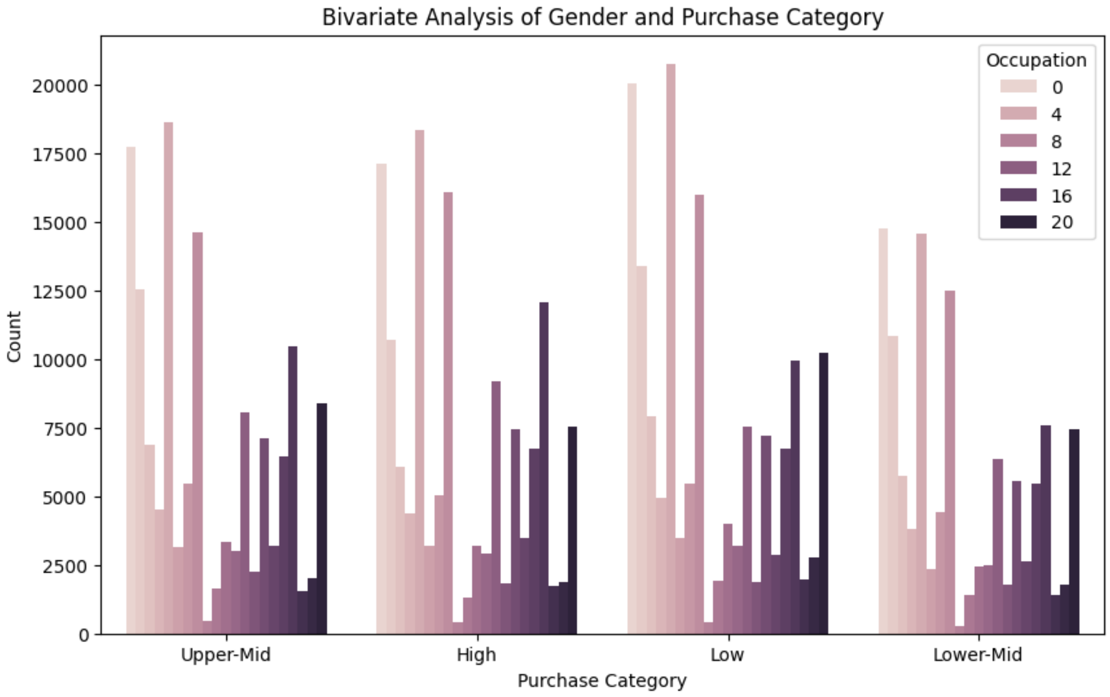


```
[24]: plt.figure(figsize=(10, 6))
      sns.countplot(data=df, x='Purchase_Category', hue='Age')
      plt.title('Bivariate Analysis of Gender and Purchase Category')
      plt.xlabel('Purchase Category')
      plt.ylabel('Count')
      plt.show()
```

