ks-customer-behaviour-segmentation

March 7, 2024

[1]:
```python
import numpy as np
import pandas as pd
```

Problem Statement Understand the characteristics of customer that will continue buying products

Problem Solution

- Analyse and understand the behavioural aspects of Starbucks customer
- Perform customer segmentation based on the study
- Find out key parameters of the customer loyalty using Chi-Square test of independence

[5]:
```python
import matplotlib.pyplot as plt
from matplotlib.patches import Patch
import seaborn as sns
import scipy.stats as st
import warnings
warnings.filterwarnings('ignore')
```

[29]:
```python
df = pd.read_csv("Starbucks satisfactory survey.csv")
df.head()
```

[29]:
```
                   Timestamp 1. Your Gender    2. Your Age  \
0  2019/10/01 12:38:43 PM GMT+8        Female  From 20 to 29
1  2019/10/01 12:38:54 PM GMT+8        Female  From 20 to 29
2  2019/10/01 12:38:56 PM GMT+8          Male  From 20 to 29
3  2019/10/01 12:39:08 PM GMT+8        Female  From 20 to 29
4  2019/10/01 12:39:20 PM GMT+8          Male  From 20 to 29

  3. Are you currently…? 4. What is your annual income?  \
0                Student             Less than RM25,000
1                Student             Less than RM25,000
2               Employed             Less than RM25,000
3                Student             Less than RM25,000
4                Student             Less than RM25,000

  5. How often do you visit Starbucks? 6. How do you usually enjoy Starbucks?  \
0                               Rarely                                Dine in
```

1	Rarely	Take away
2	Monthly	Dine in
3	Rarely	Take away
4	Monthly	Take away

7. How much time do you normally spend during your visit? \

0	Between 30 minutes to 1 hour
1	Below 30 minutes
2	Between 30 minutes to 1 hour
3	Below 30 minutes
4	Between 30 minutes to 1 hour

8. The nearest Starbucks's outlet to you is…? \

0	within 1km
1	1km - 3km
2	more than 3km
3	more than 3km
4	1km - 3km

9. Do you have Starbucks membership card? … \

0	Yes …
1	Yes …
2	Yes …
3	No …
4	No …

11. On average, how much would you spend at Starbucks per visit? \

0	Less than RM20
1	Less than RM20
2	Less than RM20
3	Less than RM20
4	Around RM20 - RM40

12. How would you rate the quality of Starbucks compared to other brands (Coffee Bean, Old Town White Coffee..) to be: \

0	4
1	4
2	4
3	2
4	3

13. How would you rate the price range at Starbucks? \

0	3
1	3
2	3
3	1
4	3

14. How important are sales and promotions in your purchase decision? \

0	5
1	4
2	4
3	4
4	4

15. How would you rate the ambiance at Starbucks? (lighting, music, etc…) \

0	5
1	4
2	4
3	3
4	2

16. You rate the WiFi quality at Starbucks as.. \

0	4
1	4
2	4
3	3
4	2

17. How would you rate the service at Starbucks? (Promptness, friendliness, etc..) \

0	4
1	5
2	4
3	3
4	3

18. How likely you will choose Starbucks for doing business meetings or hangout with friends? \

0	3
1	2
2	3
3	3
4	3

19. How do you come to hear of promotions at Starbucks? Check all that apply. \

0	Starbucks Website/Apps;Social Media;Emails;Dea…
1	Social Media;In Store displays
2	In Store displays;Billboards
3	Through friends and word of mouth
4	Starbucks Website/Apps;Social Media

```
  20. Will you continue buying at Starbucks?
0                                        Yes
1                                        Yes
2                                        Yes
3                                         No
4                                        Yes

[5 rows x 21 columns]
```

0.0.1 Data Wrangling

[33]:
```
df.columns = ['Timestamp',
              'Gender',
              'Age',
              'Occupation',
              'Annual_Income',
              'Visit_Frequency',
              'Service_preferred',
              'Time_Spent_Frequency',
              'Nearest_Store_Distance',
              'Membership',
              'Frequent_Product',
              'Avg_Money_Spent',
              'Quality_Rating_vs_Other_Brands',
              'Price_Rating',
              'Sales_Promotion_Importance',
              'Ambiance_Rating',
              'WiFi_Rating',
              'Service_Rating',
              'Meetings_hangouts_preference',
              'Promotion_Source',
              'Loyalty'
             ]
df.head()
```

[33]:
```
                   Timestamp  Gender            Age Occupation  \
0  2019/10/01 12:38:43 PM GMT+8  Female  From 20 to 29    Student
1  2019/10/01 12:38:54 PM GMT+8  Female  From 20 to 29    Student
2  2019/10/01 12:38:56 PM GMT+8    Male  From 20 to 29   Employed
3  2019/10/01 12:39:08 PM GMT+8  Female  From 20 to 29    Student
4  2019/10/01 12:39:20 PM GMT+8    Male  From 20 to 29    Student

        Annual_Income Visit_Frequency Service_preferred  \
0  Less than RM25,000          Rarely           Dine in
1  Less than RM25,000          Rarely         Take away
2  Less than RM25,000         Monthly           Dine in
3  Less than RM25,000          Rarely         Take away
```

```
4  Less than RM25,000         Monthly        Take away

          Time_Spent_Frequency Nearest_Store_Distance Membership  …  \
0  Between 30 minutes to 1 hour             within 1km        Yes  …
1              Below 30 minutes              1km - 3km        Yes  …
2  Between 30 minutes to 1 hour           more than 3km        Yes  …
3              Below 30 minutes           more than 3km         No  …
4  Between 30 minutes to 1 hour              1km - 3km         No  …

      Avg_Money_Spent Quality_Rating_vs_Other_Brands  Price_Rating  \
0      Less than RM20                              4             3
1      Less than RM20                              4             3
2      Less than RM20                              4             3
3      Less than RM20                              2             1
4  Around RM20 - RM40                              3             3

   Sales_Promotion_Importance  Ambiance_Rating  WiFi_Rating  Service_Rating  \
0                           5                5            4               4
1                           4                4            4               5
2                           4                4            4               4
3                           4                3            3               3
4                           4                2            2               3

   Meetings_hangouts_preference  \
0                             3
1                             2
2                             3
3                             3
4                             3

                                    Promotion_Source Loyalty
0  Starbucks Website/Apps;Social Media;Emails;Dea…     Yes
1                     Social Media;In Store displays     Yes
2                       In Store displays;Billboards     Yes
3                    Through friends and word of mouth      No
4                  Starbucks Website/Apps;Social Media     Yes

[5 rows x 21 columns]
```

[8]:
```python
len(df)
```

[8]:
```
122
```

Check the different Columns datatypes and null values

[34]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 122 entries, 0 to 121
Data columns (total 21 columns):
 #   Column                          Non-Null Count  Dtype 
---  ------                          --------------  ----- 
 0   Timestamp                       122 non-null    object
 1   Gender                          122 non-null    object
 2   Age                             122 non-null    object
 3   Occupation                      122 non-null    object
 4   Annual_Income                   122 non-null    object
 5   Visit_Frequency                 122 non-null    object
 6   Service_preferred               121 non-null    object
 7   Time_Spent_Frequency            122 non-null    object
 8   Nearest_Store_Distance          122 non-null    object
 9   Membership                      122 non-null    object
 10  Frequent_Product                122 non-null    object
 11  Avg_Money_Spent                 122 non-null    object
 12  Quality_Rating_vs_Other_Brands  122 non-null    int64 
 13  Price_Rating                    122 non-null    int64 
 14  Sales_Promotion_Importance      122 non-null    int64 
 15  Ambiance_Rating                 122 non-null    int64 
 16  WiFi_Rating                     122 non-null    int64 
 17  Service_Rating                  122 non-null    int64 
 18  Meetings_hangouts_preference    122 non-null    int64 
 19  Promotion_Source                121 non-null    object
 20  Loyalty                         122 non-null    object
dtypes: int64(7), object(14)
memory usage: 20.1+ KB
```

[35]:
```
df[df.Service_preferred.isnull()]
```

[35]:
```
                       Timestamp Gender            Age Occupation  \
81  2019/10/03 9:11:28 AM GMT+8   Male  From 20 to 29   Employed

          Annual_Income Visit_Frequency Service_preferred Time_Spent_Frequency  \
81  Less than RM25,000           Never               NaN     Below 30 minutes

   Nearest_Store_Distance Membership  … Avg_Money_Spent  \
81          more than 3km         No  …            Zero

   Quality_Rating_vs_Other_Brands  Price_Rating  Sales_Promotion_Importance  \
81                              1             1                           1

    Ambiance_Rating  WiFi_Rating  Service_Rating  \
81                3            3               3

    Meetings_hangouts_preference  Promotion_Source Loyalty
81                             3               NaN      No
```

```
[1 rows x 21 columns]
```

[36]:
```python
# Only one row has null value. Delete the row
df = df[-df.Service_preferred.isnull()]
len(df)
```

[36]:
```
121
```

[37]:
```python
df.describe()
```

[37]:
```
       Quality_Rating_vs_Other_Brands  Price_Rating  \
count                      121.000000    121.000000
mean                         3.685950      2.909091
std                          0.913173      1.072381
min                          1.000000      1.000000
25%                          3.000000      2.000000
50%                          4.000000      3.000000
75%                          4.000000      4.000000
max                          5.000000      5.000000

       Sales_Promotion_Importance  Ambiance_Rating  WiFi_Rating  \
count                  121.000000       121.000000   121.000000
mean                     3.818182         3.760331     3.256198
std                      1.064581         0.931171     0.962020
min                      1.000000         1.000000     1.000000
25%                      3.000000         3.000000     3.000000
50%                      4.000000         4.000000     3.000000
75%                      5.000000         4.000000     4.000000
max                      5.000000         5.000000     5.000000

       Service_Rating  Meetings_hangouts_preference
count      121.000000                    121.000000
mean         3.752066                      3.520661
std          0.829468                      1.033595
min          1.000000                      1.000000
25%          3.000000                      3.000000
50%          4.000000                      4.000000
75%          4.000000                      4.000000
max          5.000000                      5.000000
```

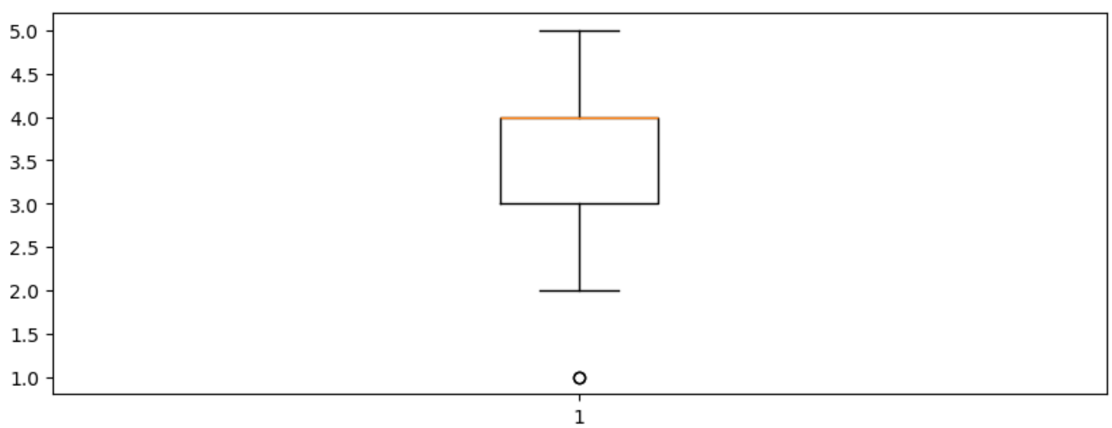
Univariate Analysis

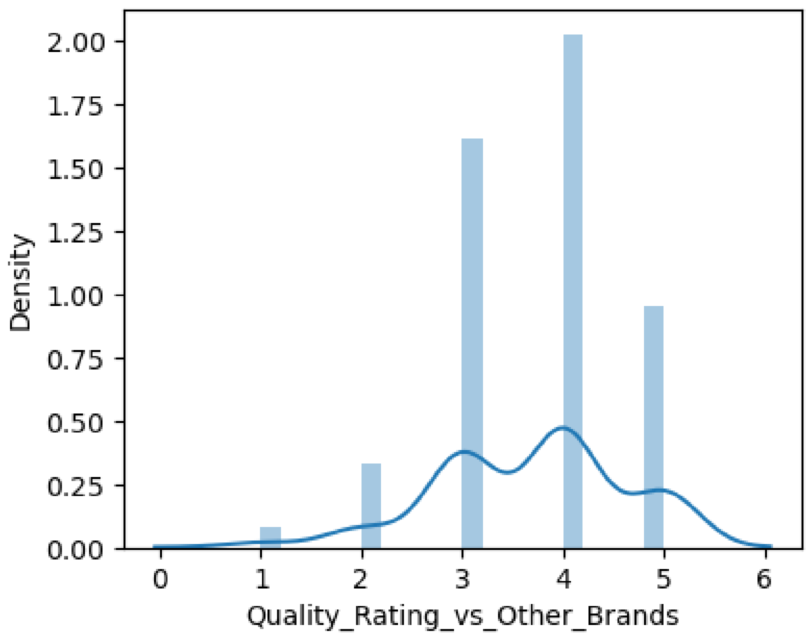
[38]:
```python
num_cols = df.select_dtypes(include='int64').columns
num_cols
```

[38]:
```
Index(['Quality_Rating_vs_Other_Brands', 'Price_Rating',
       'Sales_Promotion_Importance', 'Ambiance_Rating', 'WiFi_Rating',
       'Service_Rating', 'Meetings_hangouts_preference'],
      dtype='object')
```

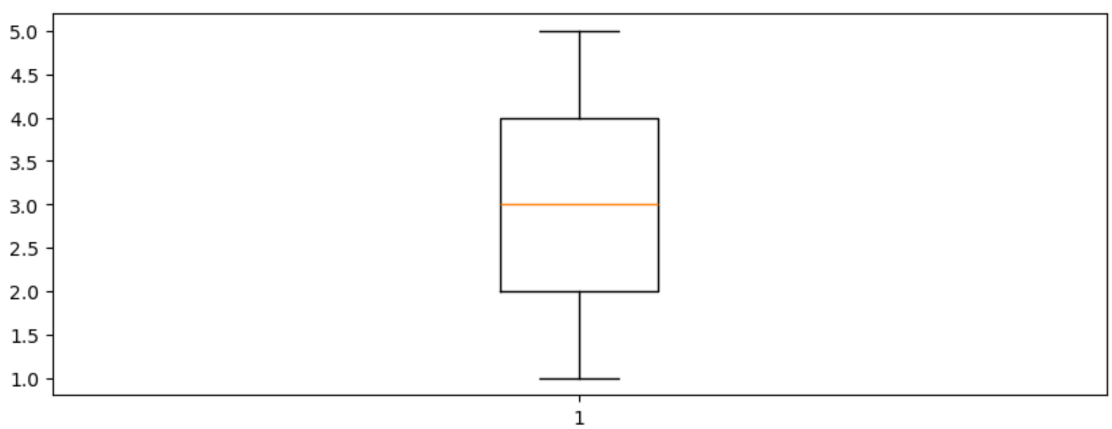
[21]:
```
def plot_numeric(df,x):
    plt.figure(figsize=(10,8))
    plt.subplot(2,1,1)
    plt.boxplot(df[i], vert=True)
    plt.show()
    plt.figure(figsize=(10,8))
    plt.subplot(2,2,2)
    sns.distplot(df[i], bins=20)
    plt.show()

