Business Problem

The Management team at Walmart Inc. wants to analyze the customer purchase behavior (specifically, purchase amount) against the customer's gender and the various other factors to help the business make better decisions. They want to understand if the spending habits differ between male and female customers: Do women spend more on Black Friday than men? (Assume 50 million customers are male and 50 million are female).

Importing all the packages

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

```
df=pd.read_csv('walmart_data.csv?1641285094')
df.head()
```

	User_ID	Product_ID	Gender	Age	Occupation	City_Category	Stay_In_Current_City_Years	Marital_Status	Product_Cat
0	1000001	P00069042	F	0-17	10	A	2	0	
1	1000001	P00248942	F	0-17	10	A	2	0	
2	1000001	P00087842	F	0-17	10	A	2	0	

```
df.shape
```

```
(550068, 10)
```

```
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
```

```
df.isna().sum()
```

	0
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

This data contains no missing values

```
columns = ['Occupation','Marital_Status','Product_Category']
df[columns] = df[columns].astype('object')
df.dtypes
```

	0
User_ID	int64
Product_ID	object
Gender	object
Age	object
Occupation	object
City_Category	object
Stay_In_Current_City_Years	object
Marital_Status	object
Product_Category	object
Purchase	int64

dtype: object

Changing datatype int64 to object

```
df.describe()
```

	User_ID	Purchase
count	5.500680e+05	550068.000000
mean	1.003029e+06	9263.968713
std	1.727592e+03	5023.065394
min	1.000001e+06	12.000000
25%	1.001516e+06	5823.000000
50%	1.003077e+06	8047.000000
75%	1.004478e+06	12054.000000
max	1.006040e+06	23961.000000

```
categorical_cols = ['Gender', 'Age', 'Stay_In_Current_City_Years', 'Marital_Status','City_Category']
df[categorical_cols].melt().groupby(['variable', 'value'])[['value']].count()*100/len(df)
```

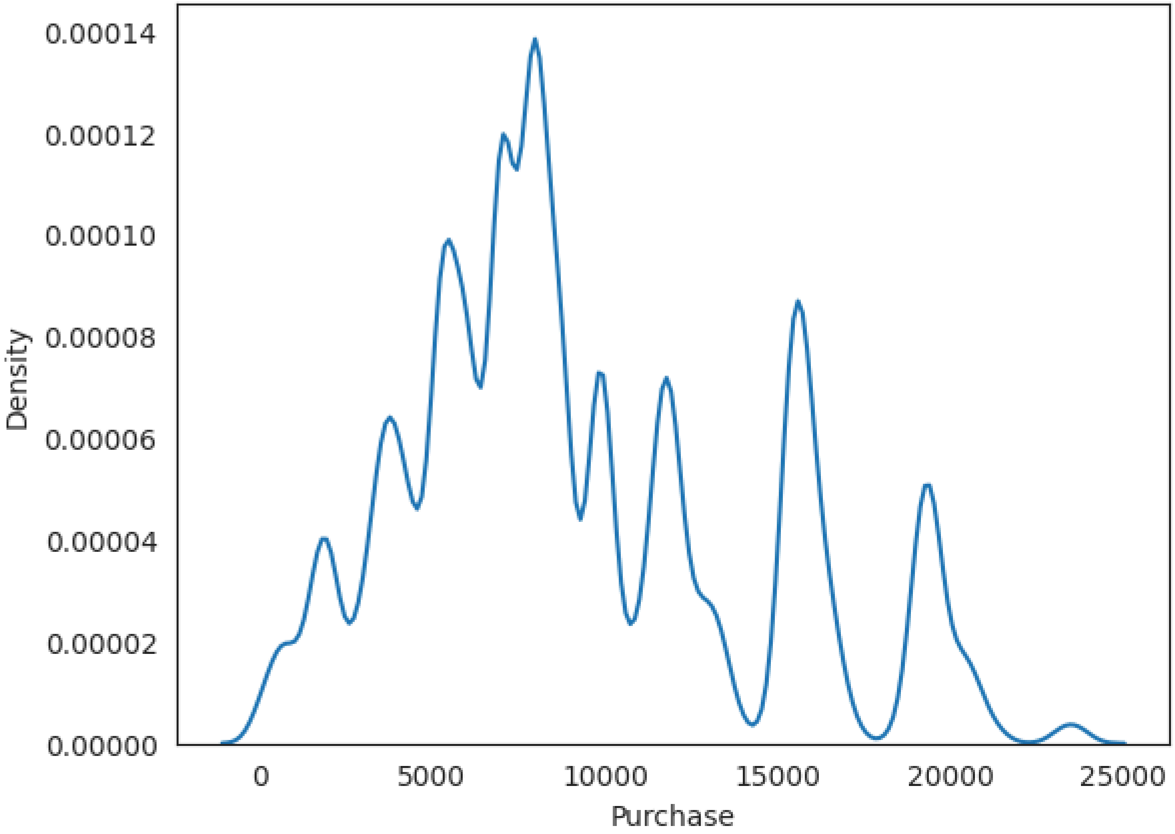
		value
variable	value	
Age	**0-17**	2.745479
	18-25	18.117760
	26-35	39.919974
	36-45	19.999891
	46-50	8.308246
	51-55	6.999316
	55+	3.909335
City_Category	**A**	26.854862
	B	42.026259
	C	31.118880
Gender	**F**	24.689493
	M	75.310507
Marital_Status	**0**	59.034701
	1	40.965299
Stay_In_Current_City_Years	**0**	13.525237
	1	35.235825
	2	18.513711
	3	17.322404
	4+	15.402823

- 75% of users are male and 25% are female.

- Users ages 26–35 are 40%, users ages 36–45 are 20%, users ages 18–25 are 18%,and very low users ages (0–17 & 55+)are 5%.
- 60% of users are single, and 40% are married.

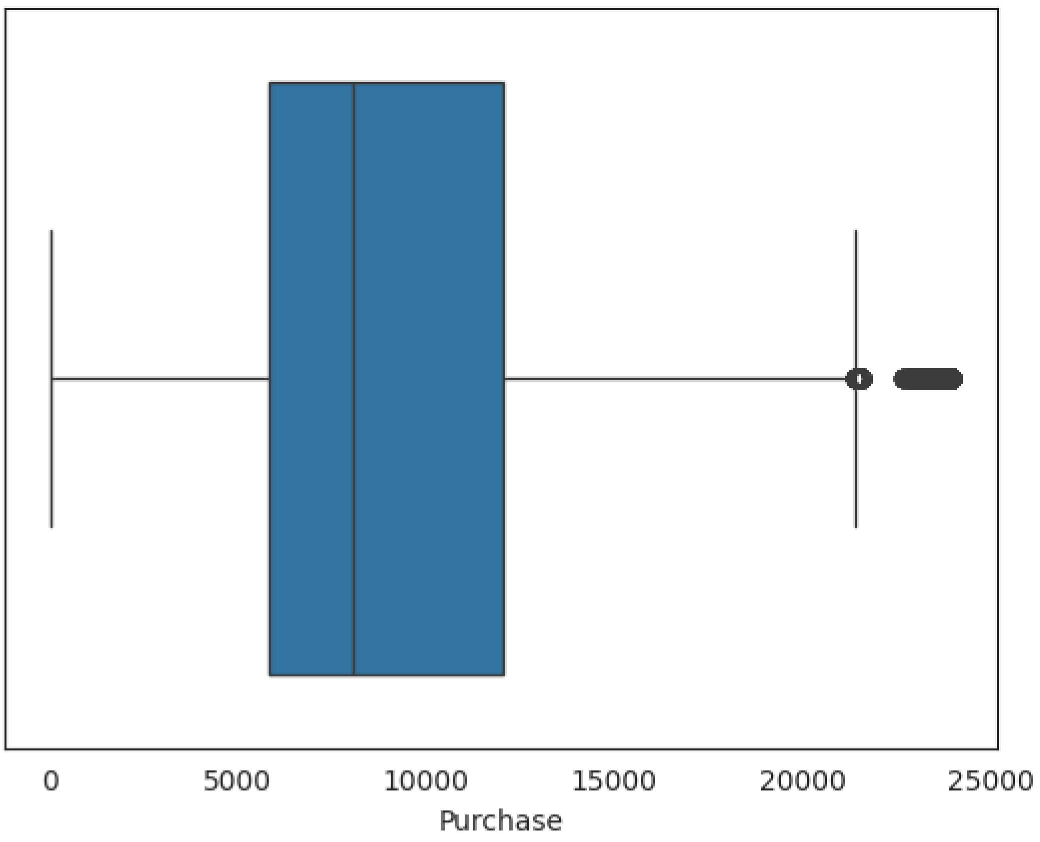
Visual Analysis - Univariate & Bivariate

```
sns.kdeplot(data=df, x='Purchase')
plt.show()
```