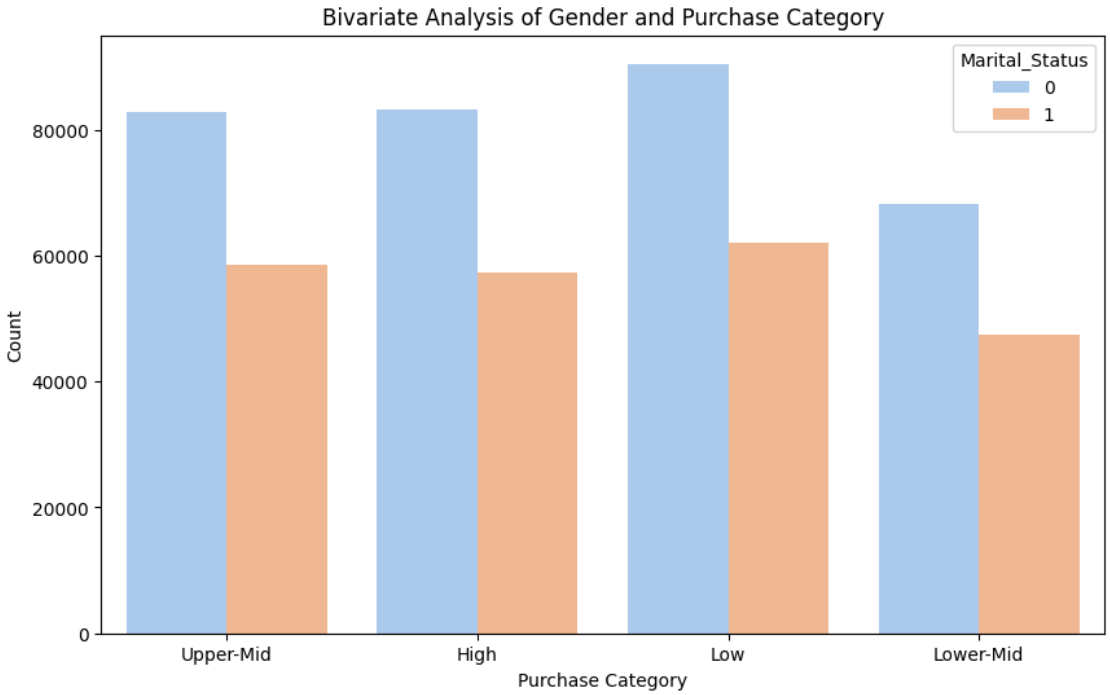


[25]:

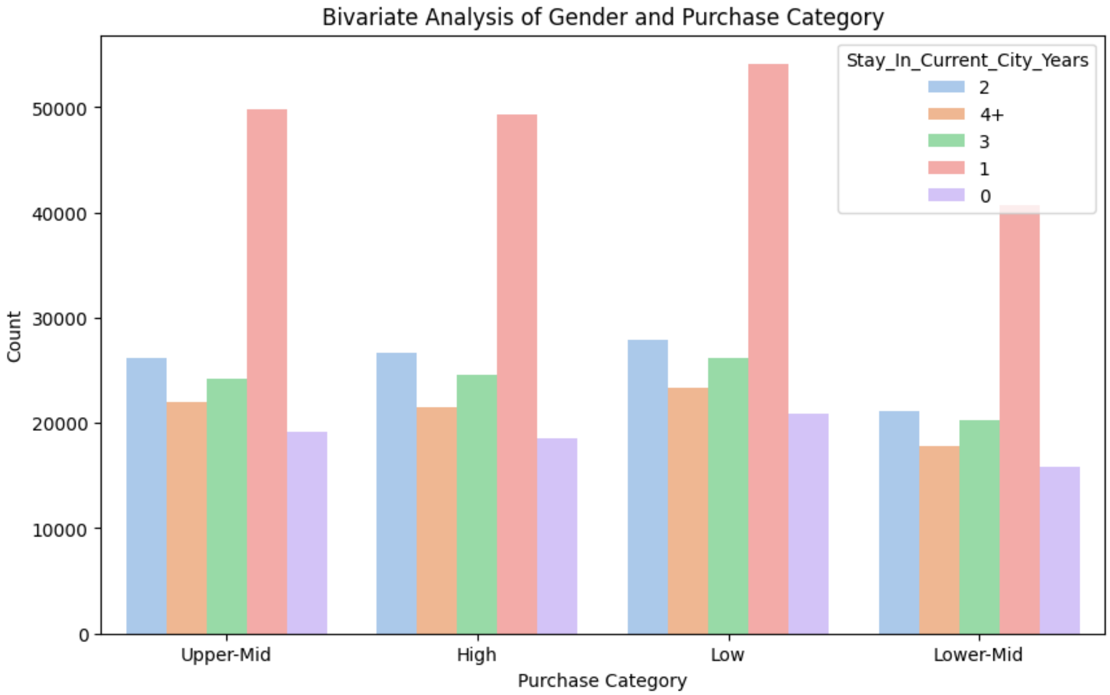
```python
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='Purchase_Category', hue='Occupation')
plt.title('Bivariate Analysis of Gender and Purchase Category')
plt.xlabel('Purchase Category')
plt.ylabel('Count')
plt.show()
```



[26]:
```
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='Purchase_Category', hue='Marital_Status')
plt.title('Bivariate Analysis of Gender and Purchase Category')
plt.xlabel('Purchase Category')
plt.ylabel('Count')
plt.show()
```