for i in num_cols:
    print("Plots for Column: "+ i)
    plot_numeric(df,i)
    print("\n")
```

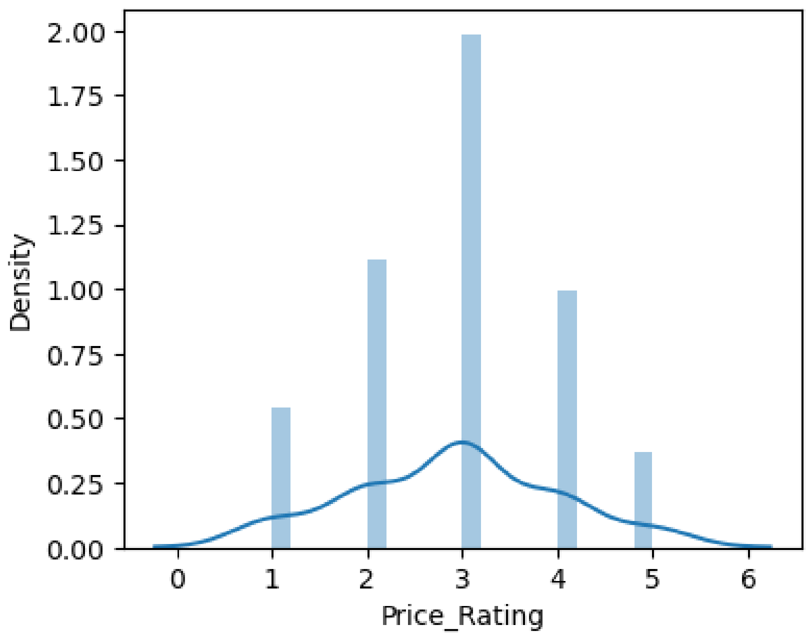
```
Plots for Column: Quality_Rating_vs_Other_Brands
```



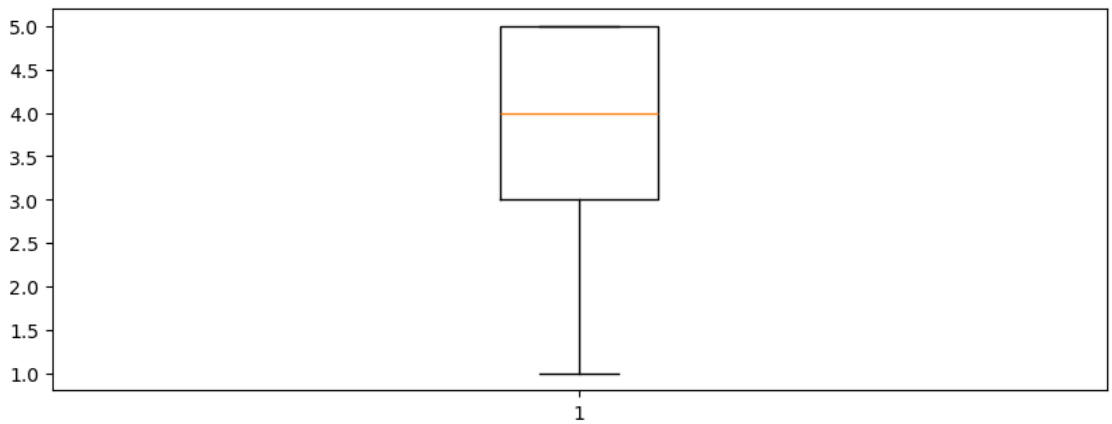


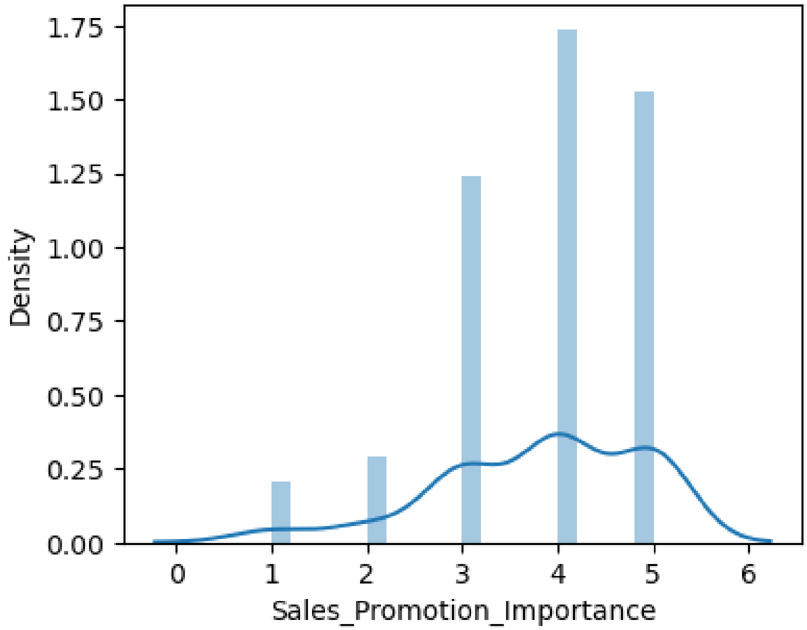

```
Plots for Column: Price_Rating
```



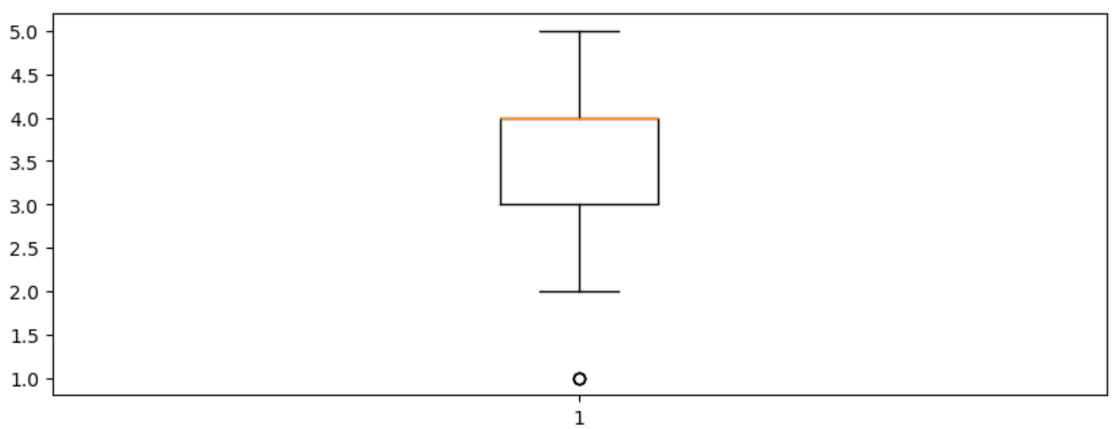


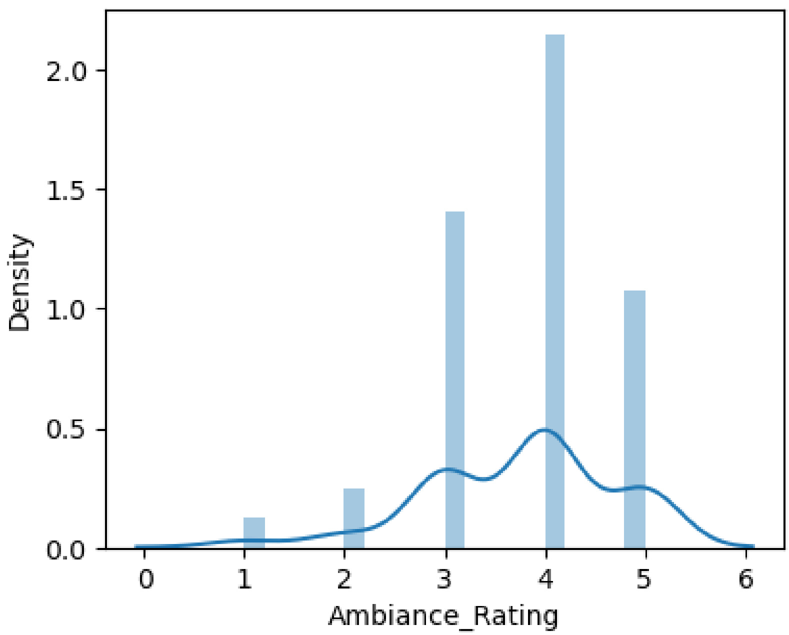
Plots for Column: Sales_Promotion_Importance



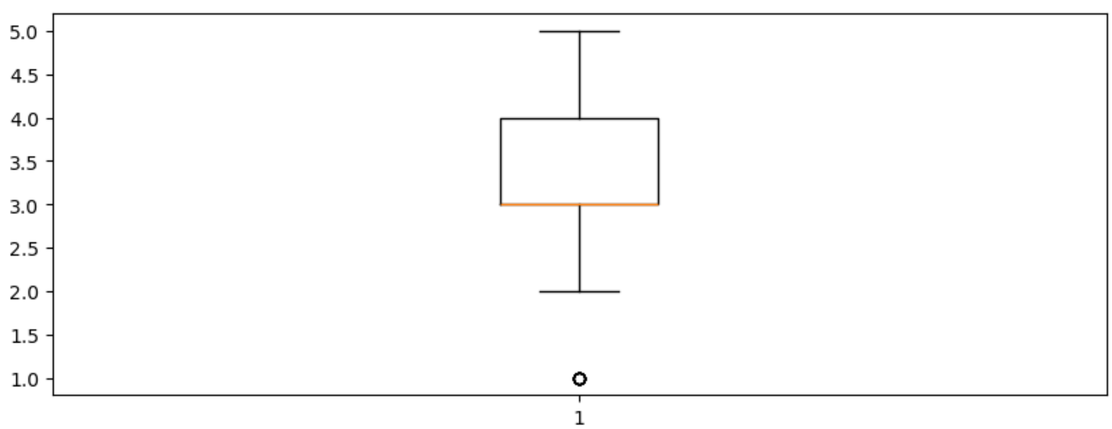


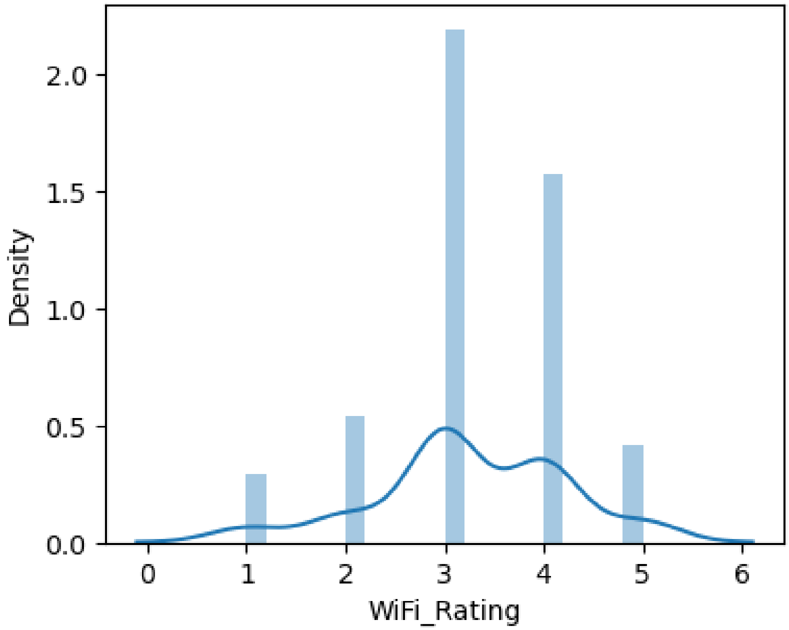

```
Plots for Column: Ambiance_Rating
```



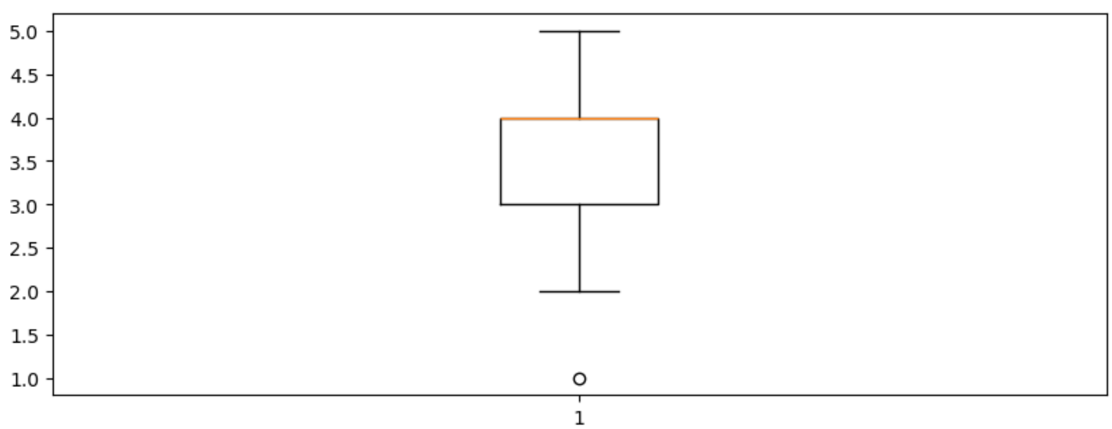


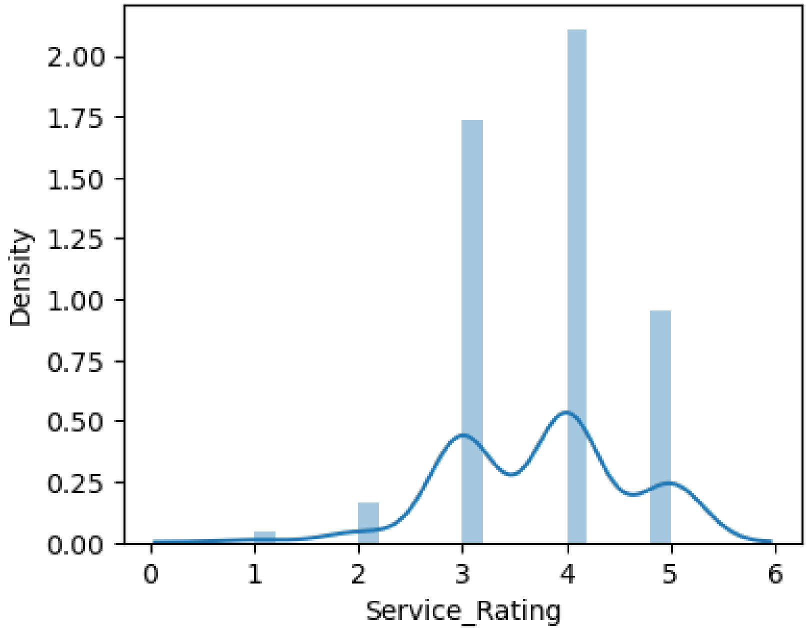
Plots for Column: WiFi_Rating



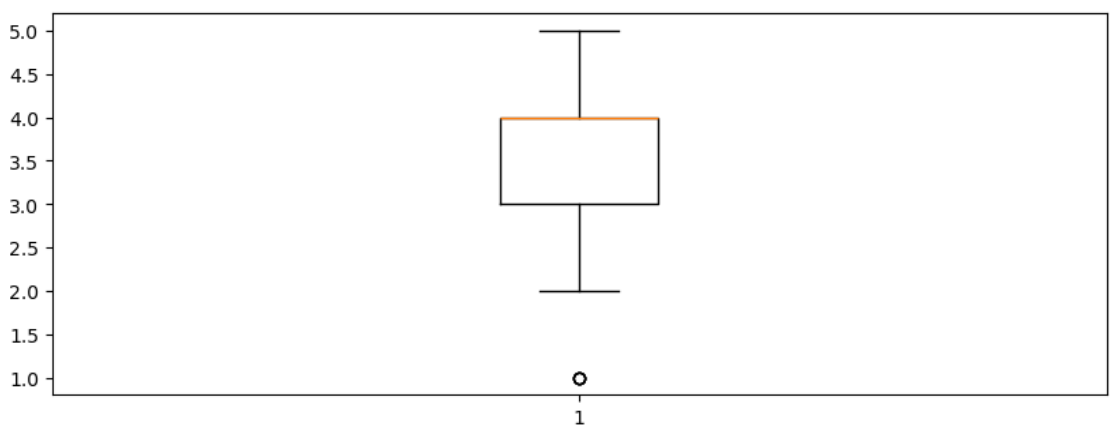


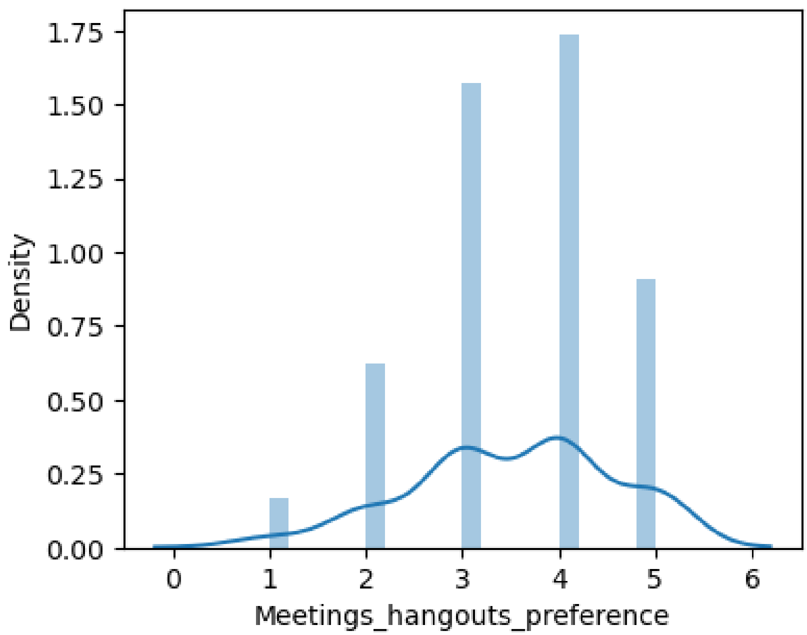