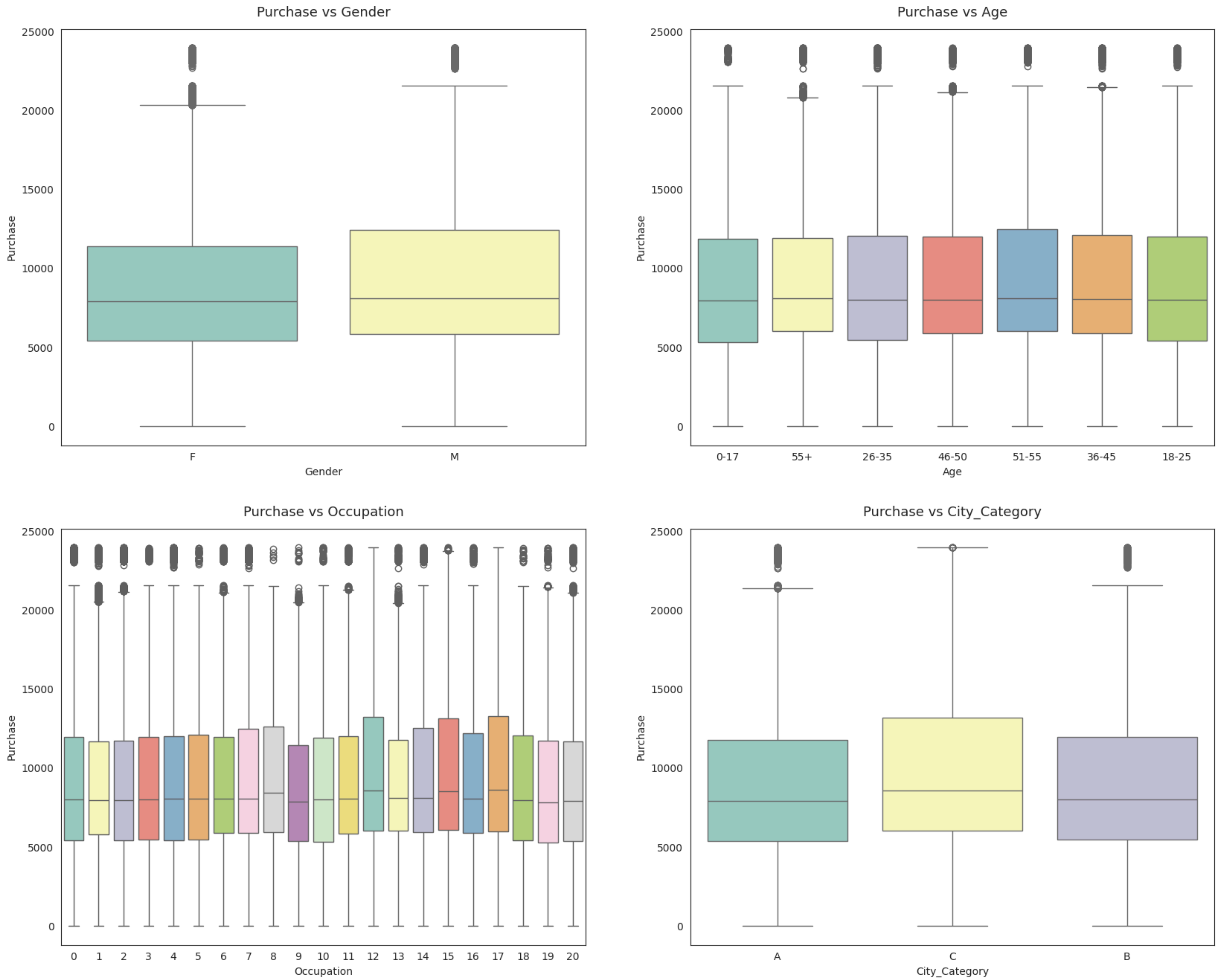
Majority of purchases lie between 5000 to 9000 units

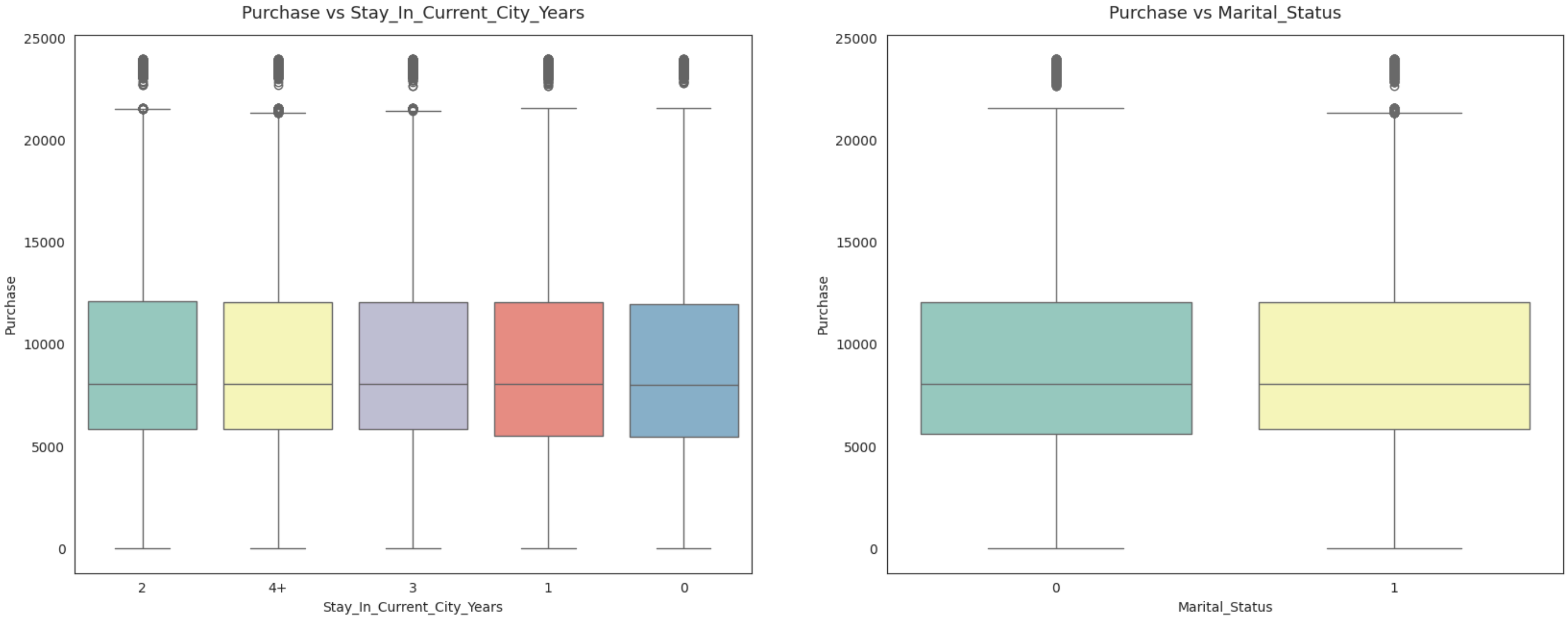
```
sns.boxplot(data=df, x='Purchase')
plt.show()
```



```
attrs = ['Gender', 'Age', 'Occupation', 'City_Category', 'Stay_In_Current_City_Years', 'Marital_Status']
sns.set_style("white")

fig, axs = plt.subplots(nrows=3, ncols=2, figsize=(20, 16))
fig.subplots_adjust(top=1.3)
count = 0
for row in range(3):
    for col in range(2):
        sns.boxplot(data=df, y='Purchase', x=attrs[count], hue=attrs[count], ax=axs[row, col], palette='Set3', legend=False
        axs[row, col].set_title(f"Purchase vs {attrs[count]}", pad=12, fontsize=13)
```

```
            count += 1
    plt.show()
```


Purchase vs Gender
Purchase
Gender
F
M
0
5000
10000
15000
20000
25000
Purchase vs Age
Purchase
Age
0-17
55+
26-35
46-50
51-55
36-45
18-25
Purchase vs Occupation
Purchase
Occupation
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Purchase vs City_Category
Purchase
City_Category
A
C
B


Purchase vs Stay_In_Current_City_Years
25000
20000
15000
10000
5000
0
Purchase
2
4+
3
1
0
Stay_In_Current_City_Years
Purchase vs Marital_Status
25000
20000
15000
10000
5000
0
Purchase
0
1
Marital_Status

```
q1=df.Purchase.quantile(0.25)
q3=df.Purchase.quantile(0.75)
print(q1,q3)
IQR=q3-q1
outliers = df[((df.Purchase<(q1-1.5*IQR)) | (df.Purchase>(q3+1.5*IQR)))]
print("num outliers : ",len(outliers))
print("percent outliers : ",len(outliers)/len(df))
```

```
5823.0 12054.0
num outliers :  2677
percent outliers :  0.004866671029763593
```

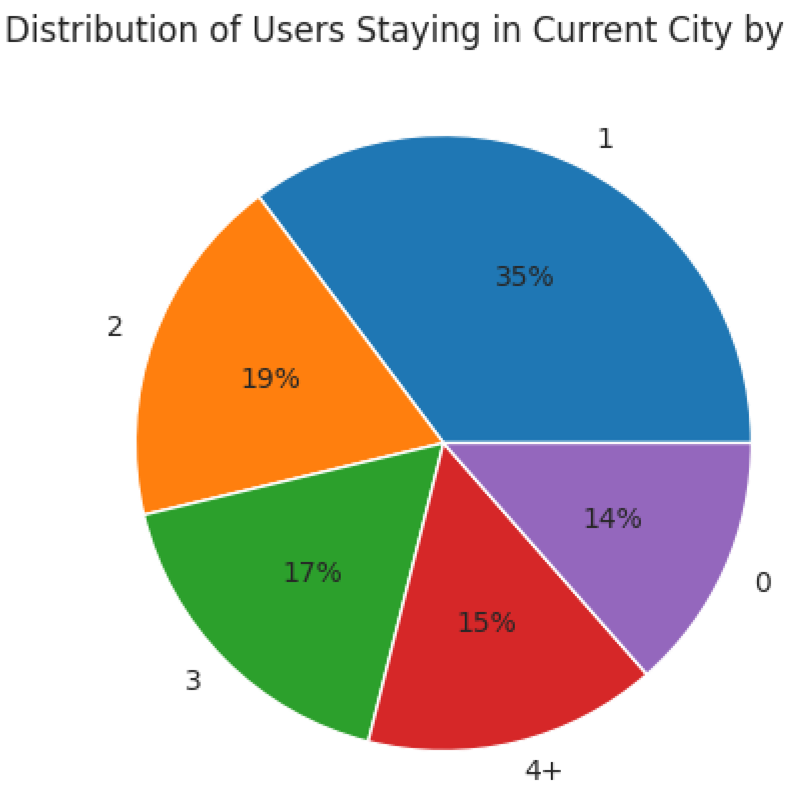
```
df_clean=df.drop(df[ (df.Purchase > (q3+1.5*IQR)) | (df.Purchase < (q1-1.5*IQR)) ].index)
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 547391 entries, 0 to 550067
Data columns (total 10 columns):
 #   Column                      Non-Null Count   Dtype
---  ------                      --------------   -----
 0   User_ID                     547391 non-null  int64
 1   Product_ID                  547391 non-null  object
 2   Gender                      547391 non-null  object
 3   Age                         547391 non-null  object
 4   Occupation                  547391 non-null  object
 5   City_Category               547391 non-null  object
 6   Stay_In_Current_City_Years  547391 non-null  object
 7   Marital_Status              547391 non-null  object
 8   Product_Category            547391 non-null  object
 9   Purchase                    547391 non-null  int64
dtypes: int64(2), object(8)
memory usage: 45.9+ MB
```

```
staying=df['Stay_In_Current_City_Years'].value_counts(normalize=True)*100
stay.index
```