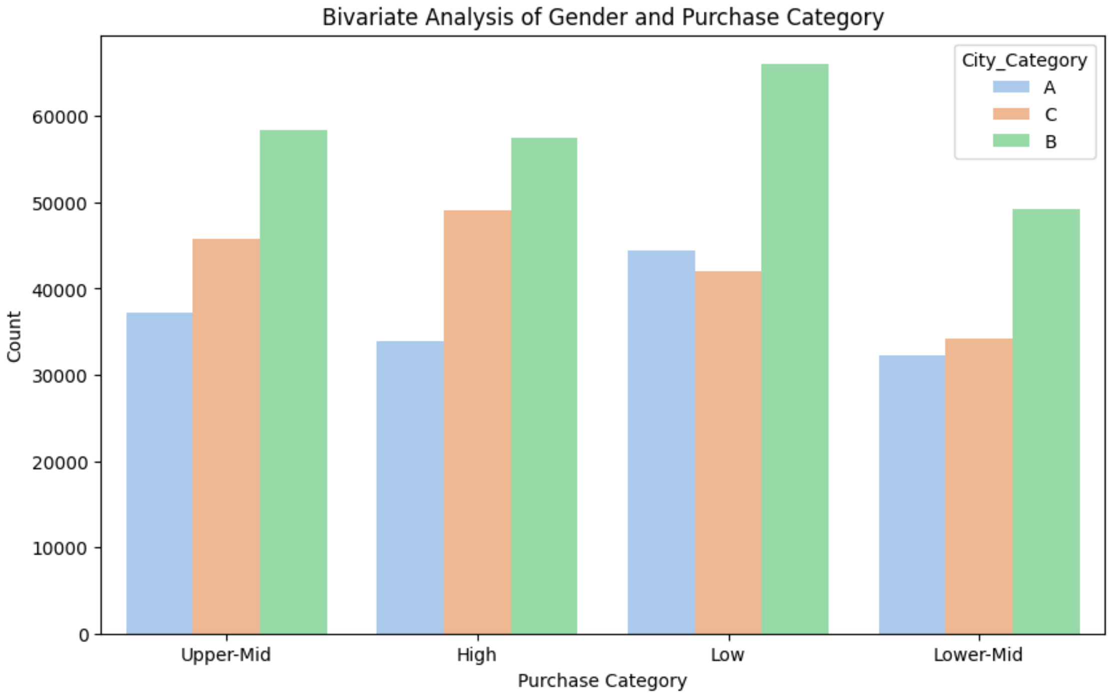


[27]:
```
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='Purchase_Category', hue='Stay_In_Current_City_Years')
plt.title('Bivariate Analysis of Gender and Purchase Category')
plt.xlabel('Purchase Category')
plt.ylabel('Count')
plt.show()
```



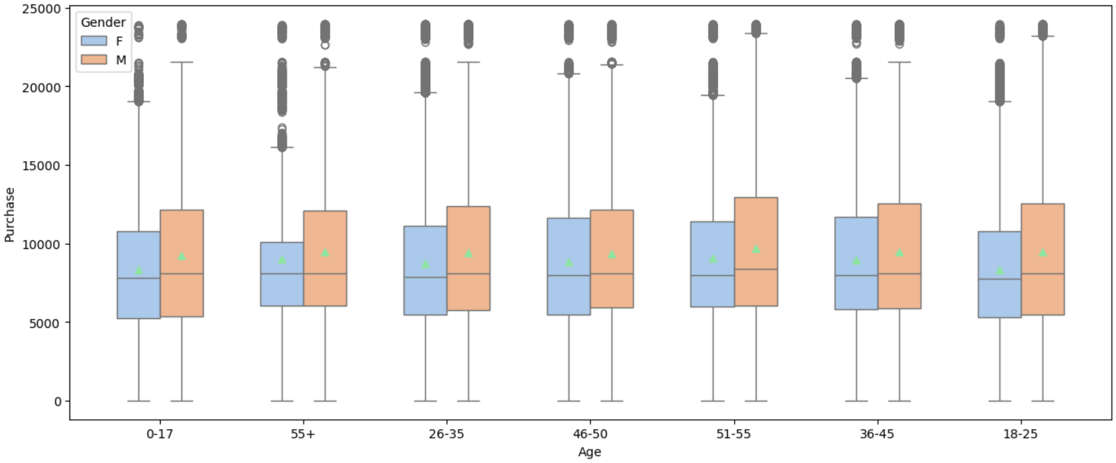
[28]:

```
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='Purchase_Category', hue='City_Category')
plt.title('Bivariate Analysis of Gender and Purchase Category')
plt.xlabel('Purchase Category')
plt.ylabel('Count')
plt.show()
```