```
Plots for Column: Service_Rating
```





Plots for Column: Meetings_hangouts_preference





- Majority customers(50%) rated 4 for quality vs other brands
- Price rating is uniformly distributed. There are approximately equal no of customers who can afford or not afford the prices
- Sales and Promotion have very good impact on the customer purchase decision(90% cusomters rated above 3)
- Majority customers rated ambiance >=3 (90%)
- Majority customers rated wifi service 3 (around 55%)
- The Serivce ratings given by the customers are around 3-5(around 90% customers)
- around 80% customers prefer Starbucks for Meetings/hangouts

```
From the above graphs we can see there are outliers in the data. Lets check the
dataset
```

[39]:
```
df[df.Quality_Rating_vs_Other_Brands <2]
```

[39]:
```
                        Timestamp Gender            Age Occupation  \
112  2019/10/03 7:58:17 PM GMT+8   Male  From 20 to 29    Student
121  2019/10/05 4:57:22 PM GMT+8   Male  From 20 to 29   Employed

             Annual_Income Visit_Frequency Service_preferred  \
112   More than RM150,000           Never             Never
121  RM50,000 - RM100,000          Rarely           Dine in

              Time_Spent_Frequency Nearest_Store_Distance Membership  …  \
```

```
112             Below 30 minutes          more than 3km         No  …
121  Between 30 minutes to 1 hour              1km - 3km         No  …

    Avg_Money_Spent Quality_Rating_vs_Other_Brands  Price_Rating  \
112            Zero                              1             1
121  Less than RM20                              1             1

     Sales_Promotion_Importance  Ambiance_Rating  WiFi_Rating  Service_Rating  \
112                           1                1            1               1
121                           5                4            3               3

     Meetings_hangouts_preference   Promotion_Source Loyalty
112                             1         Billboards      No
121                             2  In Store displays      No

[2 rows x 21 columns]
```

[40]:
```python
df = df[df.Quality_Rating_vs_Other_Brands >1]
len(df)
```

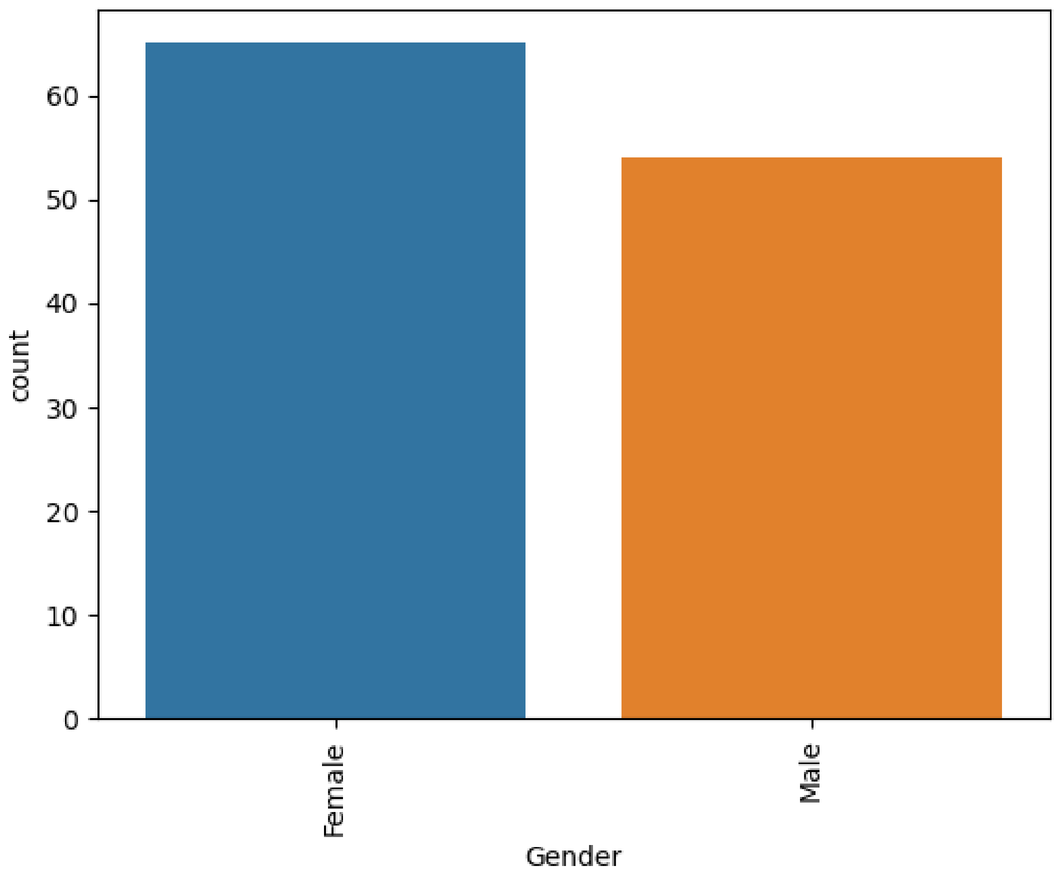
[40]:
```
119
```

[41]:
```python
cat_cols = df.select_dtypes(include='object').columns
cat_cols
```

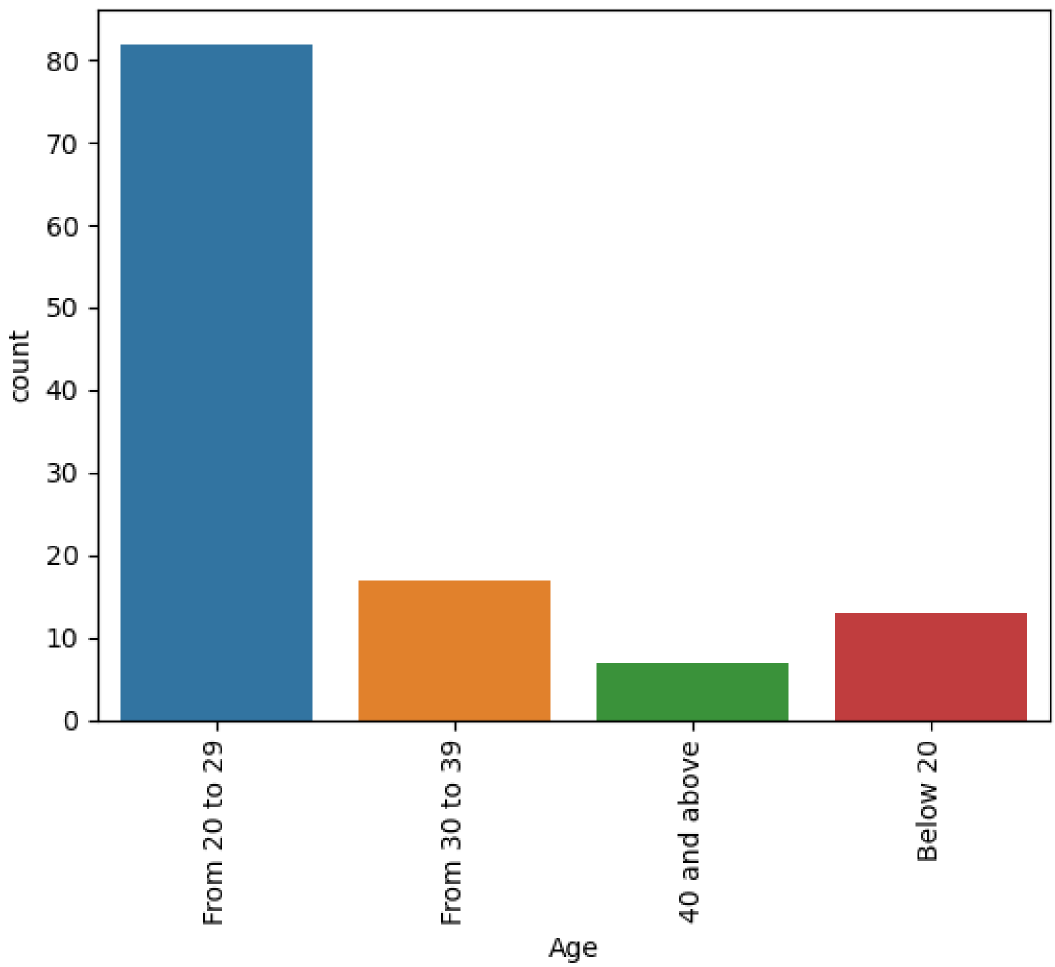
[41]:
```
Index(['Timestamp', 'Gender', 'Age', 'Occupation', 'Annual_Income',
       'Visit_Frequency', 'Service_preferred', 'Time_Spent_Frequency',
       'Nearest_Store_Distance', 'Membership', 'Frequent_Product',
       'Avg_Money_Spent', 'Promotion_Source', 'Loyalty'],
      dtype='object')
```

[48]:
```python
for i in cat_cols[1:]:
    print("CountPlot for the column: "+ i)
    sns.countplot(x=df[i], data=df)
    plt.xticks(rotation=90)
    plt.show()
```

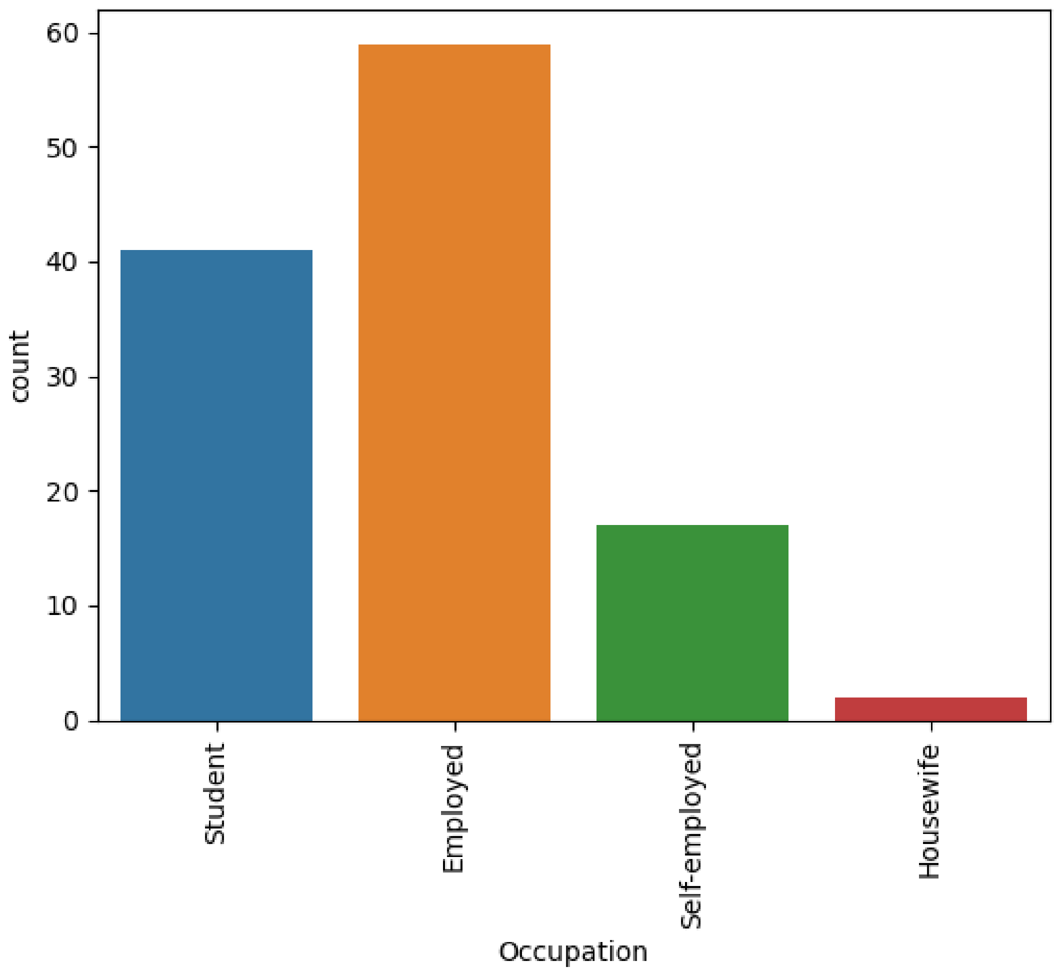
```
CountPlot for the column: Gender
```



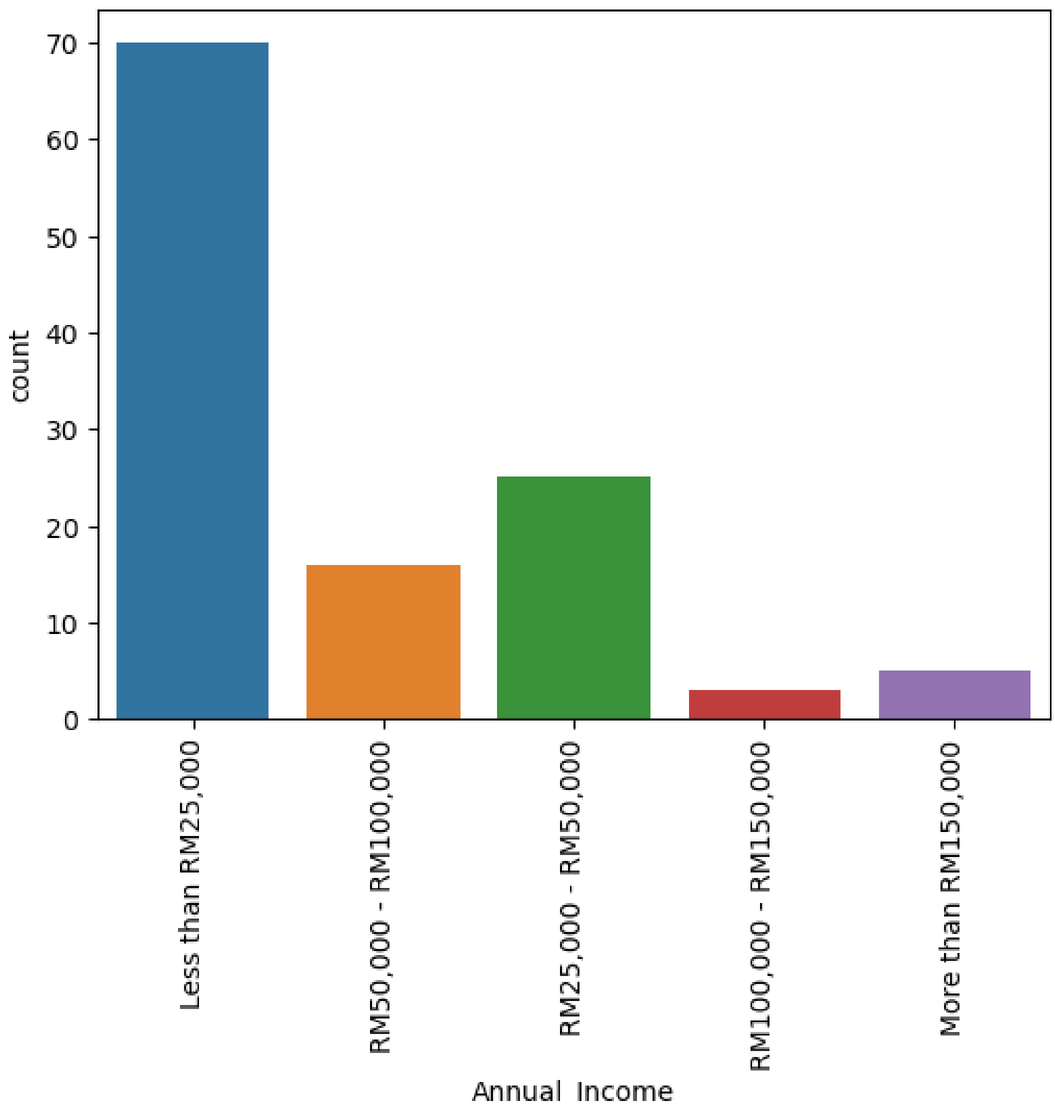
CountPlot for the column: Age



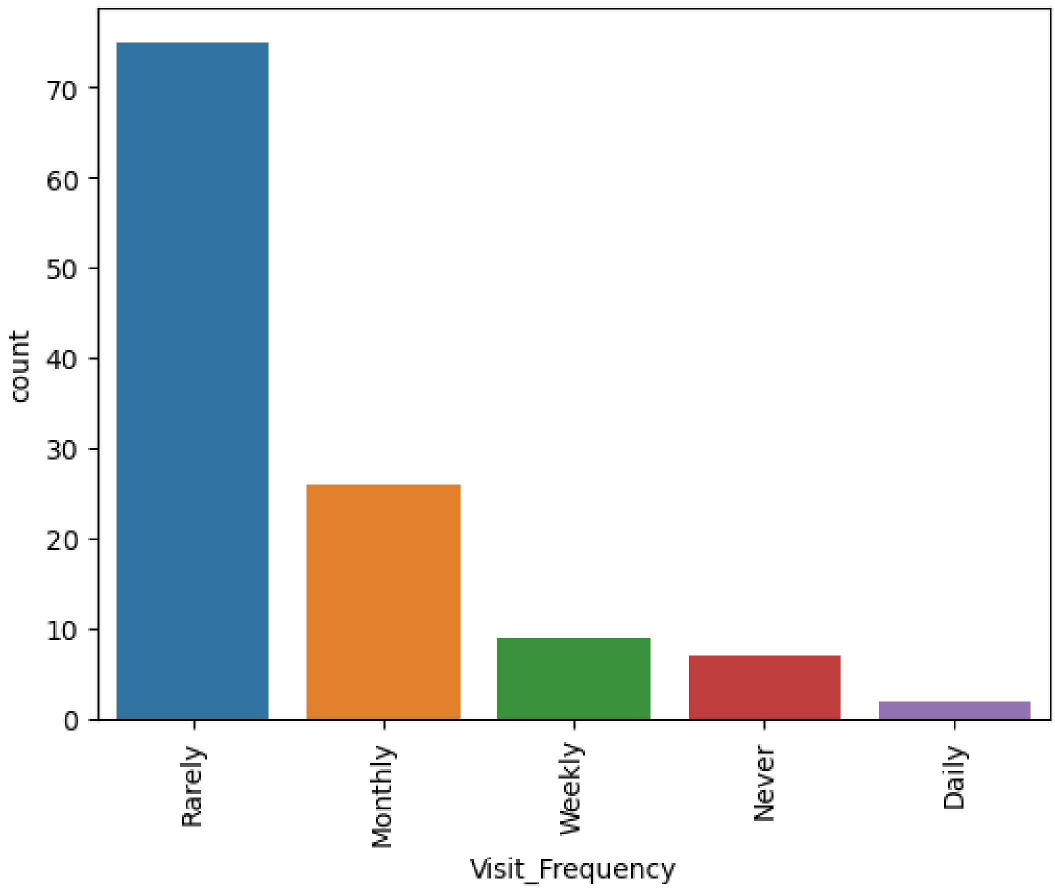