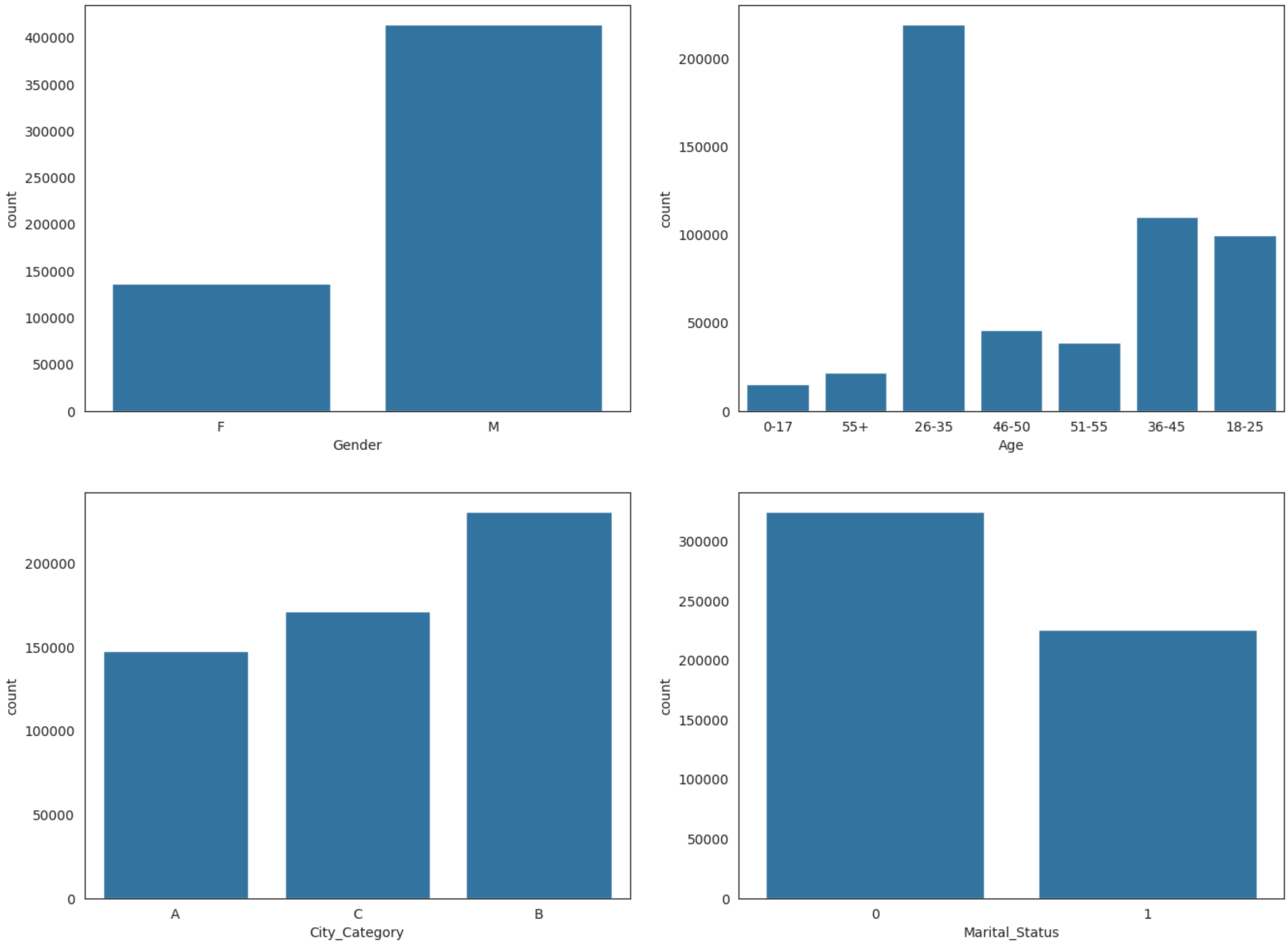
```
Index(['1', '2', '3', '4+', '0'], dtype='object', name='Stay_In_Current_City_Years')
```

```
staying.replace(to_replace='4+',value=4,inplace=True)


plt.figure(figsize=(8,5))
plt.pie(x=staying.values,labels=stay.index,autopct='%.0f%%')
plt.title('Distribution of Users Staying in Current City by Years')
plt.show()
```

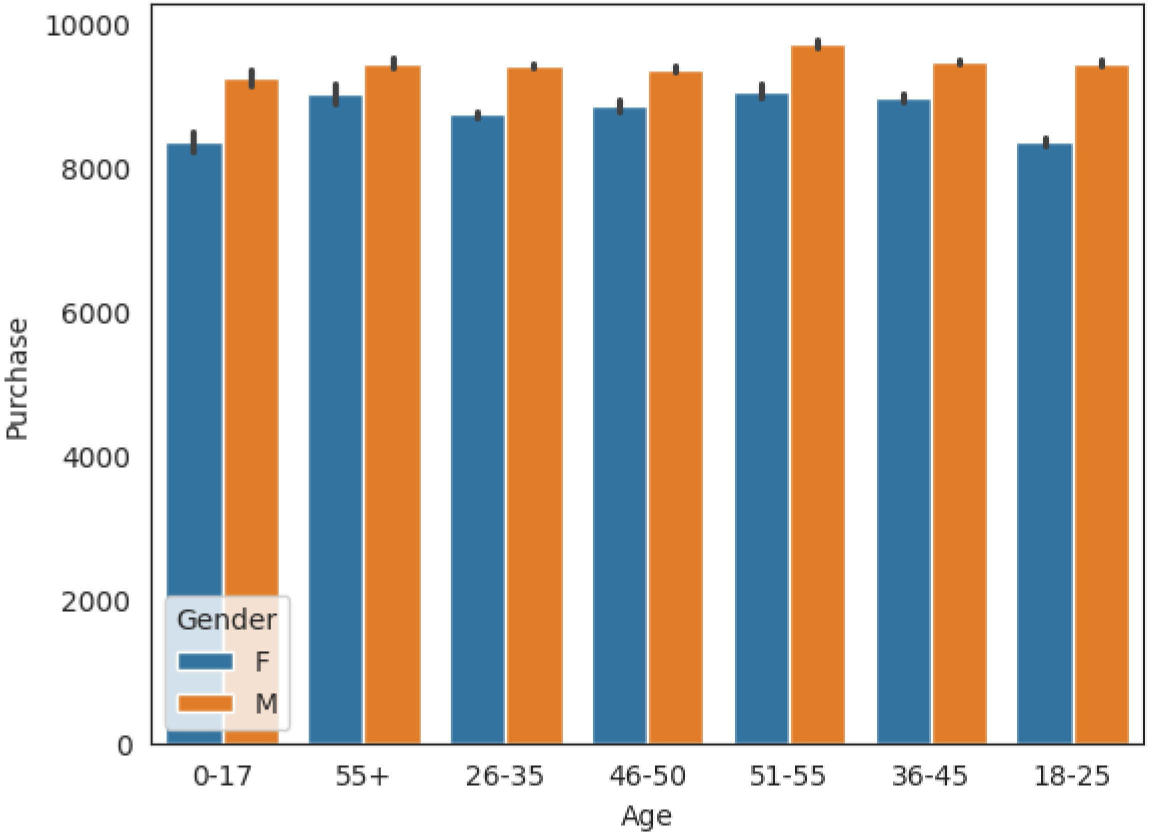


```
fig, axs = plt.subplots(nrows=2, ncols=2, figsize=(16, 12))
sns.countplot(data=df, x='Gender', ax=axs[0,0])
sns.countplot(data=df, x='Age', ax=axs[0,1])
sns.countplot(data=df, x='City_Category', ax=axs[1,0])
sns.countplot(data=df, x='Marital_Status', ax=axs[1,1])
```

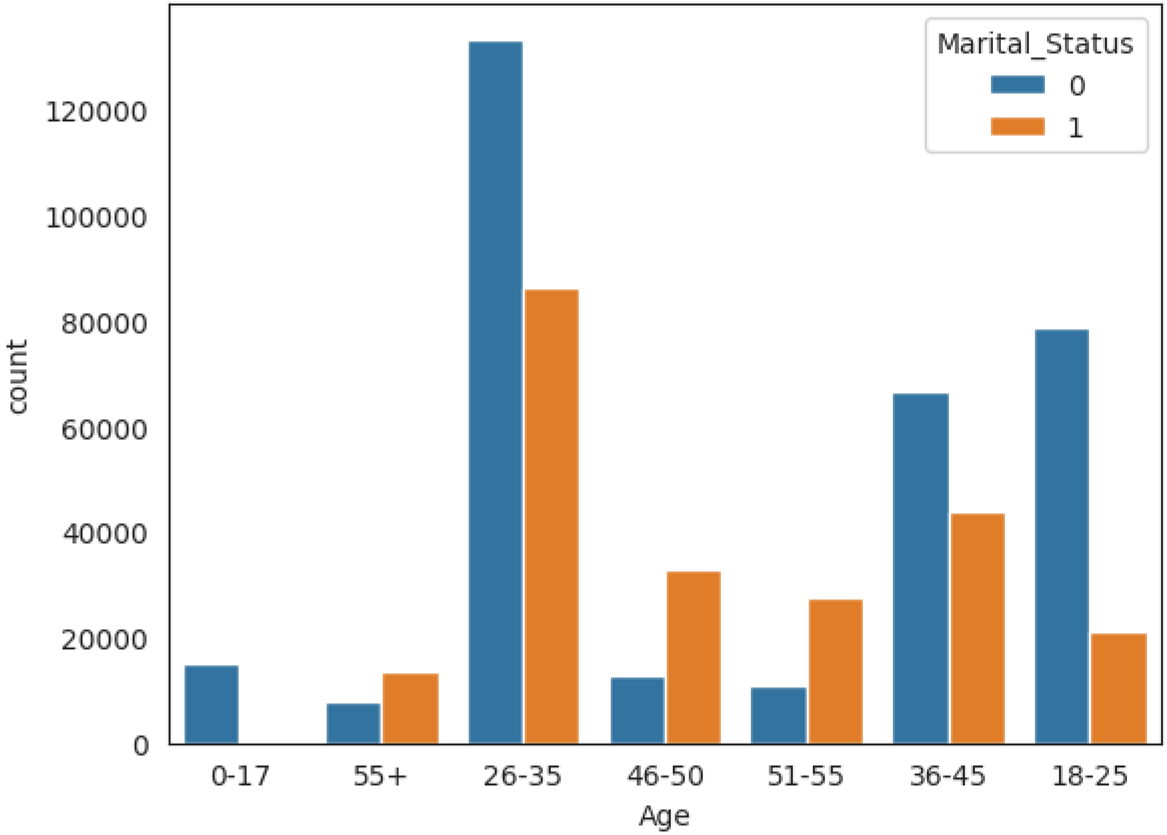
```
    plt.show()
```


400000
350000
300000
250000
200000
150000
100000
50000
0
count
F
M
Gender
200000
150000
100000
50000
0
count
0-17
55+
26-35
46-50
51-55
36-45
18-25
Age
200000
150000
100000
50000
0
count
A
C
B
City_Category
300000
250000
200000
150000
100000
50000
0
count
0
1
Marital_Status

```
sns.barplot(data=df, x='Age', y='Purchase',hue="Gender")
plt.show()
```