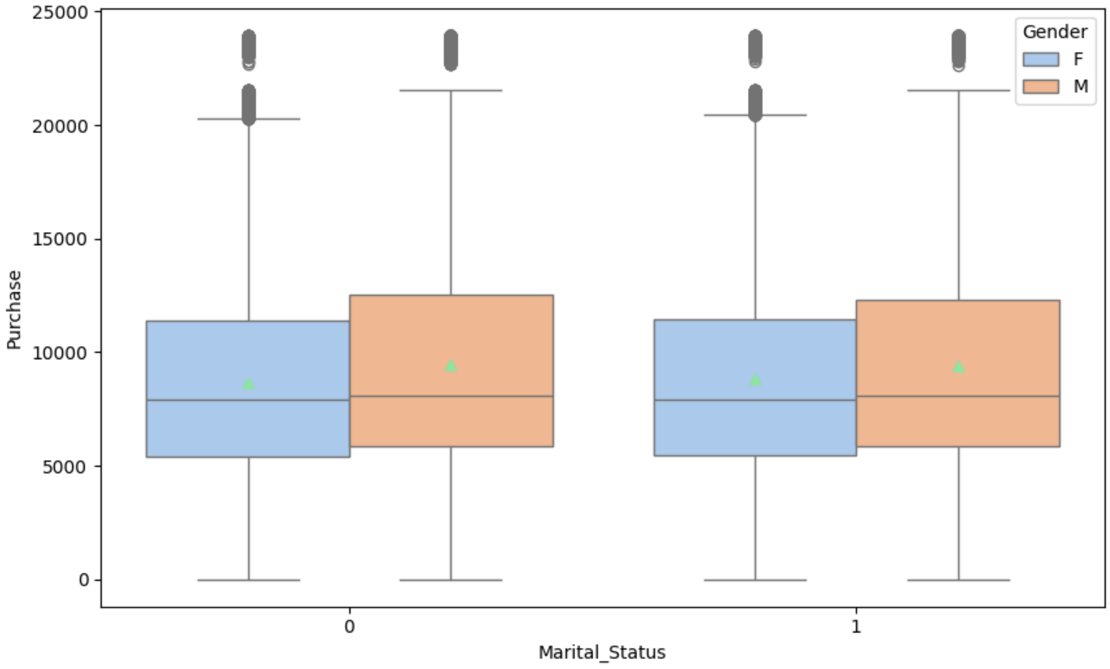
```
[29]: plt.figure(figsize = (15, 6))
      sns.boxplot(data = df, x = 'Age', y = 'Purchase', hue = 'Gender', showmeans =␣
       ↪True, width = 0.6)
      plt.plot()
```

```
[29]: []
```



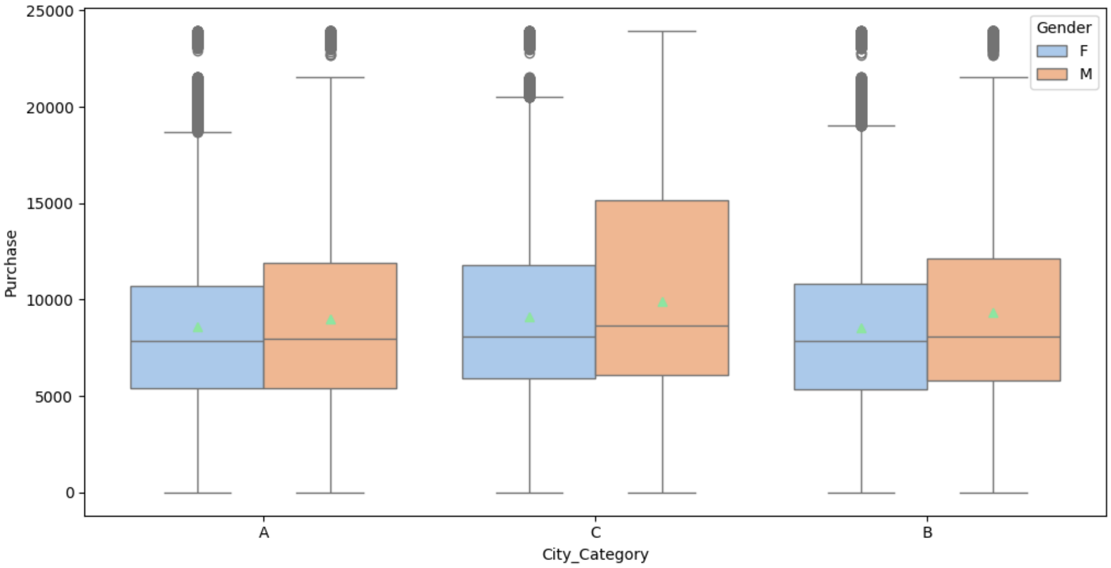
[30]:
```
plt.figure(figsize = (10, 6))
sns.boxplot(data = df, x = 'Marital_Status', y = 'Purchase', hue = 'Gender',␣
 ↪showmeans = True, width  = 0.8)
plt.plot()
```