```
CountPlot for the column: Occupation
```



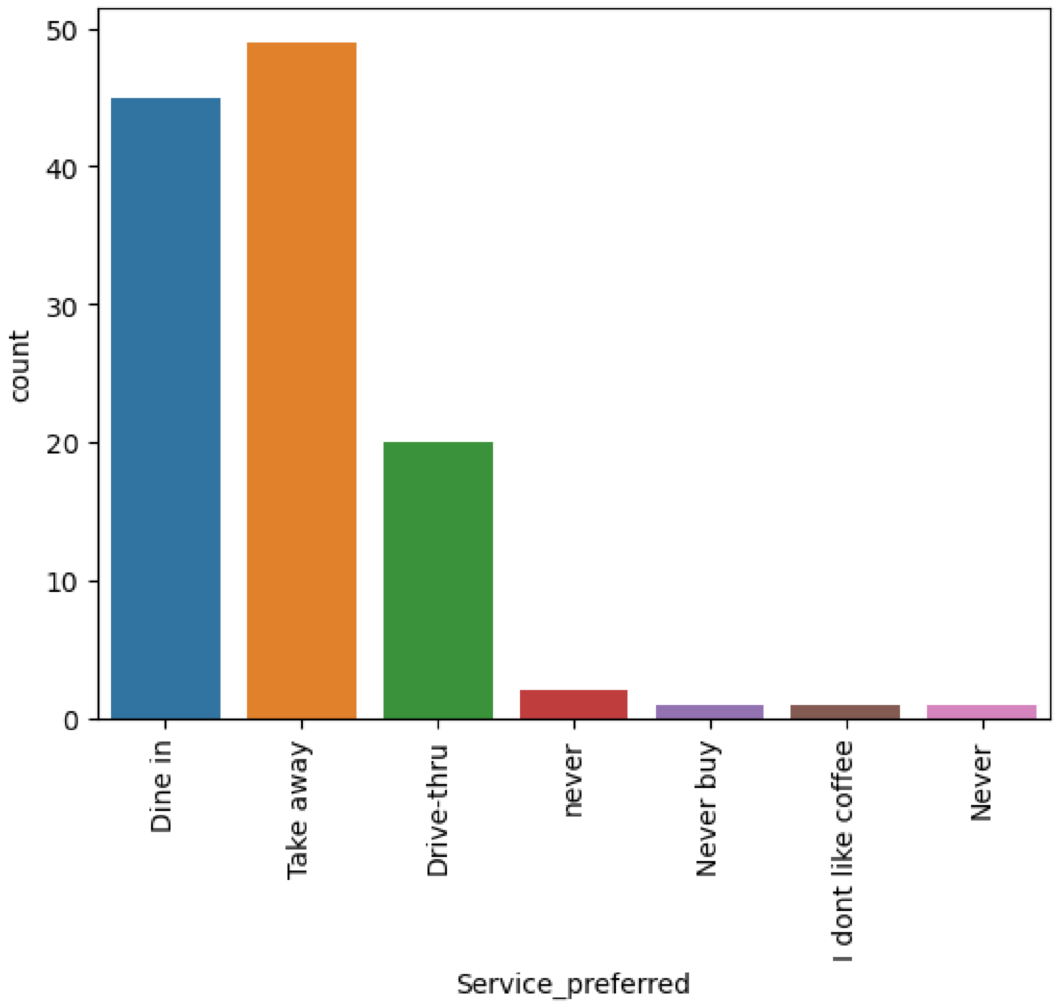
CountPlot for the column: Annual_Income



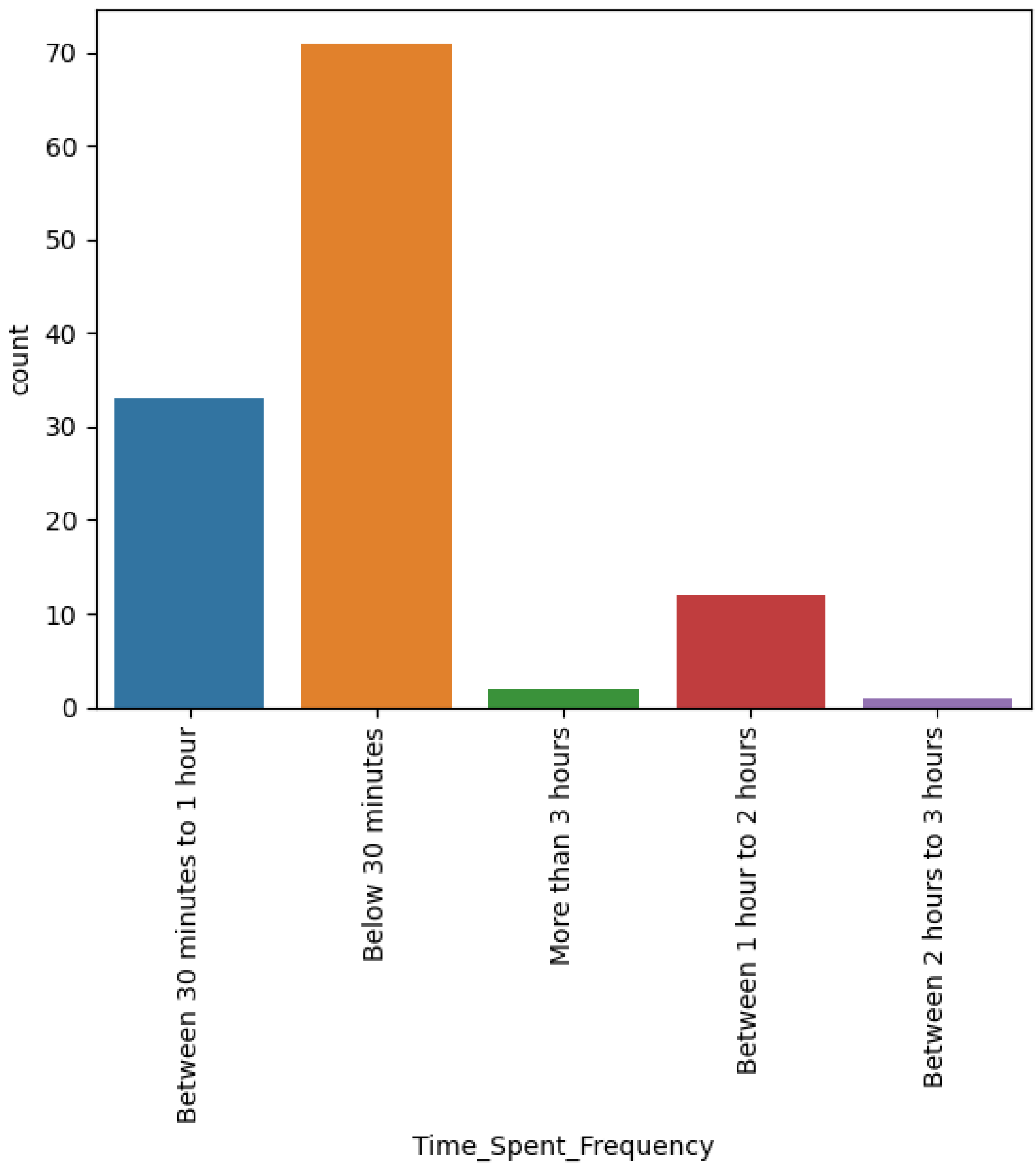

```
CountPlot for the column: Visit_Frequency
```



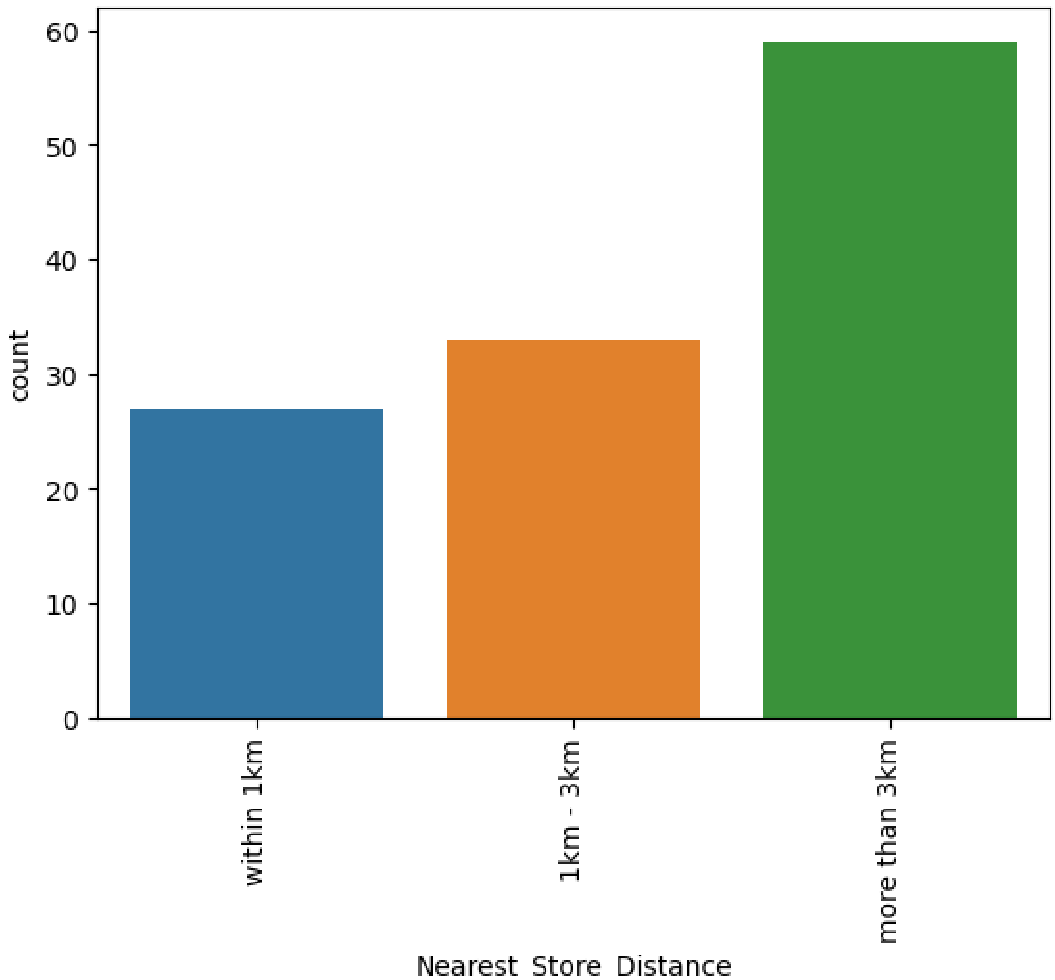

```
CountPlot for the column: Service_preferred
```



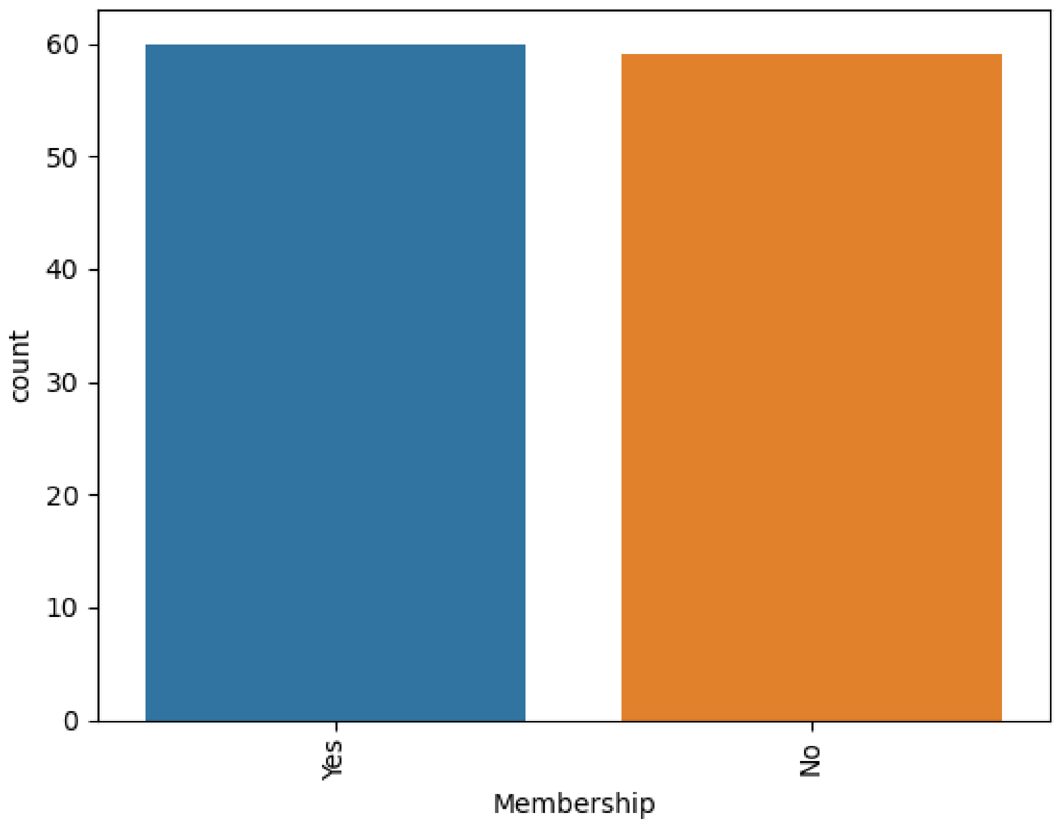