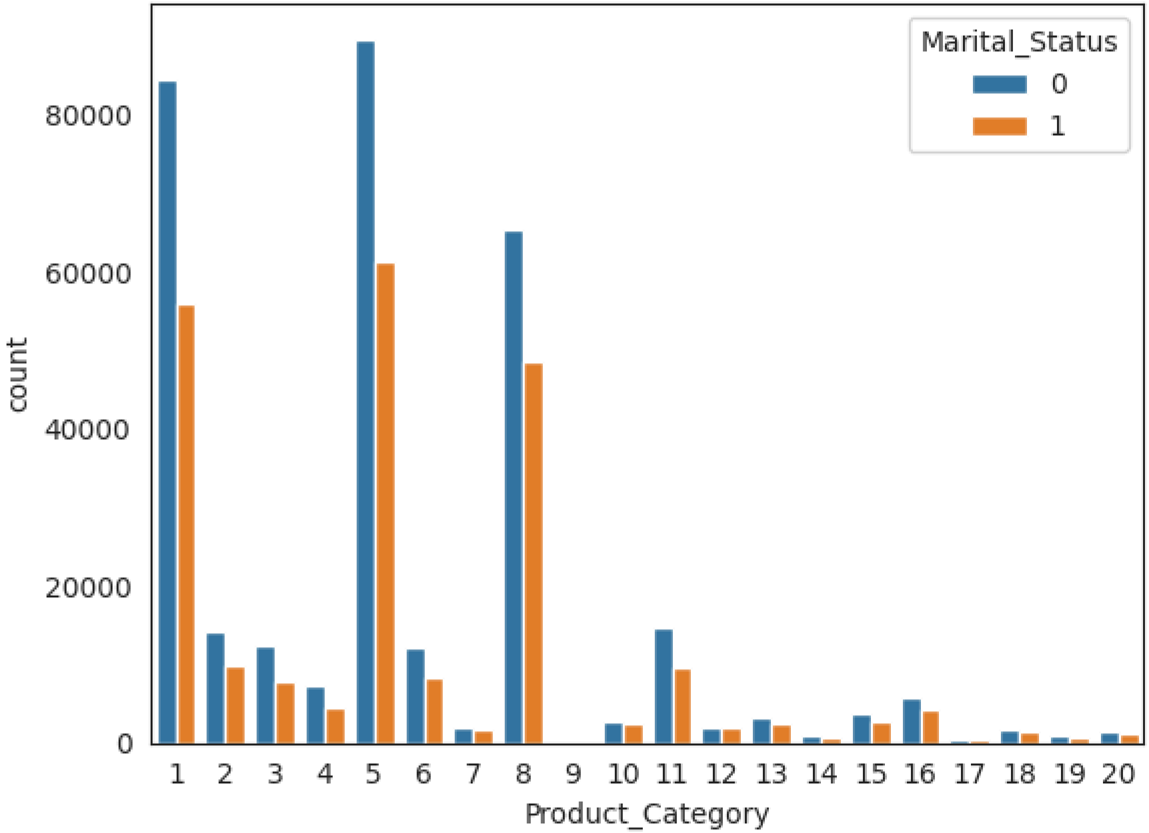


```
sns.countplot(data=df, x='Age',hue='Marital_Status')
plt.show()
```

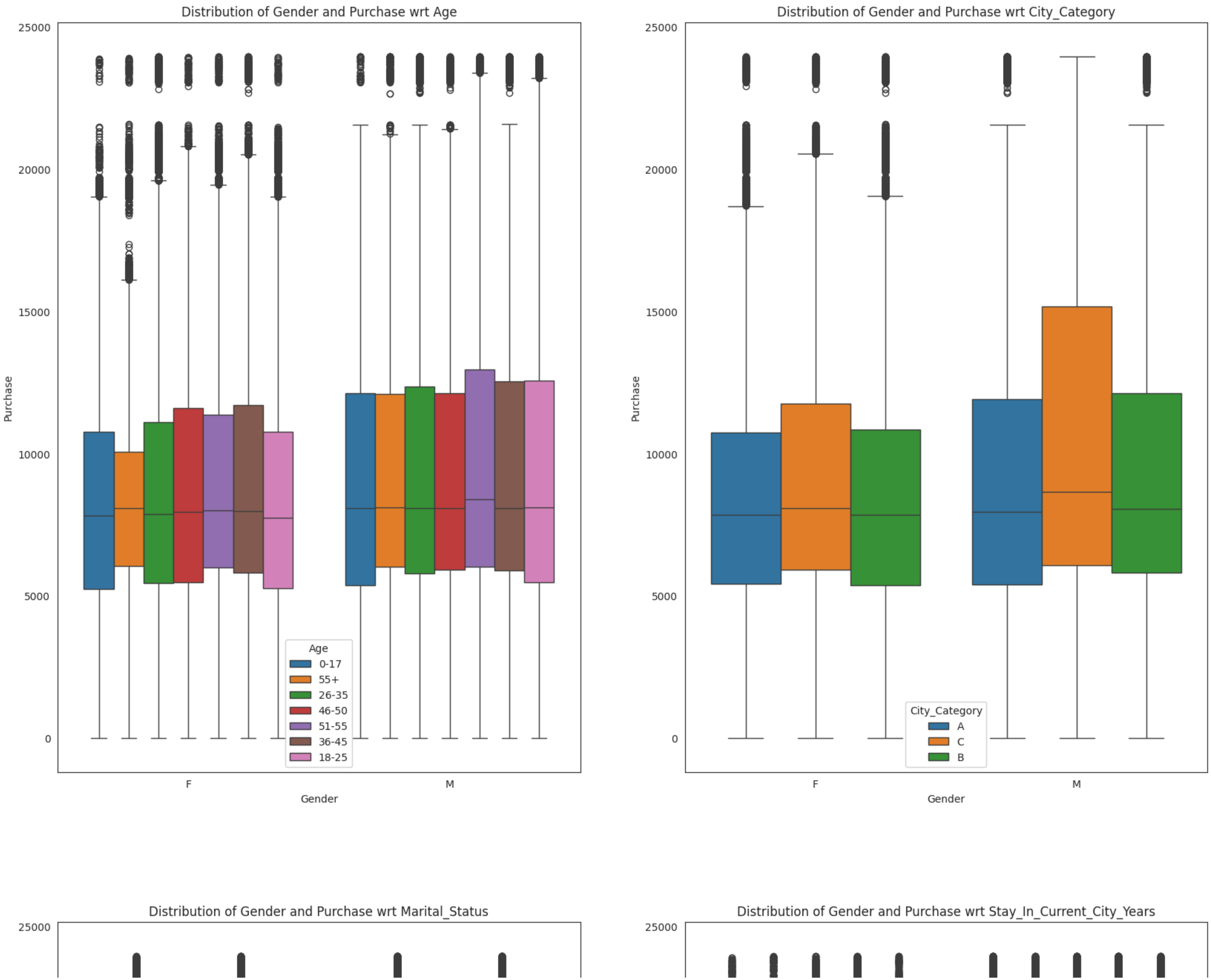


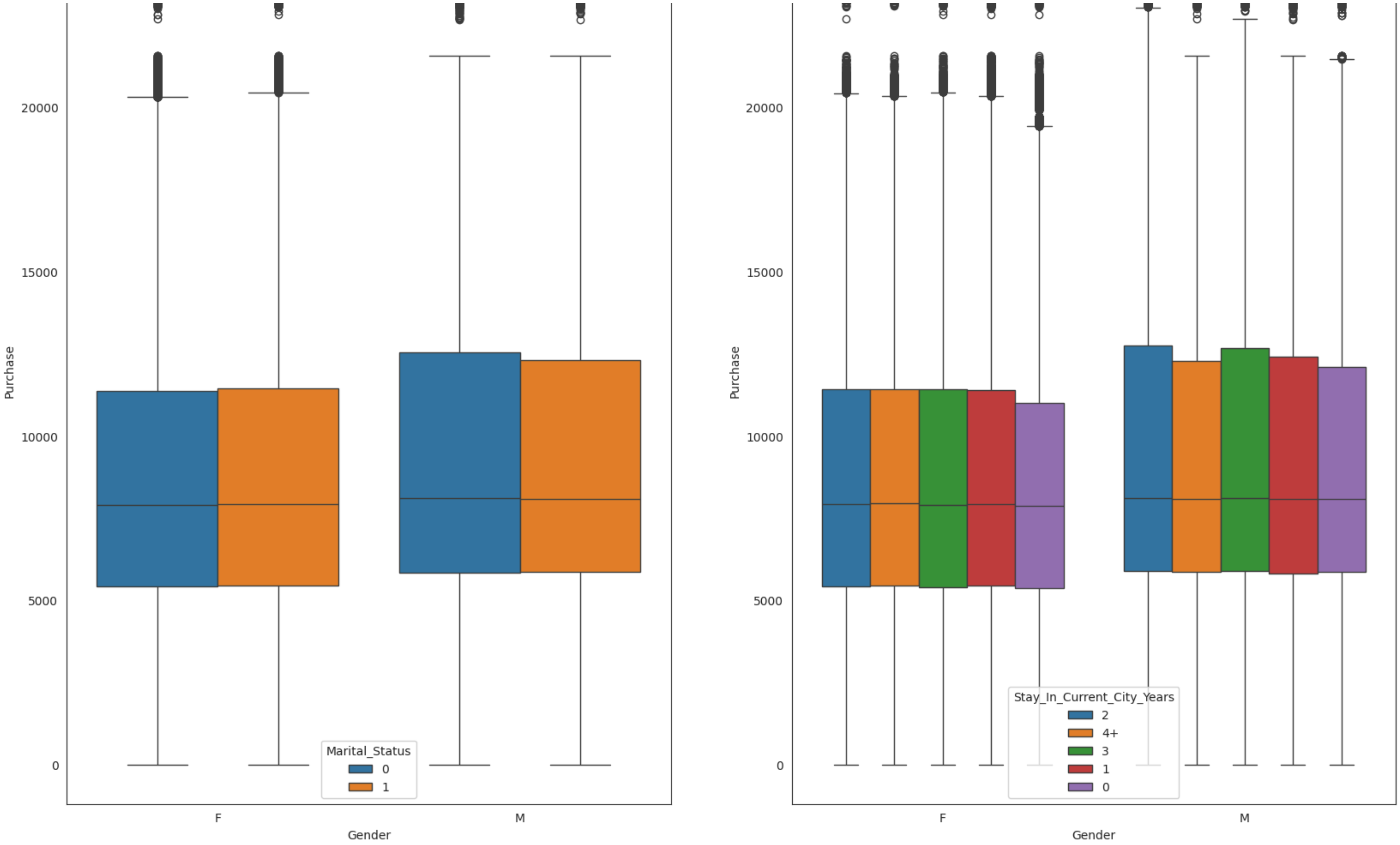
- as expected 0-17 no married
- till 45 number of unmarried people are more than married
- after 45 number of married are more

```
sns.countplot(data=df, x='Product_Category',hue='Marital_Status')
plt.show()
```



```
attr1=['Age','City_Category','Marital_Status','Stay_In_Current_City_Years']
fig, ax=plt.subplots(2,2,figsize=(20,16))
fig.subplots_adjust(top=1.5)
idx=0
for i in range(2):
    for j in range(2):
        sns.boxplot(data=df,x='Gender',y='Purchase',hue=attr1[idx],ax=ax[i,j])
        ax[i,j].set_title(f'Distribution of Gender and Purchase wrt {attr1[idx]}')
        idx+=1
plt.show()
```