[30]:
```
[]
```



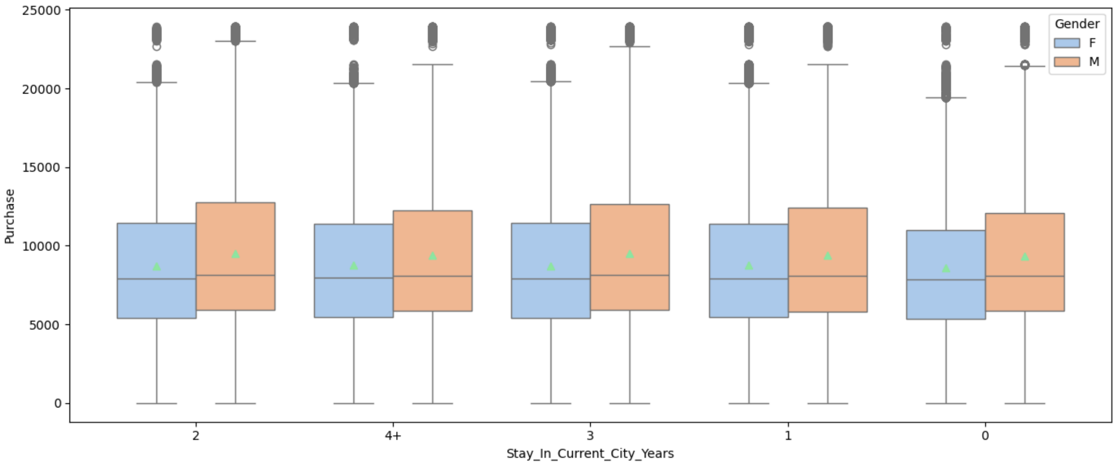
[31]:
```
plt.figure(figsize = (12, 6))
sns.boxplot(data = df, x = 'City_Category', y = 'Purchase', hue = 'Gender',␣
 ↪showmeans = True)
plt.plot()
```

[31]:
```
[]
```



[32]:
```
plt.figure(figsize = (15, 6))
sns.boxplot(data = df, x = 'Stay_In_Current_City_Years', y = 'Purchase', hue =␣
↪'Gender', showmeans = True)
plt.plot()
```

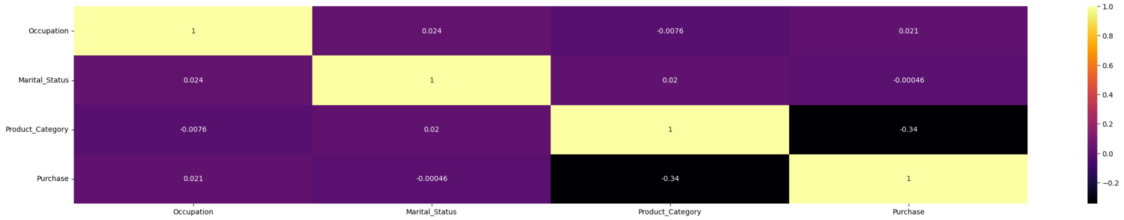
[32]: []