```
CountPlot for the column: Time_Spent_Frequency
```



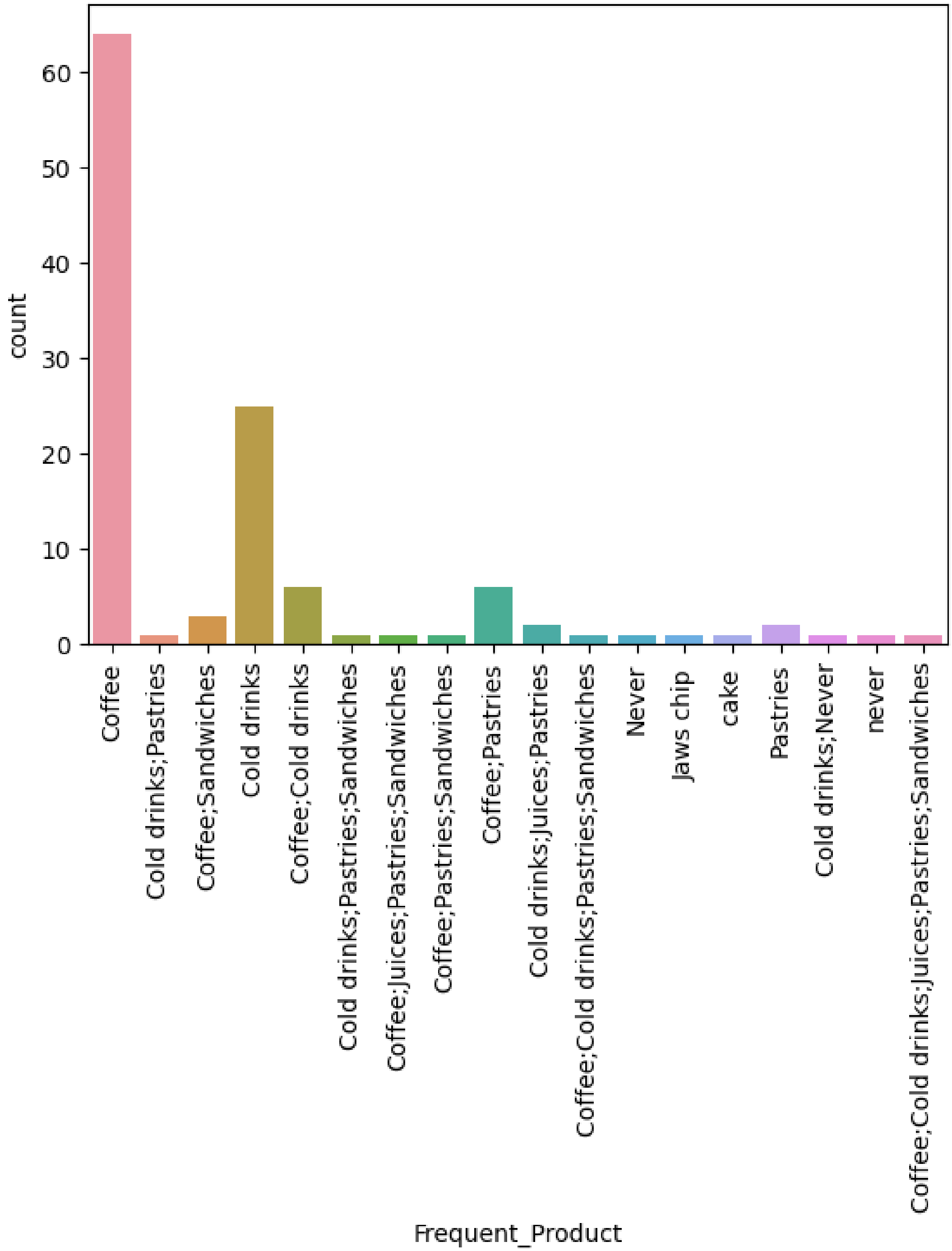
CountPlot for the column: Nearest_Store_Distance



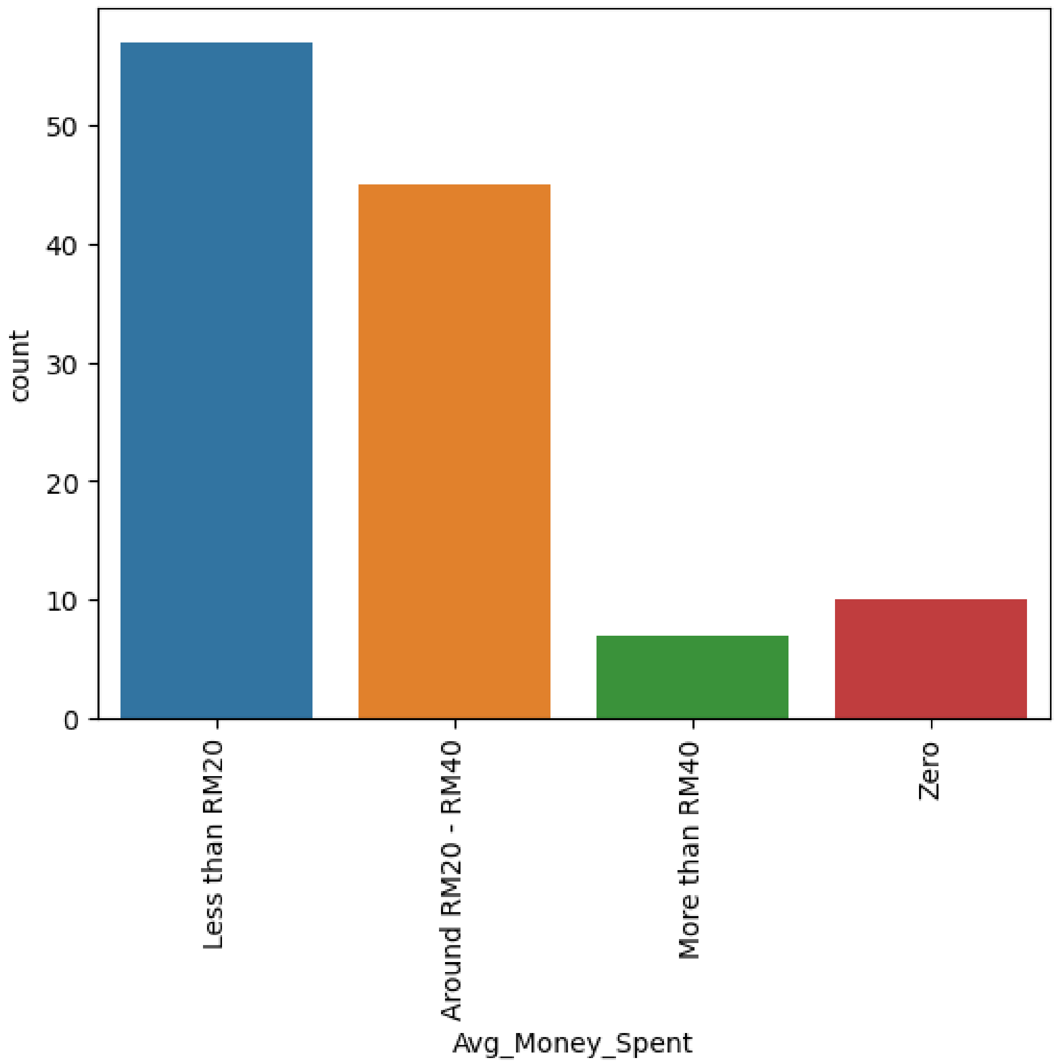
CountPlot for the column: Membership



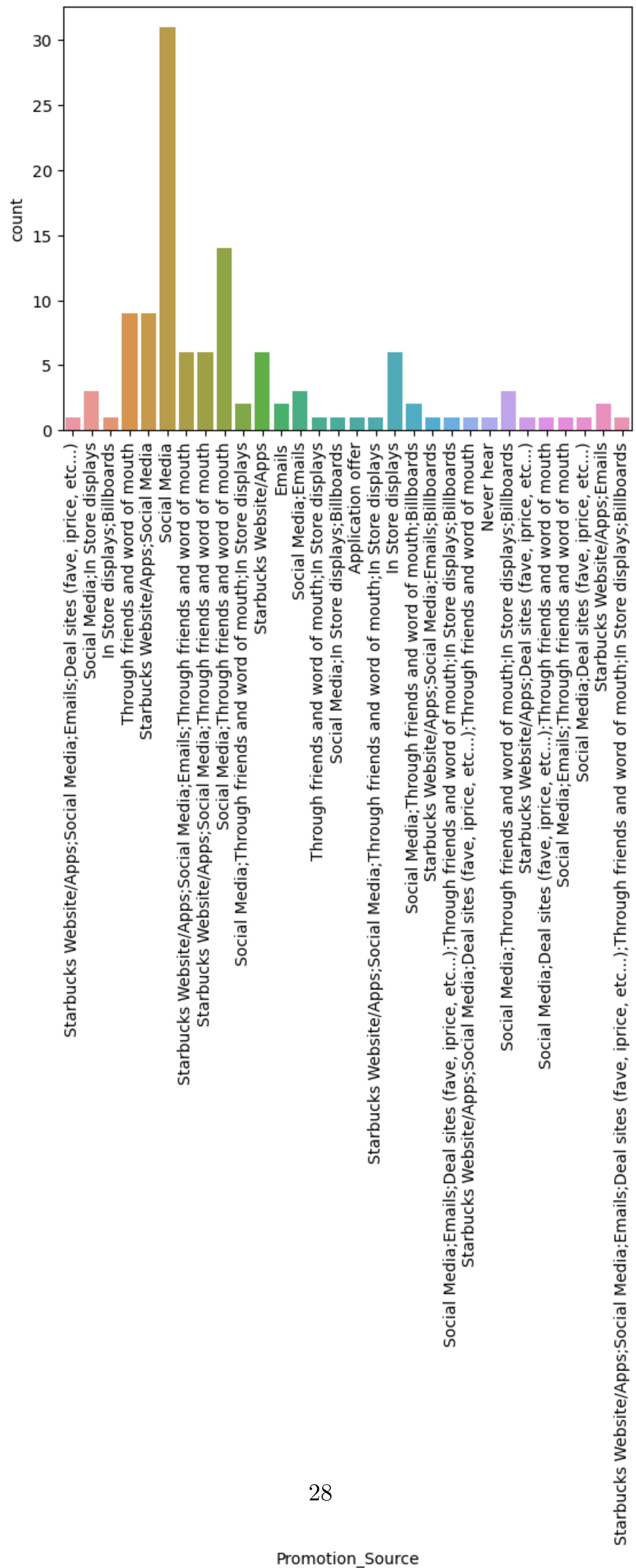
CountPlot for the column: Frequent_Product



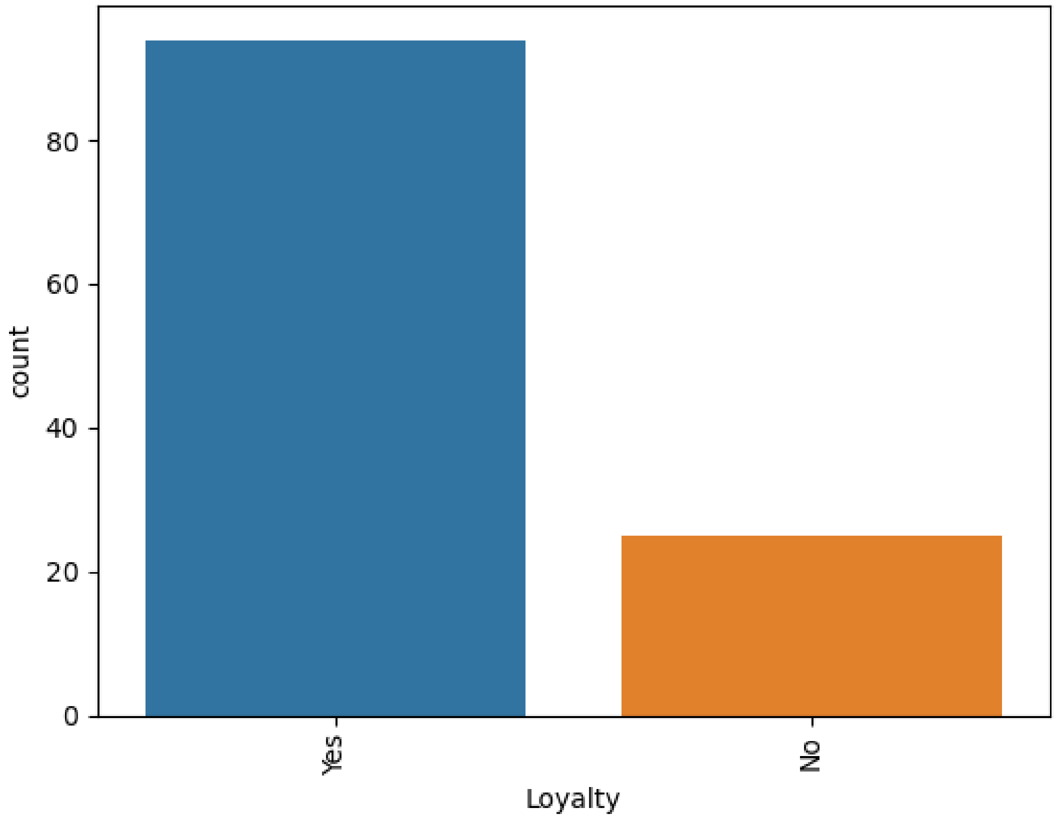
`CountPlot for the column: Avg_Money_Spent`



CountPlot for the column: Promotion_Source


count
0
5
10
15
20
25
30
Starbucks Website/Apps;Social Media;Emails;Deal sites (fave, iprice, etc...)
Social Media;In Store displays
In Store displays;Billboards
Through friends and word of mouth
Starbucks Website/Apps;Social Media
Social Media
Starbucks Website/Apps;Social Media;Emails;Through friends and word of mouth
Starbucks Website/Apps;Social Media;Through friends and word of mouth
Social Media;Through friends and word of mouth
Social Media;Through friends and word of mouth;In Store displays
Starbucks Website/Apps
Emails
Social Media;Emails
Through friends and word of mouth;In Store displays
Social Media;In Store displays;Billboards
Application offer
Starbucks Website/Apps;Social Media;Through friends and word of mouth;In Store displays
In Store displays
Social Media;Through friends and word of mouth;Billboards
Starbucks Website/Apps;Social Media;Emails;Billboards
Social Media;Emails;Deal sites (fave, iprice, etc...);Through friends and word of mouth;In Store displays;Billboards
Starbucks Website/Apps;Social Media;Deal sites (fave, iprice, etc...);Through friends and word of mouth
Never hear
Social Media;Through friends and word of mouth;In Store displays;Billboards
Starbucks Website/Apps;Deal sites (fave, iprice, etc...)
Social Media;Deal sites (fave, iprice, etc...);Through friends and word of mouth
Social Media;Emails;Through friends and word of mouth
Social Media;Deal sites (fave, iprice, etc...)
Starbucks Website/Apps;Emails
Starbucks Website/Apps;Social Media;Emails;Deal sites (fave, iprice, etc...);Through friends and word of mouth;In Store displays;Billboards
Promotion_Source