Distribution of Gender and Purchase wrt Age
25000
20000
15000
10000
5000
0
Purchase
F
M
Gender
Age
0-17
55+
26-35
46-50
51-55
36-45
18-25
Distribution of Gender and Purchase wrt City_Category
25000
20000
15000
10000
5000
0
Purchase
F
M
Gender
City_Category
A
C
B
Distribution of Gender and Purchase wrt Marital_Status
25000
Distribution of Gender and Purchase wrt Stay_In_Current_City_Years
25000


Purchase
20000
15000
10000
5000
0
Marital_Status
0
1
F
M
Gender
Purchase
20000
15000
10000
5000
0
Stay_In_Current_City_Years
2
4+
3
1
0
F
M
Gender

- Male cutomers purchase more than the females, among males 51-55 age group average purchase value is high compared to others.
- Males from City category A have high purchase value compared to other categories where females from category A has low purchase values.

```
user_amt=df.groupby(['User_ID','Gender'])[['Purchase']].sum().reset_index()
user_amt.head()
```

	User_ID	Gender	Purchase
0	1000001	F	334093
1	1000002	M	810472
2	1000003	M	341635
3	1000004	M	206468
4	1000005	M	821001

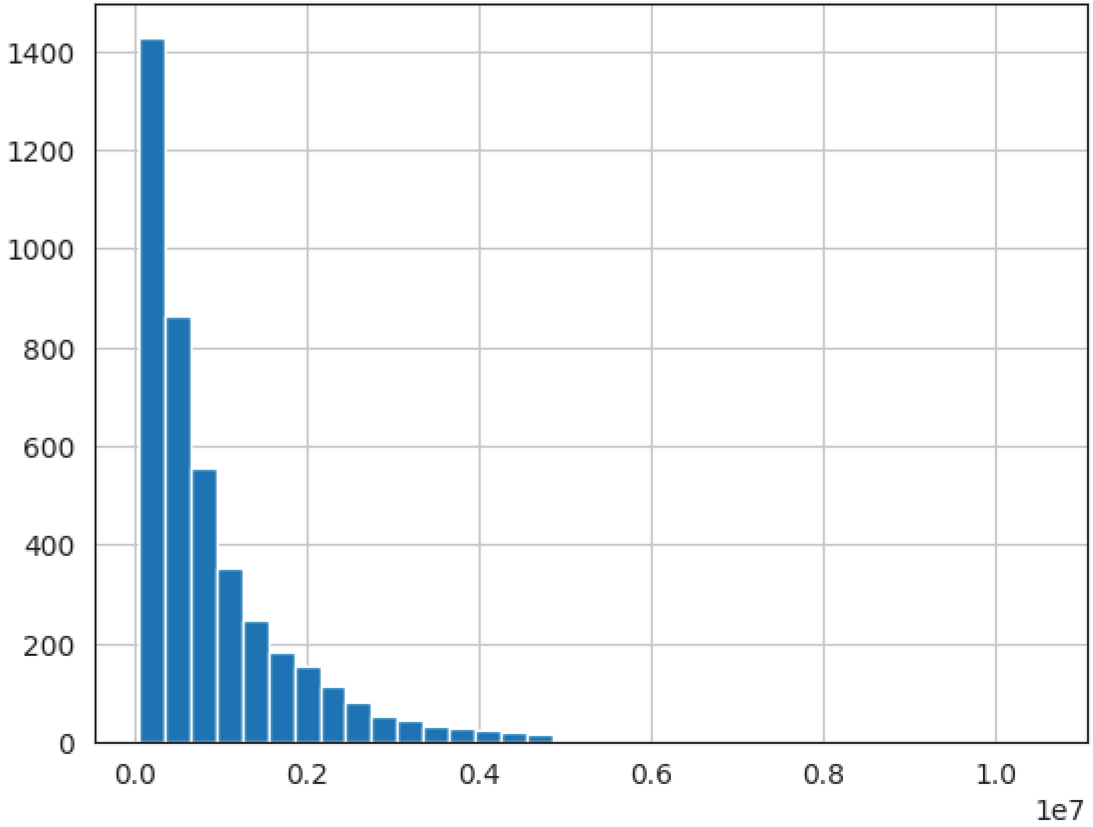
```
Female_data = df[df["Gender"]=="F"]
print("Female Purchase amount Mean:"+ str(Female_data["Purchase"].mean()))
```

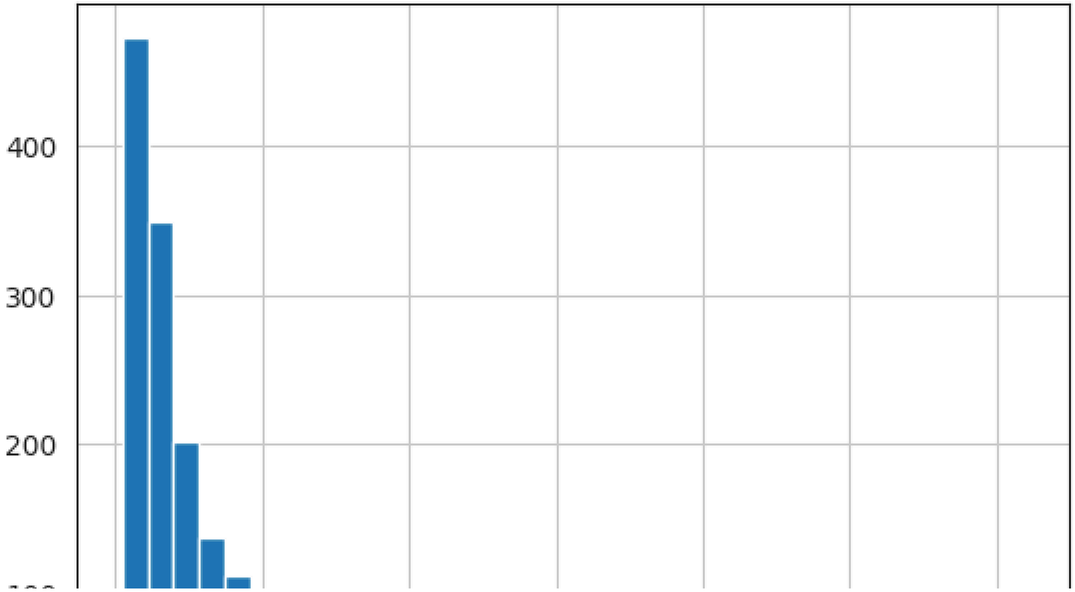
```
Female Purchase amount Mean:8734.565765155476
```

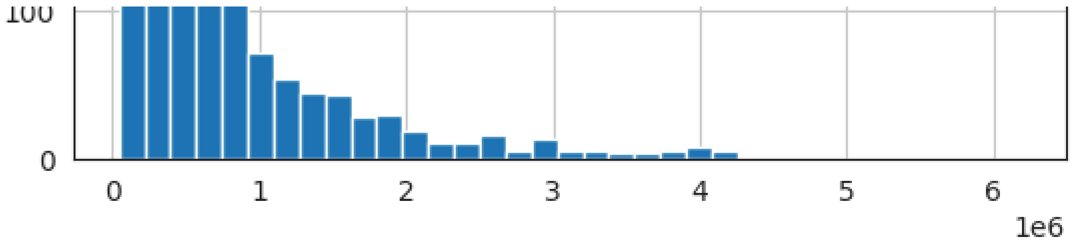
```
Male_data = df[df["Gender"]=="M"]
print("Female Purchase amount Mean:"+ str(Male_data["Purchase"].mean()))
```

```
Female Purchase amount Mean:9437.526040472265
```

```
user_amt[user_amt['Gender']=='M']['Purchase'].hist(bins=35)
plt.show()
user_amt[user_amt['Gender']=='F']['Purchase'].hist(bins=35)
plt.show()
```