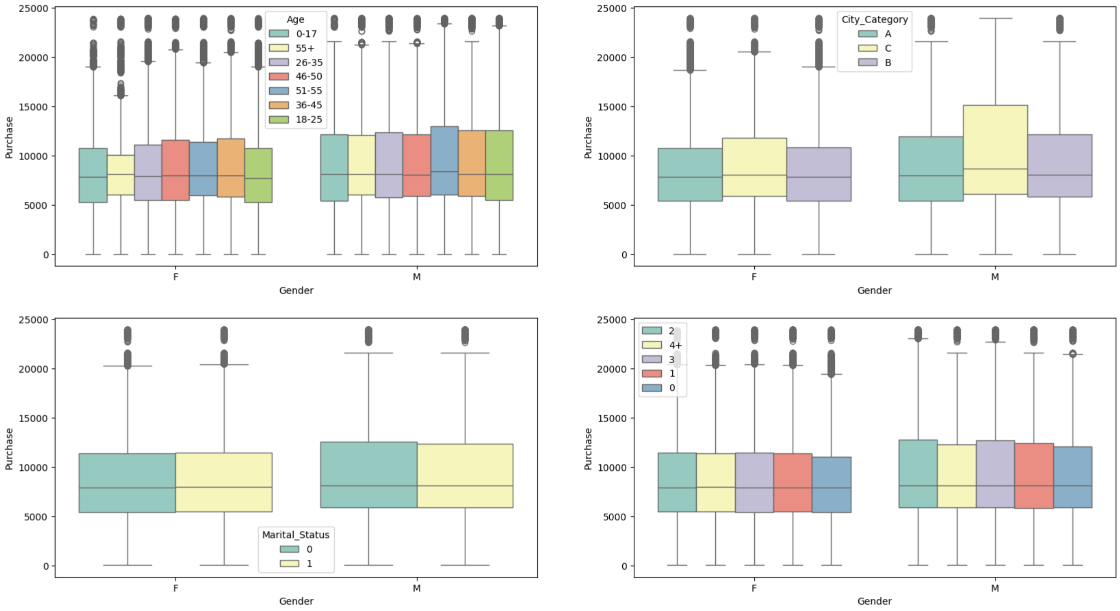
[32]:
```

```

[33]:
```
plt.figure(figsize=(30,5))
```

```
sns.heatmap(df[[ 'Occupation' ,         'Marital_Status',␣
 ↪         'Product_Category' ,        'Purchase']].corr(), cmap="inferno",␣
 ↪annot=True)
plt.show()
```



[34]:
```
fig, axs = plt.subplots(nrows=2, ncols=2, figsize=(20, 6))
fig.subplots_adjust(top=1.5)
sns.boxplot(data=df, y='Purchase', x='Gender', hue='Age', palette='Set3',␣
 ↪ax=axs[0,0])
sns.boxplot(data=df, y='Purchase', x='Gender', hue='City_Category',␣
 ↪palette='Set3', ax=axs[0,1])

sns.boxplot(data=df, y='Purchase', x='Gender', hue='Marital_Status',␣
 ↪palette='Set3', ax=axs[1,0])
sns.boxplot(data=df, y='Purchase', x='Gender',␣
 ↪hue='Stay_In_Current_City_Years', palette='Set3', ax=axs[1,1])
axs[1,1].legend(loc='upper left')

plt.show()
```



[35]:

```python
# Average amount spent by male v/s female
avg_df = df.groupby(['User_ID', 'Gender'])[['Purchase']].sum()
avg_df = avg_df.reset_index()
avg_df['Gender'].value_counts()
```

[35]:

```
Gender
M    4225
F    1666
Name: count, dtype: int64
```

[36]:

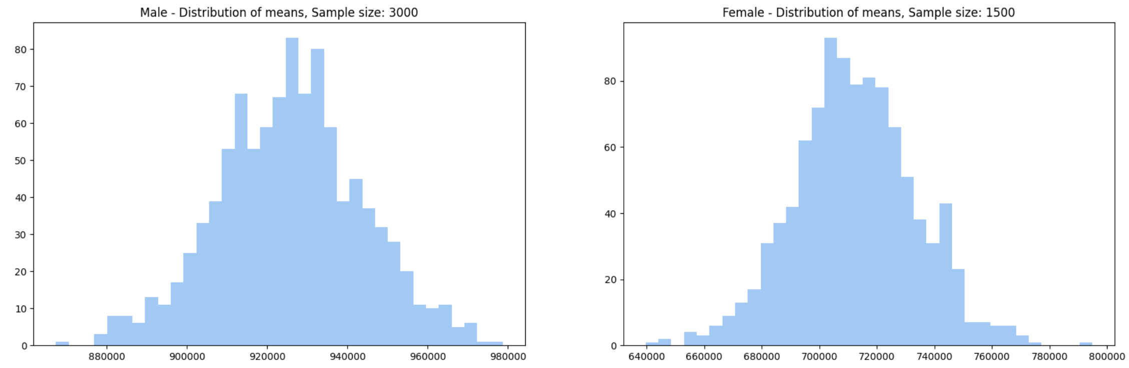
```python
male_avg = avg_df[avg_df['Gender']=='M']['Purchase'].mean()
female_avg = avg_df[avg_df['Gender']=='F']['Purchase'].mean()

print("Average amount spent by Male customers: {:.2f}".format(male_avg))
print("Average amount spent by Female customers: {:.2f}".format(female_avg))
```

```
Average amount spent by Male customers: 925344.40
Average amount spent by Female customers: 712024.39
```