```
CountPlot for the column: Loyalty
```



- Both Females and Males customer are comparable in count
- Customers between age 20 to 29 are the majority customers then 30 to 40 age. 40 and above age group are less interested in the products
- Employees and Students are more interested in the products compared to Self-employed. Ignore Housewife as the category has too less in count to consider to draw insights
- Customers with annual income below RM50000 are the potential customers
- Most of the customers visit rarely. Monthly visitors are also significant in number. Daily visitors are very less in count
- Take away customers are very high next comes the Drive In and then Drive thru categories
- Majority customers spend less than an hour. Very few people spend time around an hour to two
- Majority of customers are more than 3km distance from the store.
- Customers with membership are almost in number to no membership customers
- Coffee, Cold drinks, Pastries seems to be the frequently bought products in Store
- Majority of people spend money less than RM20. Customer count spending more money decreases with increase in Money
- Social media is the main source of Promotion for the products

- Interestingly, even the customers having/not having membership are equal in number, majority of customers are loyal to our brand

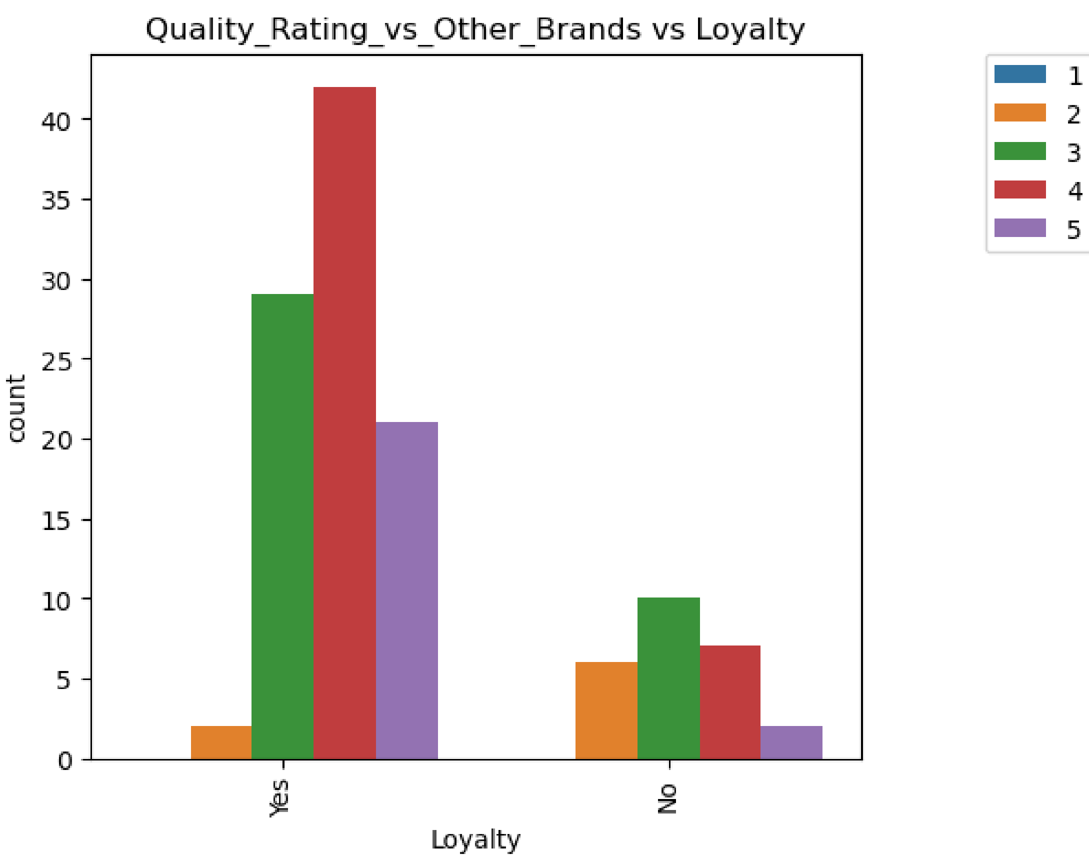
Bi-Variate Analysis

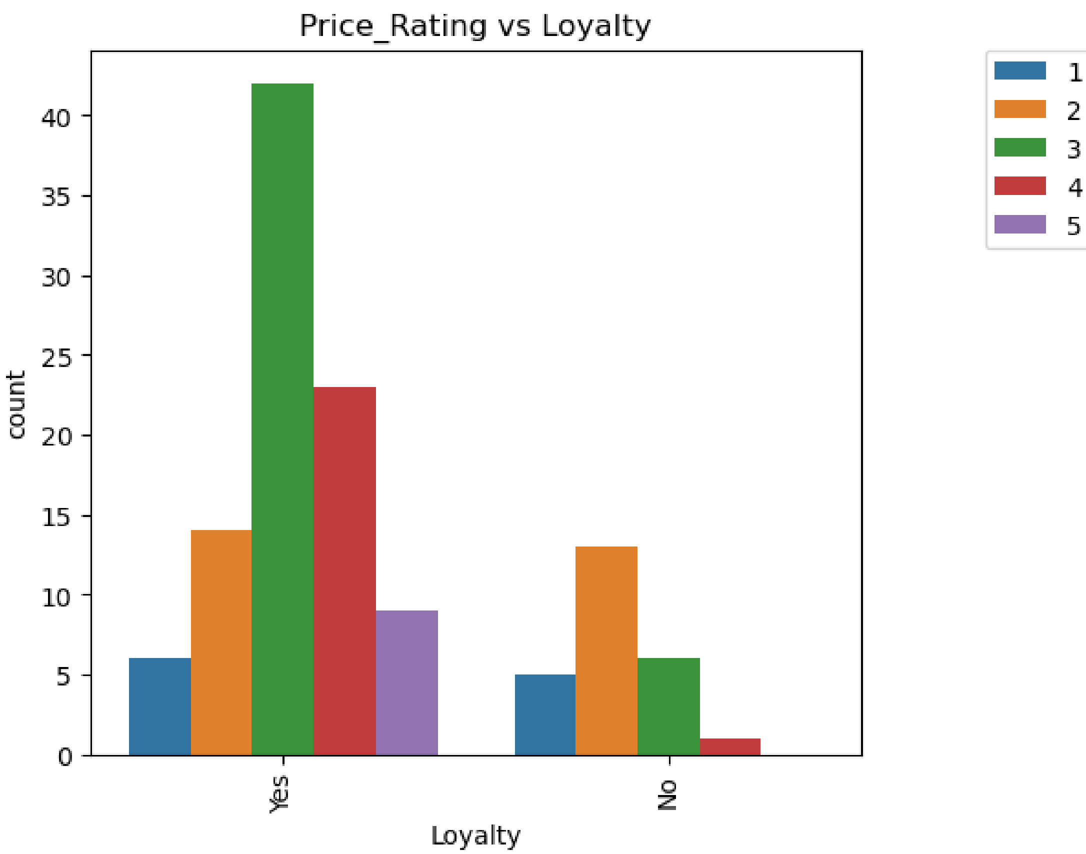
[ ]:

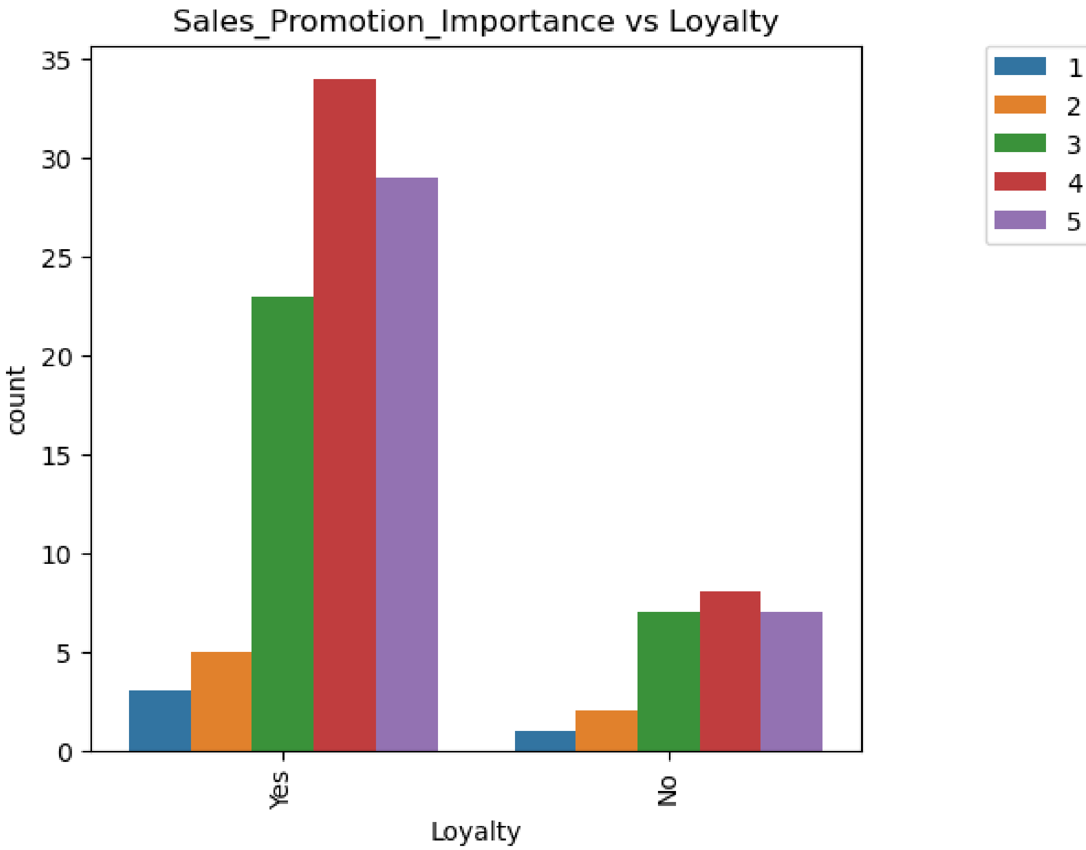
```

```

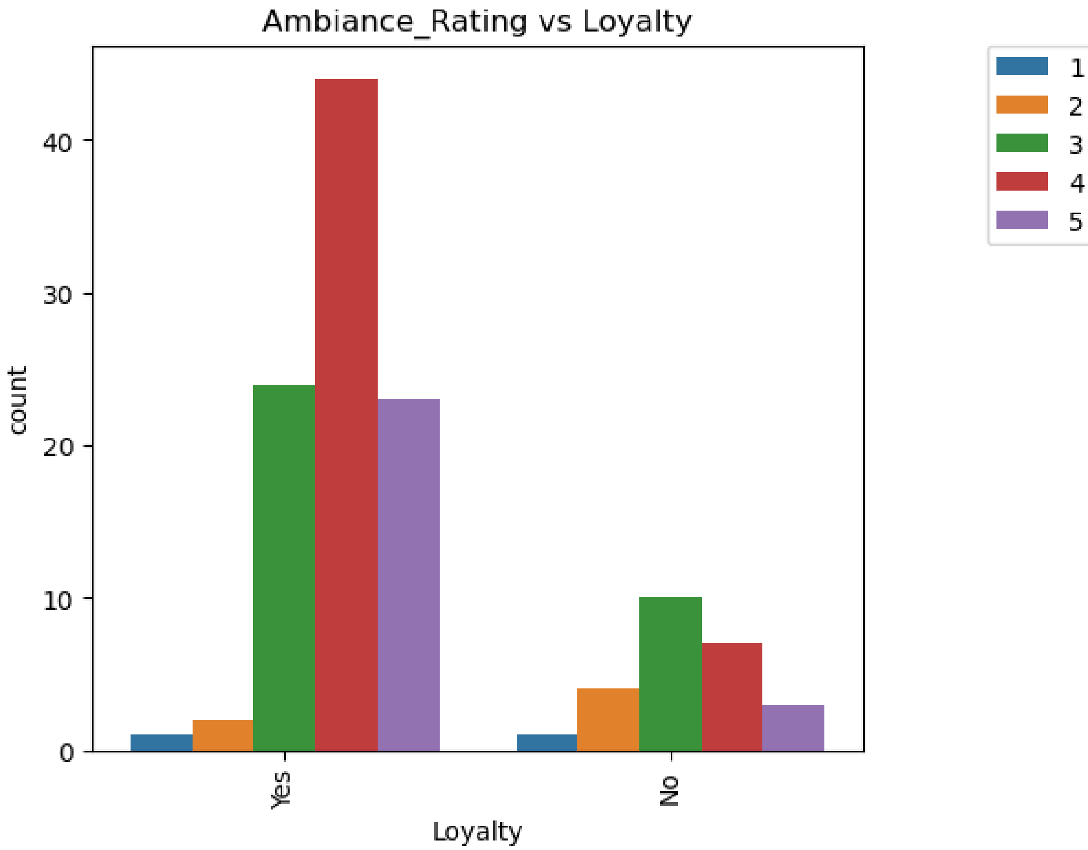
[85]:

```
hue_order=['1','2','3','4','5']
for i in num_cols:
    df[i]=df[i].astype(str)
    plt.figure(figsize=(25,5))
    plt.subplot(1,4,1)
    sns.countplot(x=df.Loyalty, hue=df[i], hue_order=hue_order)
    plt.title(i+" vs Loyalty")
    plt.xticks(rotation=90)
    plt.legend(bbox_to_anchor=(1.3,1), borderaxespad=0)
    plt.show()
```

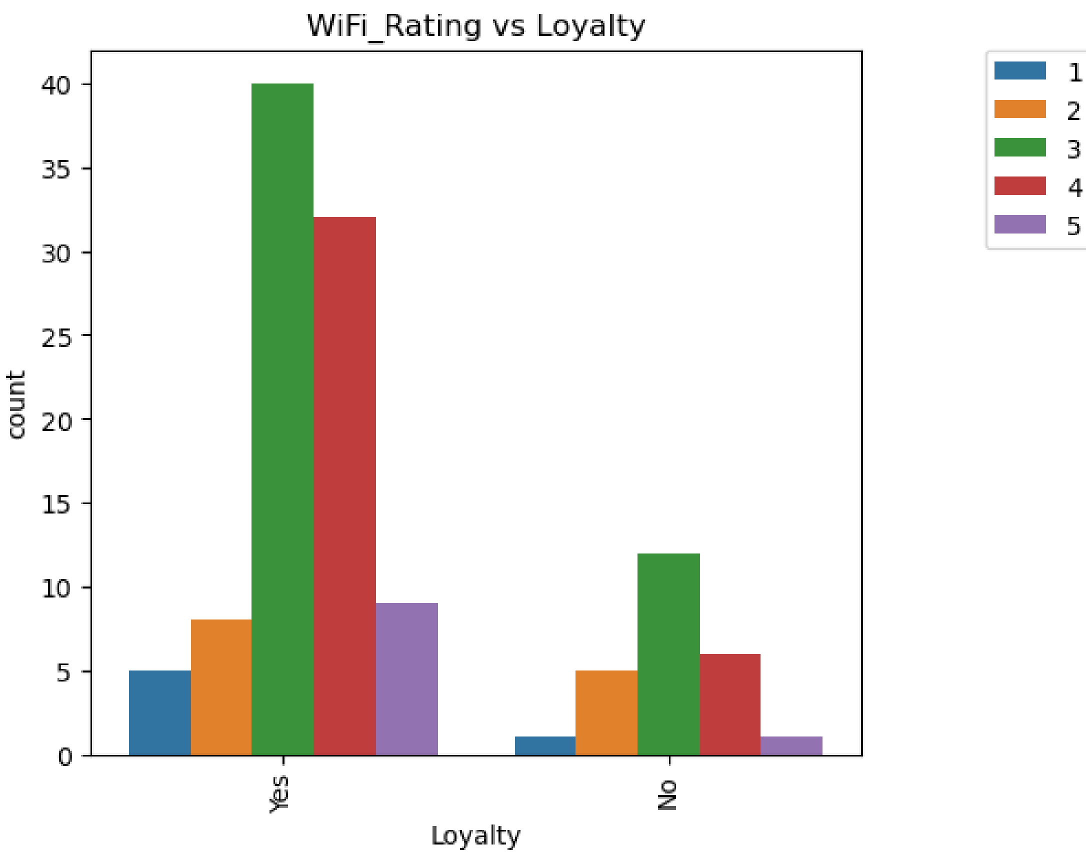


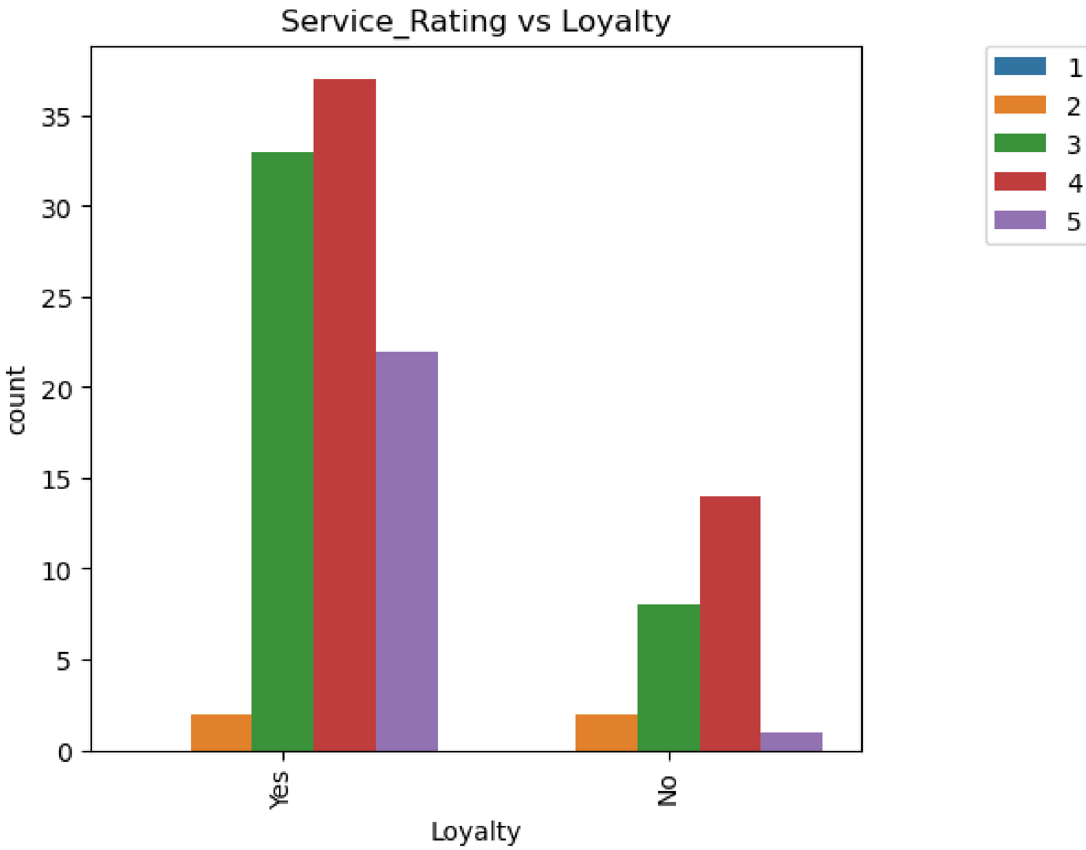

Price_Rating vs Loyalty
count
0
5
10
15
20
25
30
35
40
Yes
No
Loyalty
1
2
3
4
5

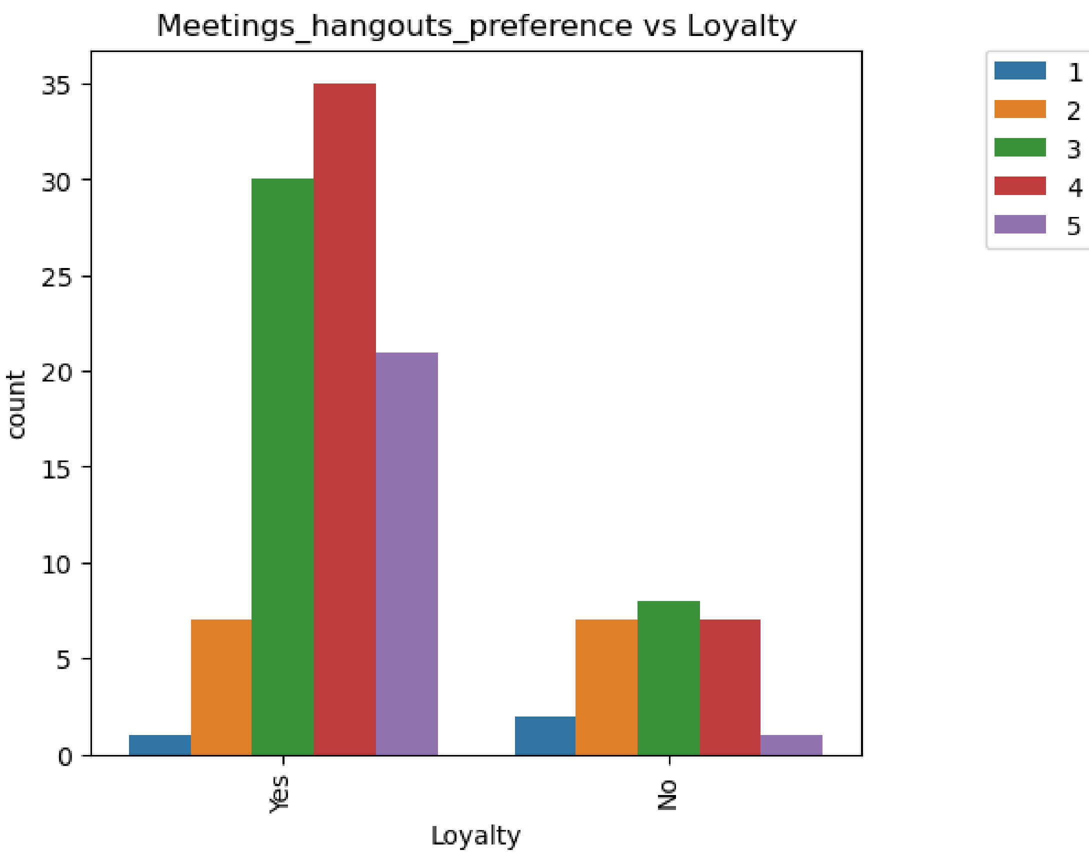

Sales_Promotion_Importance vs Loyalty
count
Loyalty
Yes
No
0
5
10
15
20
25
30
35
1
2
3
4
5



Ambiance_Rating vs Loyalty
count
40
30
20
10
0
Yes
No
Loyalty
1
2
3
4
5


WiFi_Rating vs Loyalty
count
0
5
10
15
20
25
30
35
40
Yes
No
Loyalty
1
2
3
4
5


Service_Rating vs Loyalty
count
0
5
10
15
20
25
30
35
Yes
No
Loyalty
1
2
3
4
5

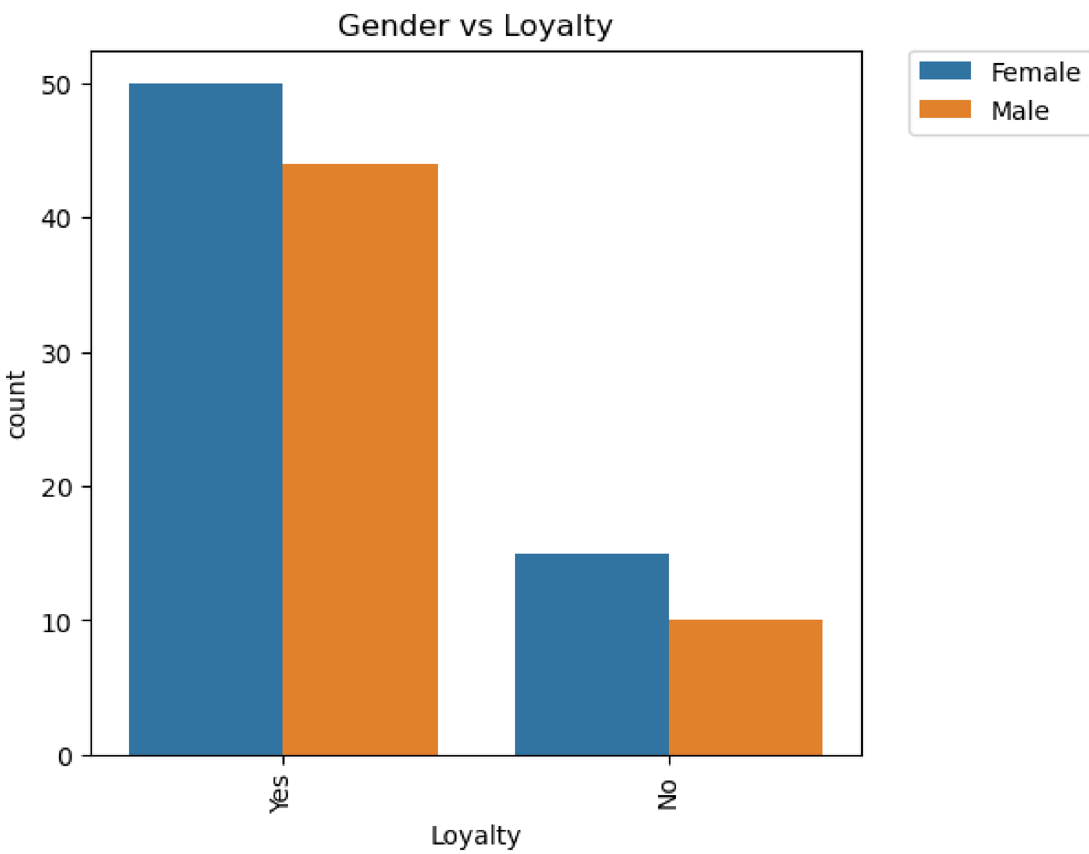


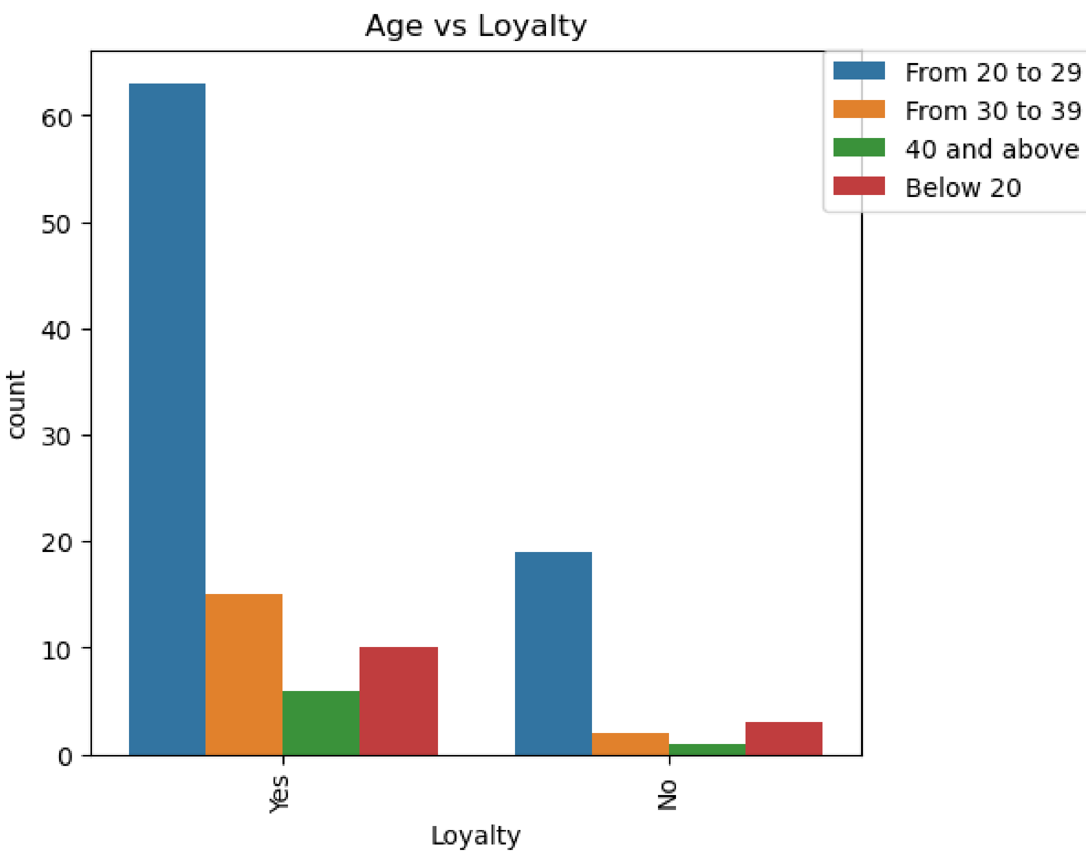
Among the loyal customer

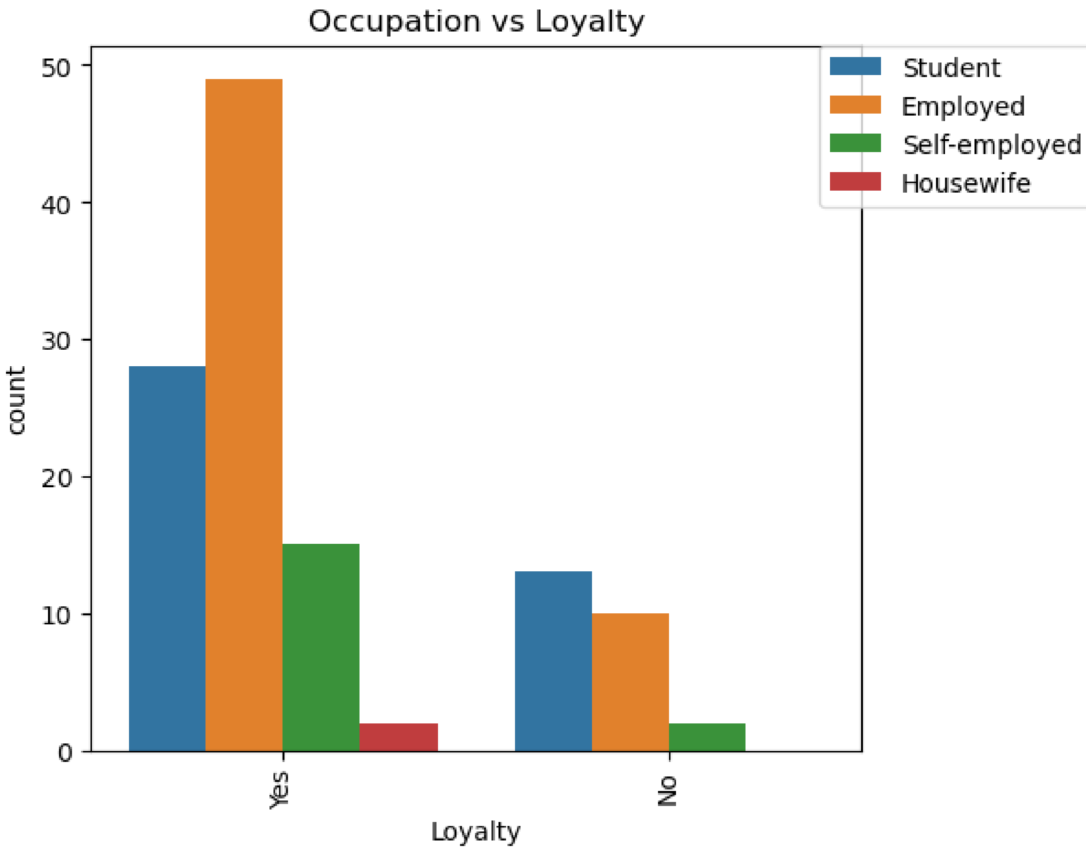
- 4 is the most common quality rating
- 3 is the most common price rating and price rating of 5 are loyal customers
- 4 is the most common ambiance rating ##### Among the Non_Loyal customers
- 3 is the most common quality rating