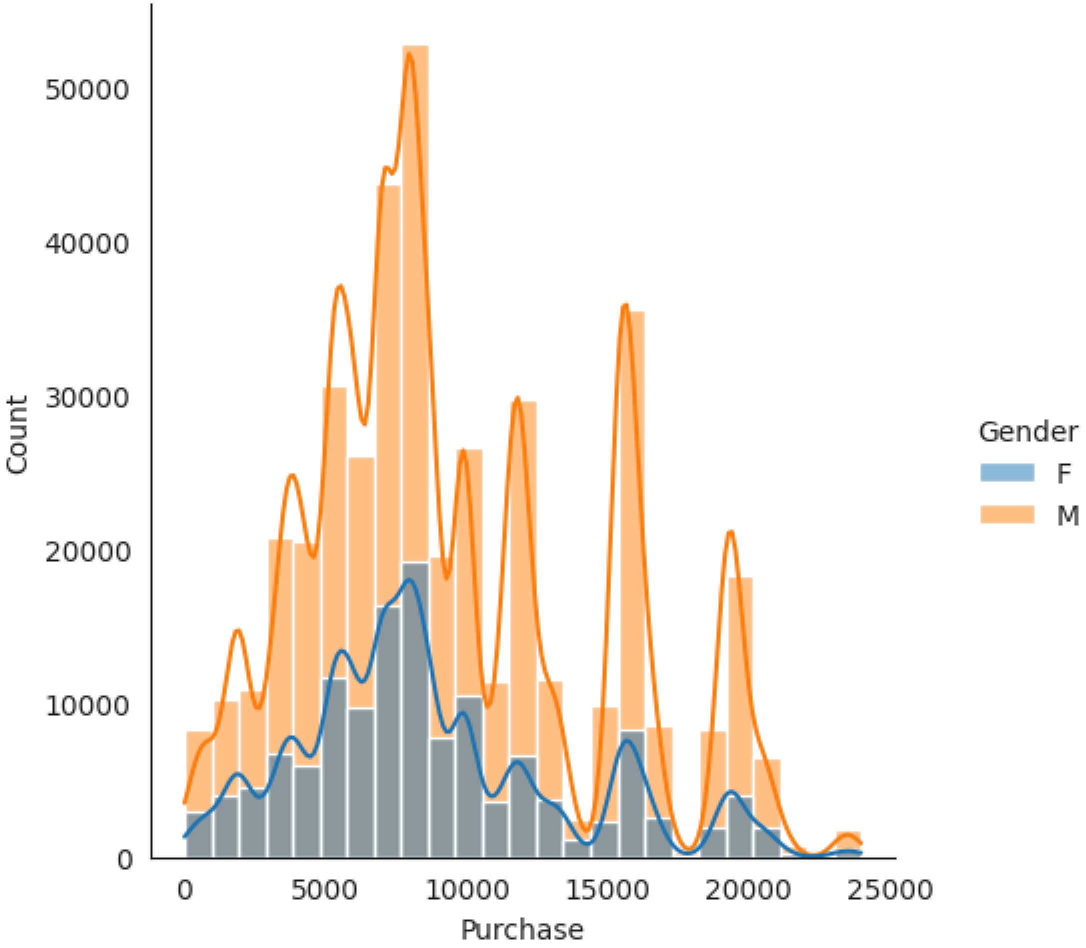

1400
1200
1000
800
600
400
200
0
0.0
0.2
0.4
0.6
0.8
1.0
1e7


400
300
200

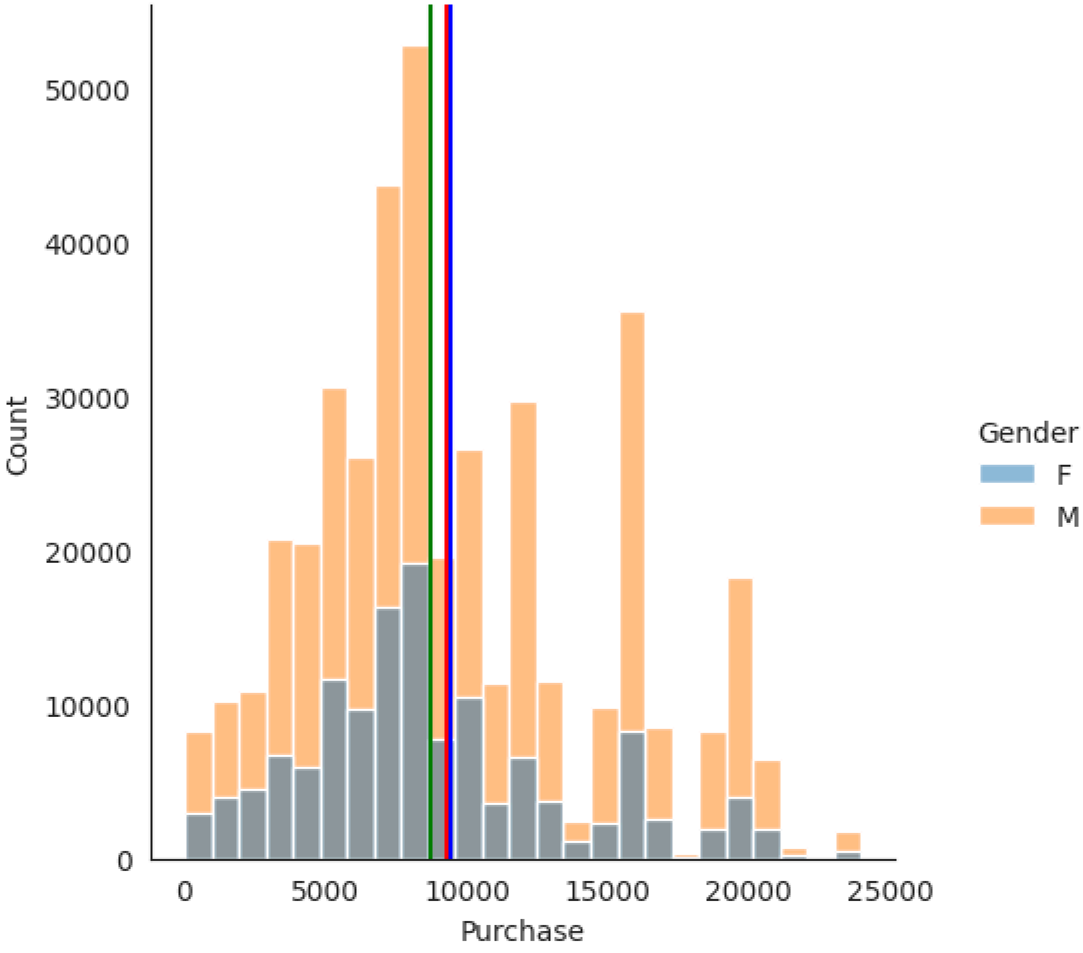


```
sns.displot(x='Purchase', bins=25, kde=True,hue='Gender', data=df )
```

```
<seaborn.axisgrid.FacetGrid at 0x7aa66e952250>
```



```
sns.displot(x='Purchase', data=df, bins=25, hue='Gender')

plt.axvline(x=df['Purchase'].mean(), color='r')
plt.axvline(x=df[df['Gender']=='M']['Purchase'].mean(), color='b')
plt.axvline(x=df[df['Gender']=='F']['Purchase'].mean(), color='g')

plt.show()
```



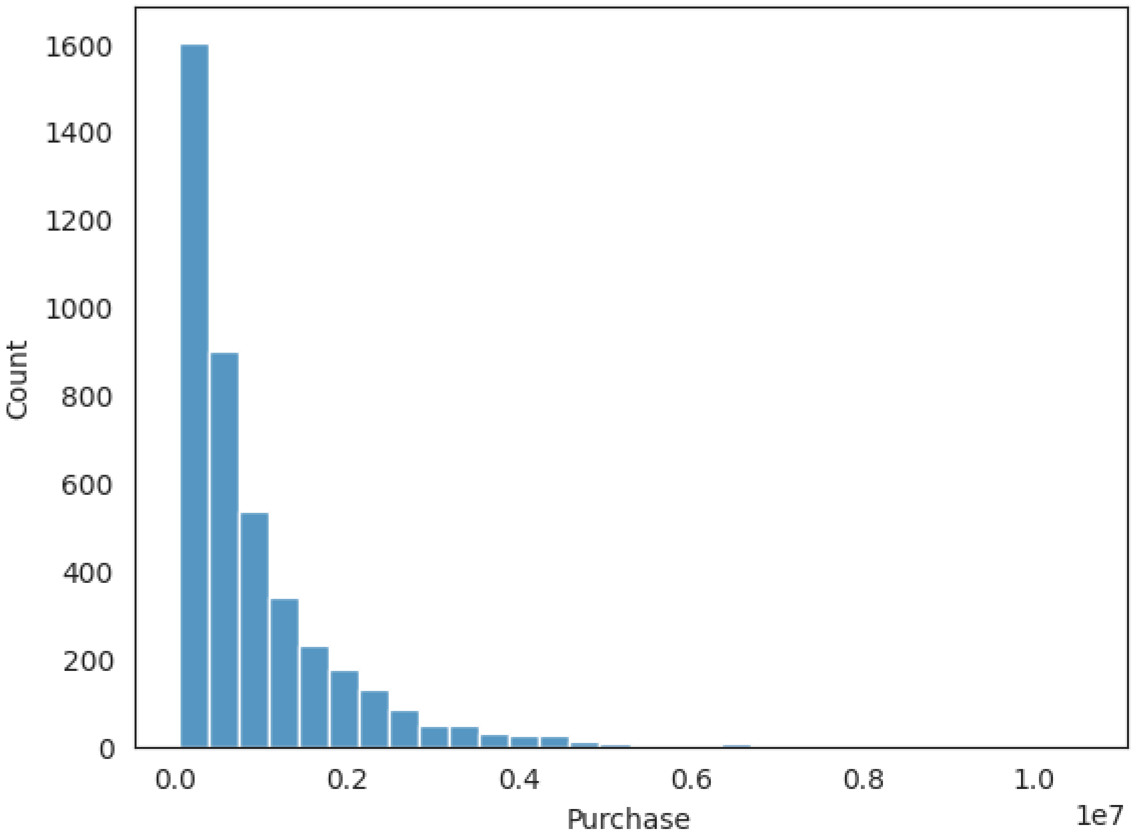
```
users_purchase=user_amt['Purchase']
users_purchase_avg=users_purchase.mean()
print("Average amount spend by a user on black friday is {:.2f}".format(users_purchase_avg))
```

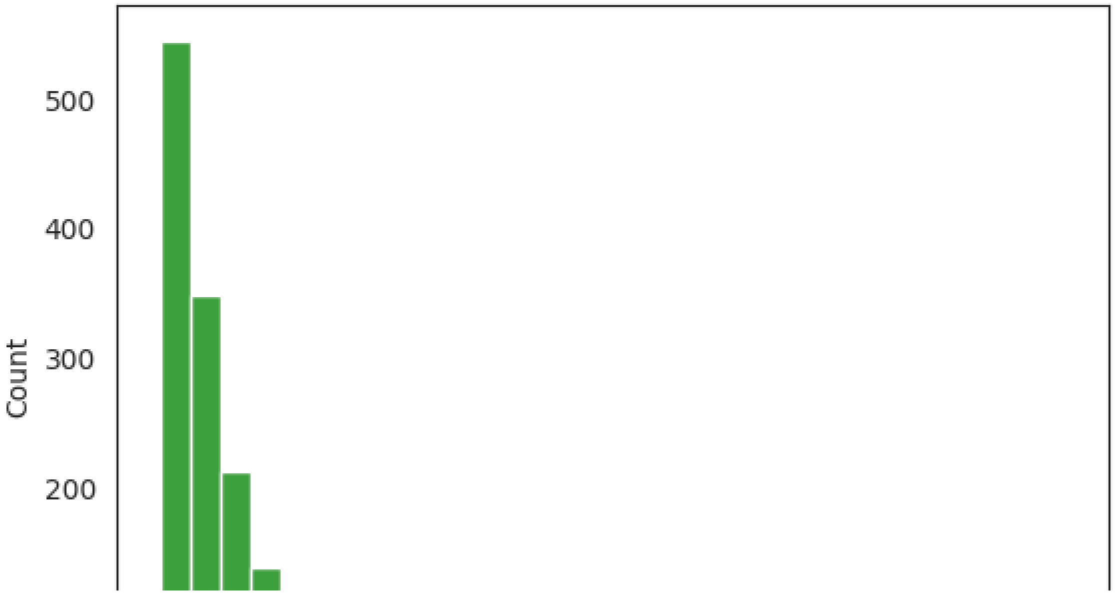
```
Average amount spend by a user on black friday is 865016.59
```