[37]:

```python
male_df = avg_df[avg_df['Gender']=='M']
female_df = avg_df[avg_df['Gender']=='F']

genders = ["M", "F"]

male_sample_size = 3000
female_sample_size = 1500
num_repitions = 1000
male_means = []
female_means = []

for _ in range(num_repitions):
    male_mean = male_df.sample(male_sample_size, replace=True)['Purchase'].
 ↪mean()
    female_mean = female_df.sample(female_sample_size,␣
 ↪replace=True)['Purchase'].mean()

    male_means.append(male_mean)
    female_means.append(female_mean)

fig, axis = plt.subplots(nrows=1, ncols=2, figsize=(20, 6))

axis[0].hist(male_means, bins=35)
axis[1].hist(female_means, bins=35)
axis[0].set_title("Male - Distribution of means, Sample size: 3000")
axis[1].set_title("Female - Distribution of means, Sample size: 1500")
```

```
plt.show()

print("Population mean - Mean of sample means of amount spend for Male: {:.2f}".
↪format(np.mean(male_means)))
print("Population mean - Mean of sample means of amount spend for Female: {:.
↪2f}".format(np.mean(female_means)))

print("\nMale - Sample mean: {:.2f} Sample std: {:.2f}".
↪format(male_df['Purchase'].mean(), male_df['Purchase'].std()))
print("Female - Sample mean: {:.2f} Sample std: {:.2f}".
↪format(female_df['Purchase'].mean(), female_df['Purchase'].std()))
```



```
Population mean - Mean of sample means of amount spend for Male: 925771.21
Population mean - Mean of sample means of amount spend for Female: 712454.81

Male - Sample mean: 925344.40 Sample std: 985830.10
Female - Sample mean: 712024.39 Sample std: 807370.73
```

[38]:
```
# margin of erro  = z_multipier * sigma / sqrt(sample_size)



male_margin_of_error_clt = 1.96*male_df['Purchase'].std()/np.sqrt(len(male_df))
male_sample_mean = male_df['Purchase'].mean()
male_lower_lim = male_sample_mean - male_margin_of_error_clt
male_upper_lim = male_sample_mean + male_margin_of_error_clt

female_margin_of_error_clt = 1.96*female_df['Purchase'].std()/np.
↪sqrt(len(female_df))
female_sample_mean = female_df['Purchase'].mean()
female_lower_lim = female_sample_mean - female_margin_of_error_clt
female_upper_lim = female_sample_mean + female_margin_of_error_clt
```

```
print("Male confidence interval of means: ({:.2f}, {:.2f})".
 ↪format(male_lower_lim, male_upper_lim))
print("Female confidence interval of means: ({:.2f}, {:.2f})".
 ↪format(female_lower_lim, female_upper_lim))
```

```
Male confidence interval of means: (895617.83, 955070.97)
Female confidence interval of means: (673254.77, 750794.02)
```

[39]:

```
marital_df = df.groupby(['User_ID', 'Marital_Status'])[['Purchase']].sum()
marital_df = marital_df.reset_index()
marital_df

marital_df['Marital_Status'].value_counts()
```

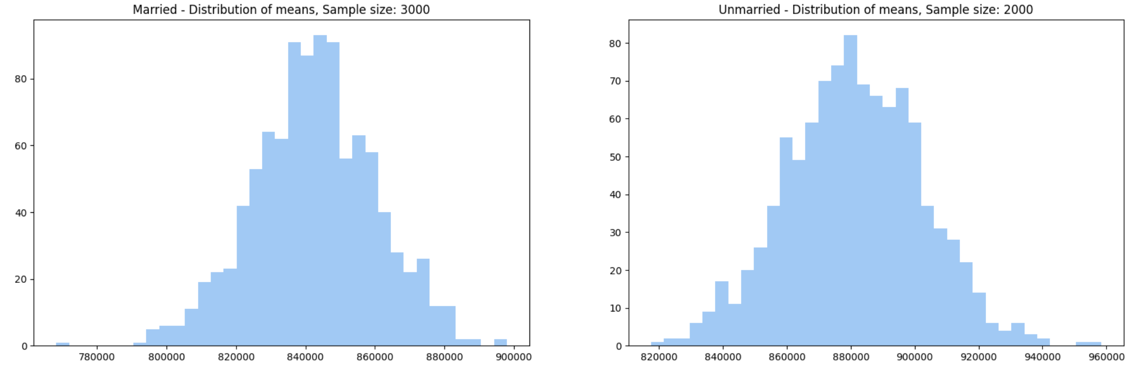
[39]:

```
Marital_Status
0    3417
1    2474
Name: count, dtype: int64
```