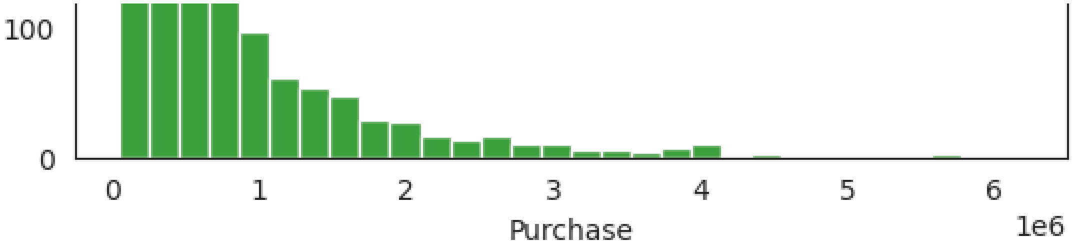
```
male_user_mean=user_amt[user_amt['Gender']=='M']['Purchase'].mean()
female_user_mean=user_amt[user_amt['Gender']=='F']['Purchase'].mean()
print("Average amount spend by male user on black friday is {:.2f}".format(male_user_mean))
print('Average amount spend by female user on black friday is {:.2f}'.format(female_user_mean))
```

```
Average amount spend by male user on black friday is 925344.40
Average amount spend by female user on black friday is 712024.39
```

```
sns.histplot(data=user_amt[user_amt['Gender']=='M']['Purchase'],bins=30)
plt.show()
sns.histplot(data=user_amt[user_amt['Gender']=='F']['Purchase'],bins=30,color='g')
plt.show()
```


1600
1400
1200
1000
800
600
400
200
0
Count
0.0
0.2
0.4
0.6
0.8
1.0
Purchase
1e7

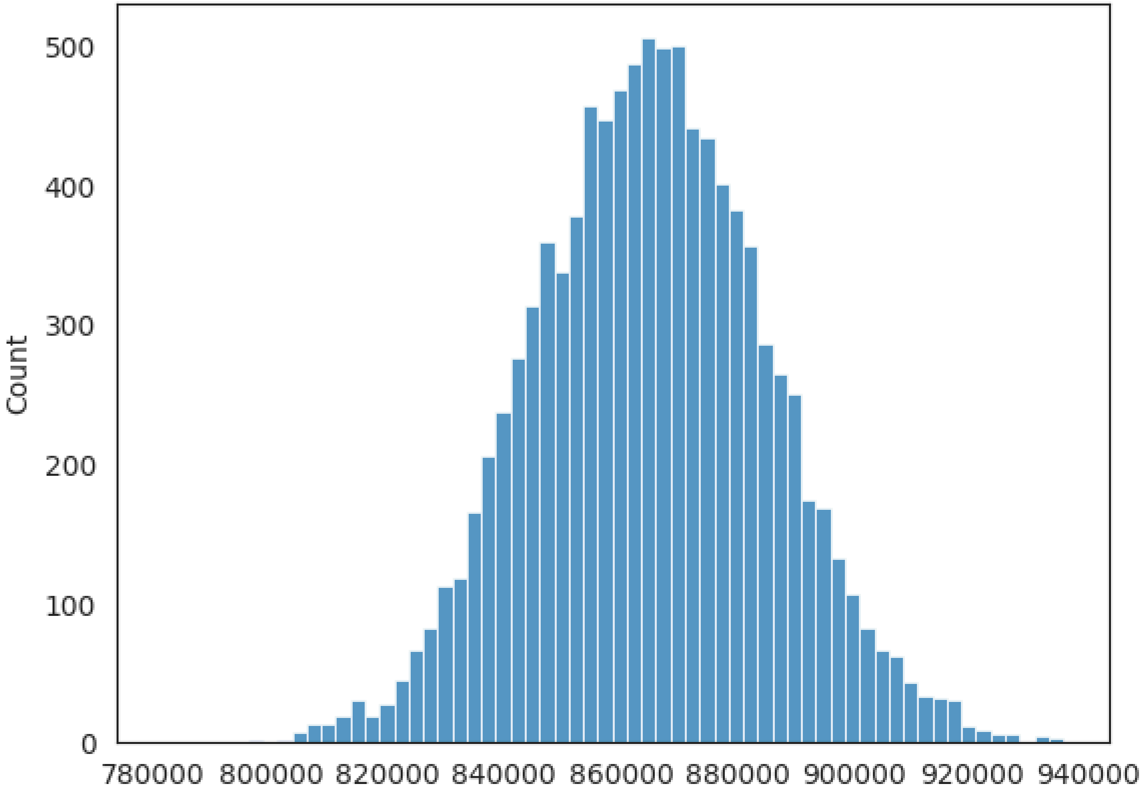

500
400
300
200
Count



Applying Central Limit Theorem

```
sample_users_mean_1600 = [np.mean(users_purchase.sample(1600)) for i in range(10000)]
```

```
sns.histplot(data=sample_users_mean_1600)
plt.show()
```



```
mean = np.mean(sample_users_mean_1600)
std = np.std(sample_users_mean_1600)
mean, std
```

```
(865003.911826, 20183.55038176947)
```

```
male_user_purchase=user_amt[user_amt['Gender']=='M']['Purchase']
female_user_purchase=user_amt[user_amt['Gender']=='F']['Purchase']
```

```
print(np.mean(male_sample_avg_1250),np.std(male_sample_avg_1250))
print(np.mean(female_sample_avg_500),np.std(female_sample_avg_500))
```

```
925326.51592888 23488.22793950574
711923.6298098 30301.625874019
```

Mean of sample means of male user purchase is 925813.45 and standard deviation is 23678.34.

Mean of sample means of female user purchase is 712173.78 and standard deviation is 30194.74

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

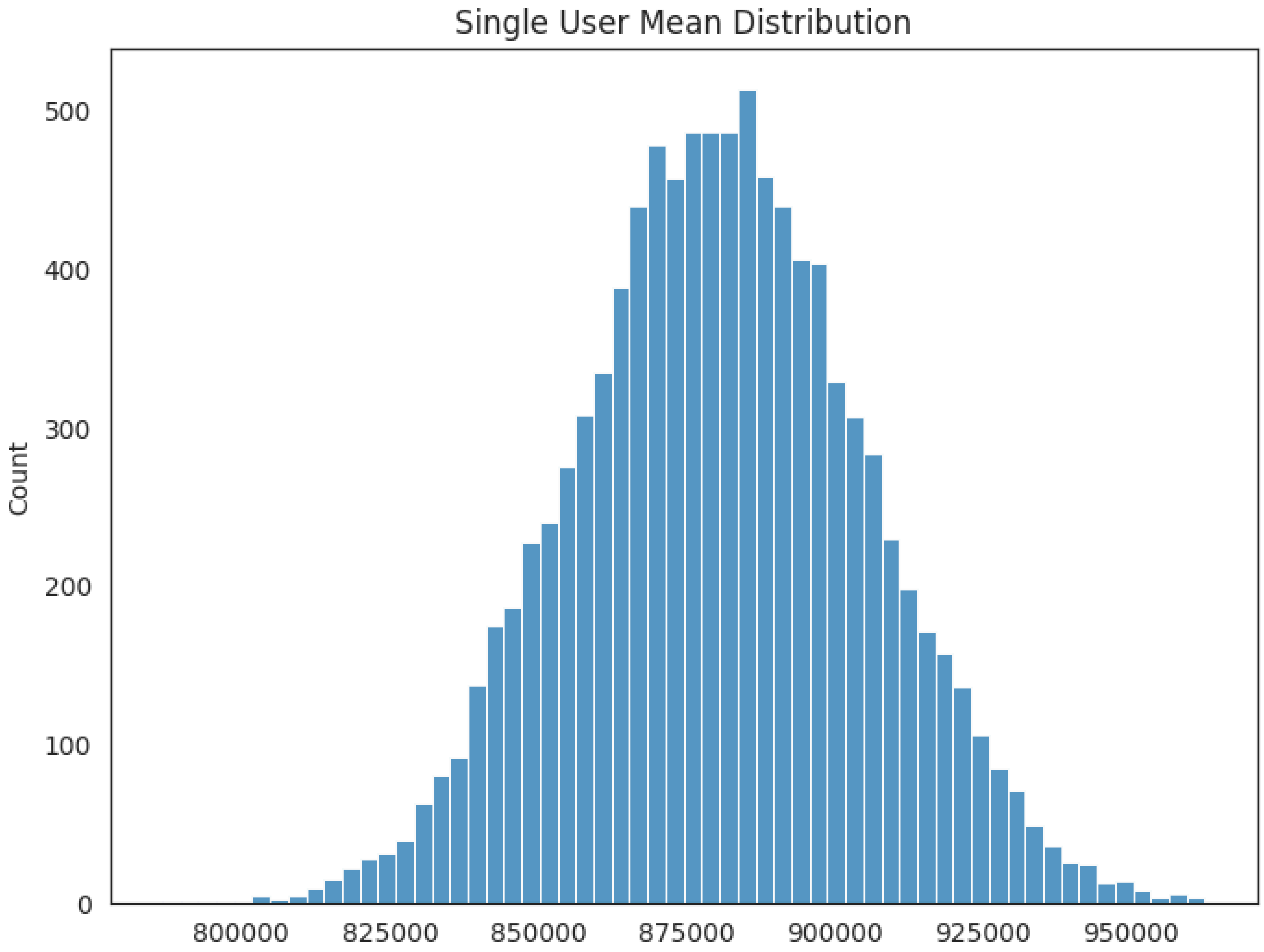
```
      User_ID  Marital_Status  Purchase
0     1000001               0    334093
1     1000002               0    810472
2     1000003               0    341635
3     1000004               1    206468
4     1000005               1    821001
...       ...             ...       ...
5886  1006036               1   4116058
5887  1006037               0   1119538
5888  1006038               0     90034
5889  1006039               1    590319
5890  1006040               0   1653299

5891 rows × 3 columns
```

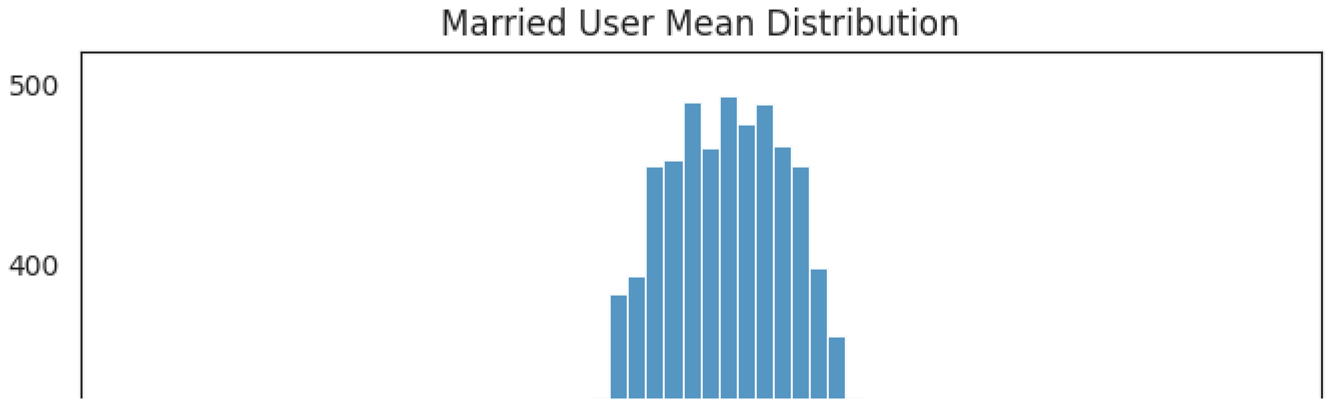
```
marital_user_amt['Marital_Status'].value_counts()
```

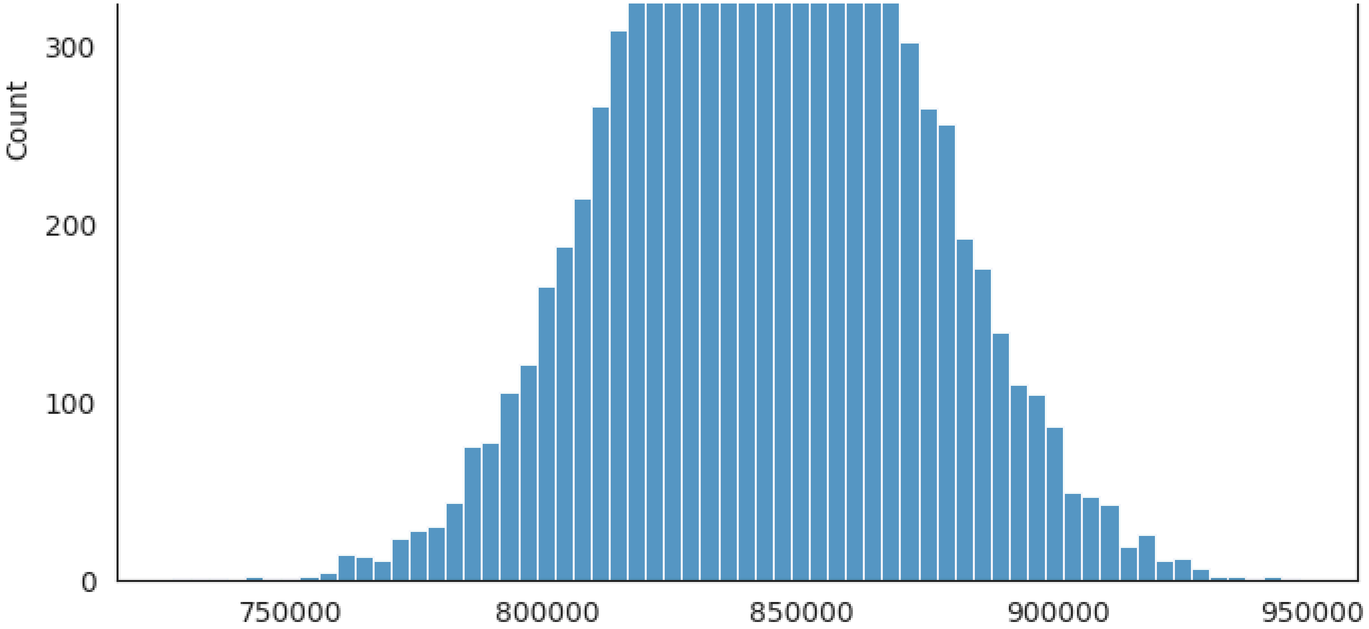
```
                     count
Marital_Status

      0               3417

      1               2474

dtype: int64
```

```
single_user_purchase=marital_user_amt[marital_user_amt['Marital_Status']==0]['Purchase']
married_user_purchase=marital_user_amt[marital_user_amt['Marital_Status']==1]['Purchase']
```

```
plt.figure(figsize=(8,6))
sns.histplot(data=single_user_mean_1025)
plt.title('Single User Mean Distribution')
plt.show()

plt.figure(figsize=(8,6))
sns.histplot(data=married_user_mean_750)
plt.title('Married User Mean Distribution')
plt.show()
```


Single User Mean Distribution
Count
0
100
200
300
400
500
800000
825000
850000
875000
900000
925000
950000


Married User Mean Distribution
400
500



```
single_user_purchase_mean=np.mean(single_user_purchase)
single_user_std=np.std(single_user_purchase)

married_user_purchase_mean=np.mean(married_user_purchase)
married_user_std=np.std(married_user_purchase)
```

```
single_user_mean_1025=[np.mean(single_user_purchase.sample(1025)) for i in range(10000)]
married_user_mean_750=[np.mean(married_user_purchase.sample(750)) for i in range(10000)]
```

```
print(np.mean(single_user_mean_1025),np.std(single_user_mean_1025))
print(np.mean(married_user_mean_750),np.std(married_user_mean_750))
```

```
880380.0800526829 24989.30233743166
843047.9198989334 28430.455321953097
```

Mean of sample means of single user purchase is 880476.87 and standard deviation is 24458.52.

Mean of sample means of married user purchase is 843421.14 and standard deviation is 28397.85

```
single_sample_lower_lim=np.mean(single_user_mean_1025) - 1.96*((single_user_std)/np.sqrt(1025))
single_sample_upper_lim=np.mean(single_user_mean_1025) + 1.96*((single_user_std)/np.sqrt(1025))

married_sample_lower_lim=np.mean(married_user_mean_750) - 1.96*((married_user_std)/np.sqrt(750))
married_sample_upper_lim=np.mean(married_user_mean_750) + 1.96*((married_user_std)/np.sqrt(750))

print("Single User purchase 95% confidence interval of means lie in range acc to CLT is: ({:.2f}, {:.2f})".format(single_sa
print("Married User purchase 95% confidence interval of means lie in range acc to CLT is: ({:.2f}, {:.2f})".format(married_
```

```
Single User purchase 95% confidence interval of means lie in range acc to CLT is: (822263.99, 938496.17)
Married User purchase 95% confidence interval of means lie in range acc to CLT is: (776119.16, 909976.68)
```

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

	User_ID	Age	Purchase
0	1000001	0-17	334093
1	1000002	55+	810472
2	1000003	26-35	341635
3	1000004	46-50	206468
4	1000005	26-35	821001
...	...	...	...
5886	1006036	26-35	4116058
5887	1006037	46-50	1119538
5888	1006038	55+	90034
5889	1006039	46-50	590319
5890	1006040	26-35	1653299

5891 rows × 3 columns

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

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

dtype: int64
```

```
sample_size = 250
num_repitions = 1500
all_age_means={}
all_age_intervals = ['26-35', '36-45', '18-25', '46-50', '51-55', '55+', '0-17']
for i in all_age_intervals:
    all_age_means[i] = []

for i in all_age_intervals:
    for _ in range(num_repitions):
        mean = age_user_amt[age_user_amt['Age']==i].sample(sample_size, replace=True)['Purchase'].mean()
        all_age_means[i].append(mean)


for i in ['26-35', '36-45', '18-25', '46-50', '51-55', '55+', '0-17']:
    age_purchase=age_user_amt[age_user_amt['Age']==i]

    Age_sample_lower_lim=np.mean(age_purchase['Purchase']) - 1.96*((np.std(age_purchase['Purchase']))/np.sqrt(250))
    Age_sample_upper_lim=np.mean(age_purchase['Purchase']) + 1.96*((np.std(age_purchase['Purchase']))/np.sqrt(250))

    print("For age {} confidence interval of means lie in the range of: ({:.2f}, {:.2f})".format(i, Age_sample_lower_lim, A
```

```
For age 26-35 confidence interval of means lie in the range of: (861810.75, 1117507.88)
For age 36-45 confidence interval of means lie in the range of: (758039.89, 1001291.53)
For age 18-25 confidence interval of means lie in the range of: (744842.29, 964883.95)
For age 46-50 confidence interval of means lie in the range of: (677460.22, 907637.34)
For age 51-55 confidence interval of means lie in the range of: (665085.79, 861316.06)
For age 55+ confidence interval of means lie in the range of: (463256.72, 616137.77)
For age 0-17 confidence interval of means lie in the range of: (533894.96, 703840.67)
```

Insights

- Around ~85% of customer transactions belongs to the ages between 18 to 50.
- There are three city categories where larger share of transactions is from city category C i.e 42%. where most unique users belongs to B
- 75% of users are male customers who purchased on black friday.
- 60% are Single users, 40% are married users.
- There are 20 different occupation categories, highest no of users belong to 4 occupation category i.e. 13%.
- Most no of users purchased the products which belong to 5 product category i.e 27%.

Recommendations

- Men spent more money than women, So company should focus on retaining the male customers and getting more male customers.
- Single Martial Status users spent more, so having unique combos of products can help.
- Company should do reserch on products which are intreseted by age groups of 18-50.
- Male customers living in City_Category C spend more money than other male customers living in B or C, Selling more products in the City_Category C will help the company increase the revenue.