[40]:

```
married_sample_size = 3000
unmarried_sample_size = 2000
num_repitions = 1000
marid_means = []
unmarid_means = []

for _ in range(num_repitions):
    marid_mean = marital_df[marital_df['Marital_Status']==1].
 ↪sample(married_sample_size, replace=True)['Purchase'].mean()
    unmarid_mean = marital_df[marital_df['Marital_Status']==0].
 ↪sample(unmarried_sample_size, replace=True)['Purchase'].mean()

    marid_means.append(marid_mean)
    unmarid_means.append(unmarid_mean)


fig, axis = plt.subplots(nrows=1, ncols=2, figsize=(20, 6))

axis[0].hist(marid_means, bins=35)
axis[1].hist(unmarid_means, bins=35)
axis[0].set_title("Married - Distribution of means, Sample size: 3000")
axis[1].set_title("Unmarried - Distribution of means, Sample size: 2000")

plt.show()

print("Population mean - Mean of sample means of amount spend for Married: {:.
 ↪2f}".format(np.mean(marid_means)))
```

```
print("Population mean - Mean of sample means of amount spend for Unmarried: {:.
 ↪2f}".format(np.mean(unmarid_means)))

print("\nMarried - Sample mean: {:.2f} Sample std: {:.2f}".
 ↪format(marital_df[marital_df['Marital_Status']==1]['Purchase'].mean(),␣
 ↪marital_df[marital_df['Marital_Status']==1]['Purchase'].std()))
print("Unmarried - Sample mean: {:.2f} Sample std: {:.2f}".
 ↪format(marital_df[marital_df['Marital_Status']==0]['Purchase'].mean(),␣
 ↪marital_df[marital_df['Marital_Status']==0]['Purchase'].std()))
```



```
Population mean - Mean of sample means of amount spend for Married: 842625.86
Population mean - Mean of sample means of amount spend for Unmarried: 881204.14

Married - Sample mean: 843526.80 Sample std: 935352.12
Unmarried - Sample mean: 880575.78 Sample std: 949436.25
```

[42]:
```
# Married

marital_status =1


new_df = marital_df[marital_df['Marital_Status']==marital_status]

margin_of_error_clt = 1.96*new_df['Purchase'].std()/np.sqrt(len(new_df))
sample_mean = new_df['Purchase'].mean()
lower_lim = sample_mean - margin_of_error_clt
upper_lim = sample_mean + margin_of_error_clt

print("{} confidence interval of means: ({:.2f}, {:.2f})".format("Married",␣
 ↪lower_lim, upper_lim))
```

```
Married confidence interval of means: (806668.83, 880384.76)
```

[43]:

```
# unmarried

marital_status = 0


new_df = marital_df[marital_df['Marital_Status']==marital_status]

margin_of_error_clt = 1.96*new_df['Purchase'].std()/np.sqrt(len(new_df))
sample_mean = new_df['Purchase'].mean()
lower_lim = sample_mean - margin_of_error_clt
upper_lim = sample_mean + margin_of_error_clt

print("{} confidence interval of means: ({:.2f}, {:.2f})".format("Unmarried",␣
 ↪lower_lim, upper_lim))
```

```
Unmarried confidence interval of means: (848741.18, 912410.38)
```

[44]:

```
age_df = df.groupby(['User_ID', 'Age'])[['Purchase']].sum()
age_df = age_df.reset_index()
age_df

age_df['Age'].value_counts()
```

[44]:

```
Age
26-35    2053
36-45    1167
18-25    1069
46-50     531
51-55     481
55+       372
0-17      218
Name: count, dtype: int64
```

[45]:

```
sample_size = 200
num_repitions = 1000

all_means = {}

age_intervals = ['26-35', '36-45', '18-25', '46-50', '51-55', '55+', '0-17']
for age_interval in age_intervals:
    all_means[age_interval] = []

for age_interval in age_intervals:
    for _ in range(num_repitions):
        mean = age_df[age_df['Age']==age_interval].sample(sample_size,␣
 ↪replace=True)['Purchase'].mean()
        all_means[age_interval].append(mean)
```

```
for val in ['26-35', '36-45', '18-25', '46-50', '51-55', '55+', '0-17']:

    new_df = age_df[age_df['Age']==val]

    margin_of_error_clt = 1.96*new_df['Purchase'].std()/np.sqrt(len(new_df))
    sample_mean = new_df['Purchase'].mean()
    lower_lim = sample_mean - margin_of_error_clt
    upper_lim = sample_mean + margin_of_error_clt

    print("For age {} --> confidence interval of means: ({:.2f}, {:.2f})".
  ↪format(val, lower_lim, upper_lim))
```

```
For age 26-35 --> confidence interval of means: (945034.42, 1034284.21)
For age 36-45 --> confidence interval of means: (823347.80, 935983.62)
For age 18-25 --> confidence interval of means: (801632.78, 908093.46)
For age 46-50 --> confidence interval of means: (713505.63, 871591.93)
For age 51-55 --> confidence interval of means: (692392.43, 834009.42)
For age 55+ --> confidence interval of means: (476948.26, 602446.23)
For age 0-17 --> confidence interval of means: (527662.46, 710073.17)
```

```
[ ]:
```