- 2 is the most common price rating
- 3 is the most common ambiance rating
- Loyality doesn't seem to depend on wifi rating and sales promotion much
- Customers giving Service rating 5 have more likely loyal customers. The likeliness seems to be decreasing with decreasing rating
- Customers with meeting_hangout_preference 4 are more likely loyal

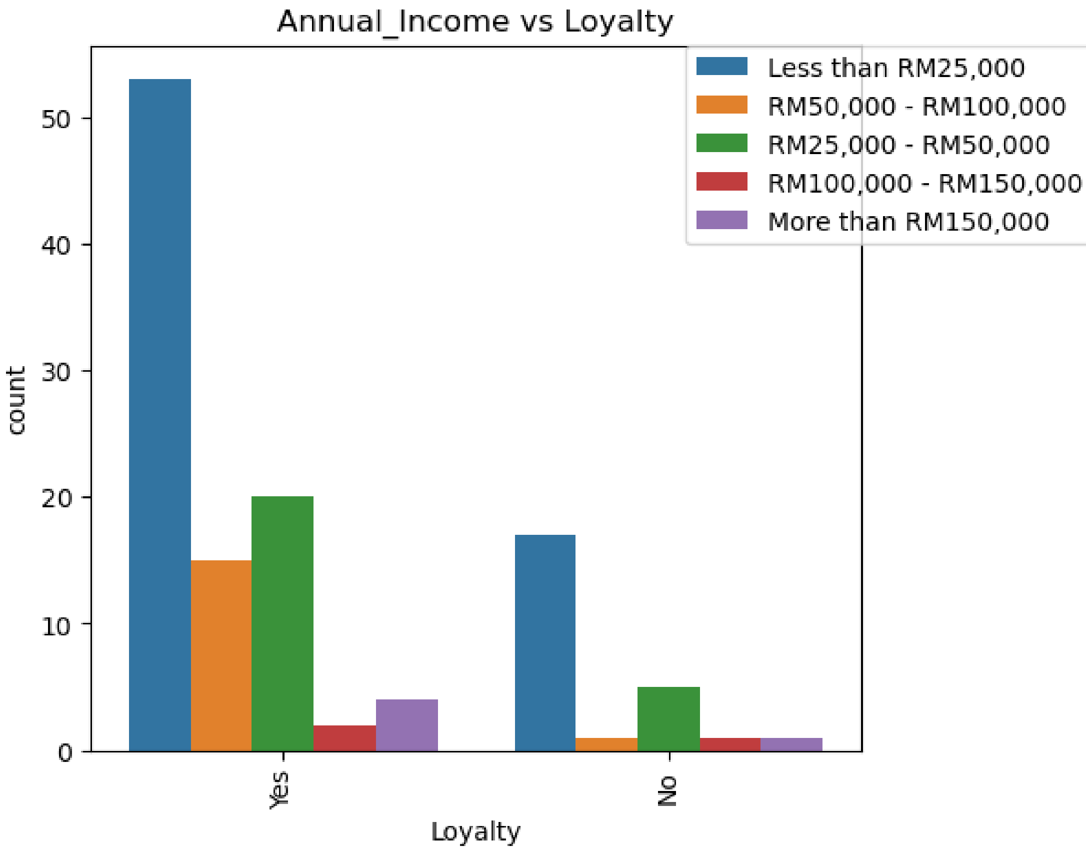
Lets analyse the categorical columns

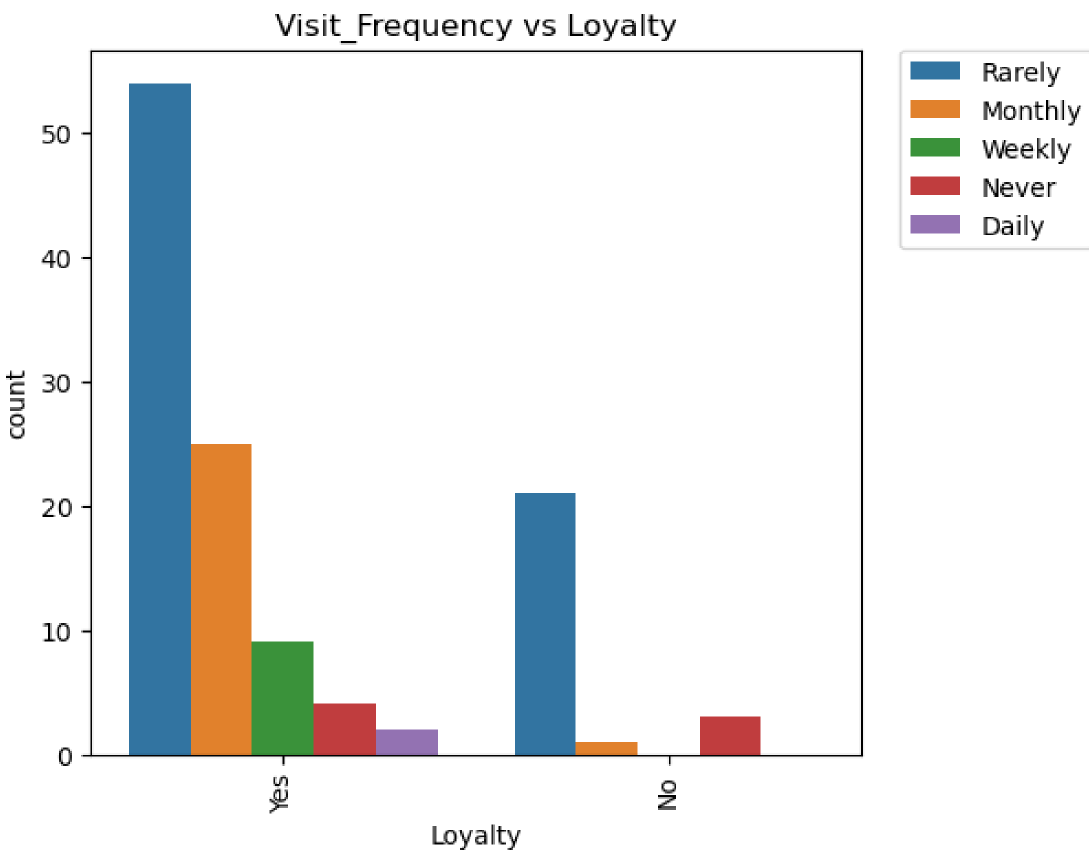
[69]:
```
for i in cat_cols[1:]:
    plt.figure(figsize=(25,5))
    plt.subplot(1,4,1)
    sns.countplot(x=df.Loyalty, hue=df[i])
    plt.title(i+" vs Loyalty")
    plt.xticks(rotation=90)
    plt.legend(bbox_to_anchor=(1.3,1), borderaxespad=0)
    plt.show()
```



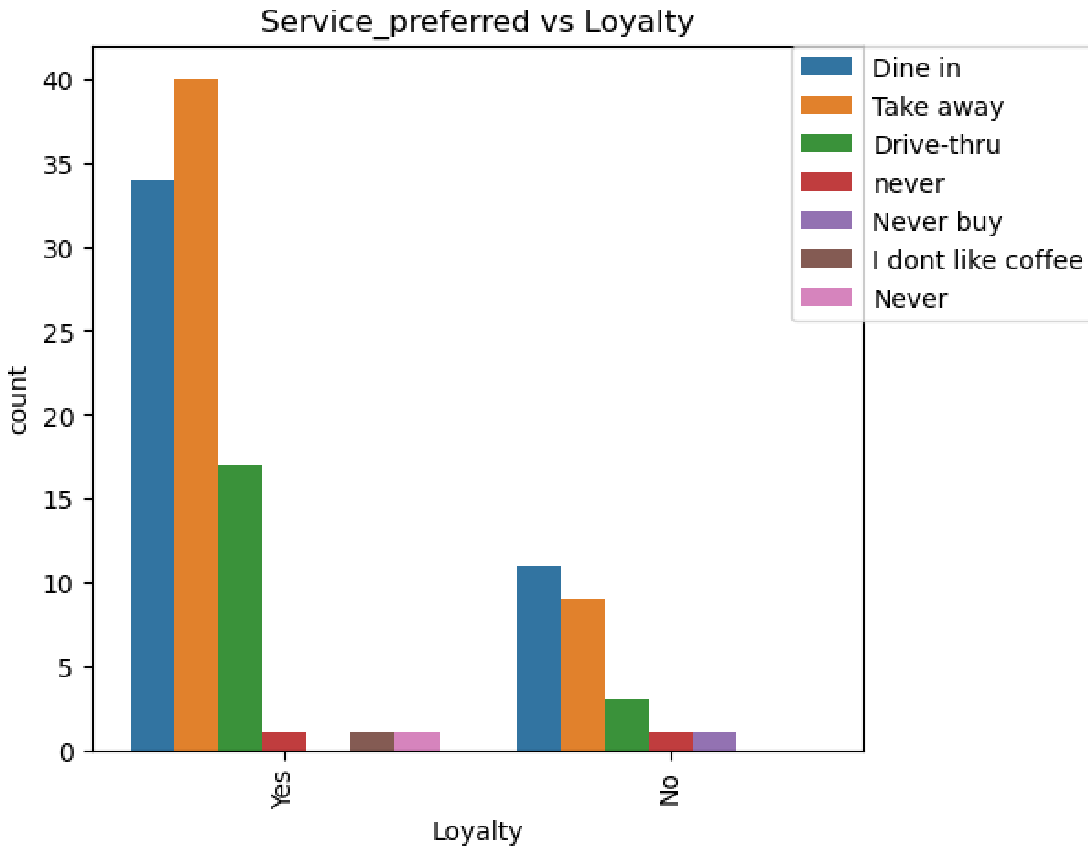

Age vs Loyalty
From 20 to 29
From 30 to 39
40 and above
Below 20
count
0
10
20
30
40
50
60
Yes
No
Loyalty


Occupation vs Loyalty
Student
Employed
Self-employed
Housewife
count
50
40
30
20
10
0
Yes
No
Loyalty

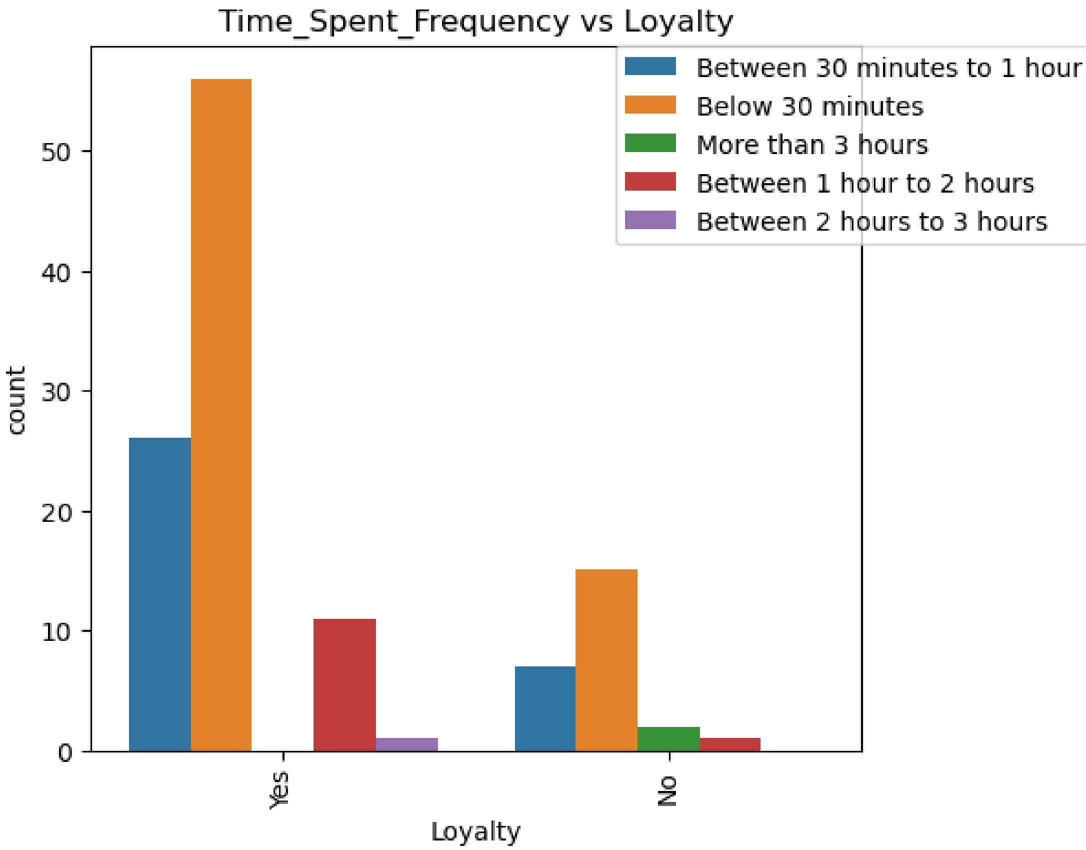

Annual_Income vs Loyalty
Less than RM25,000
RM50,000 - RM100,000
RM25,000 - RM50,000
RM100,000 - RM150,000
More than RM150,000
count
0
10
20
30
40
50
Yes
No
Loyalty

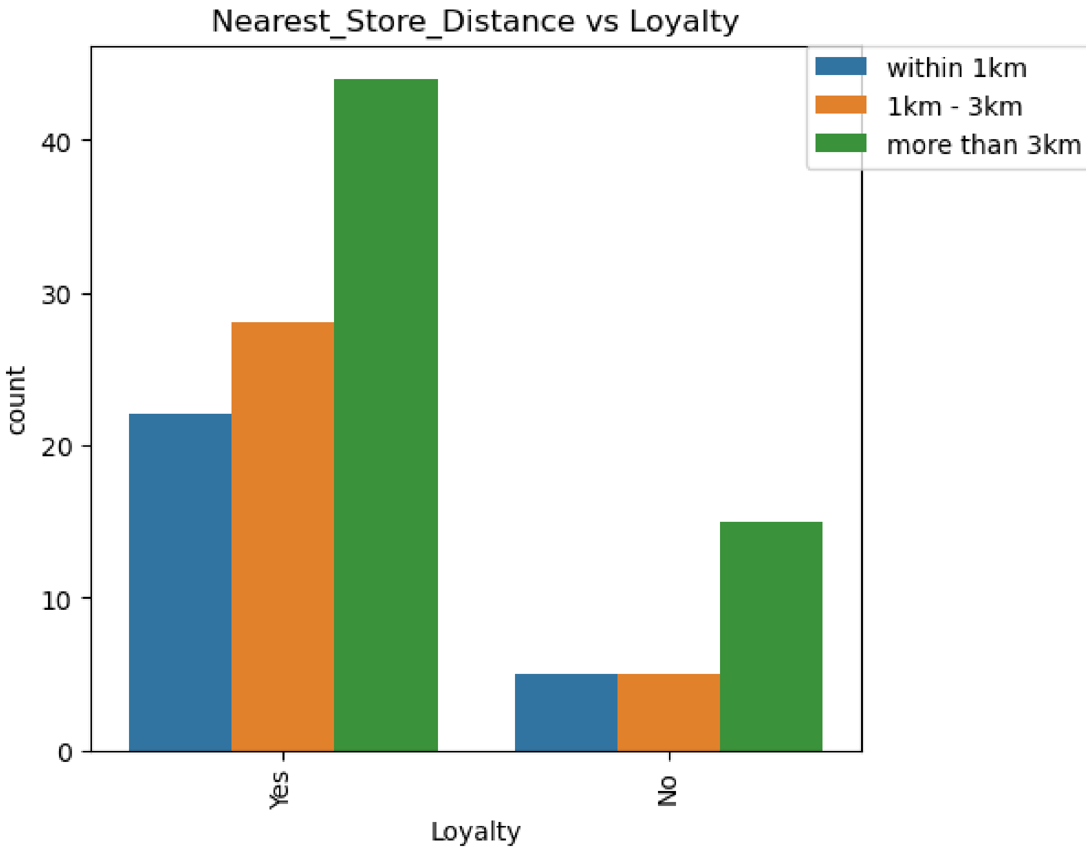


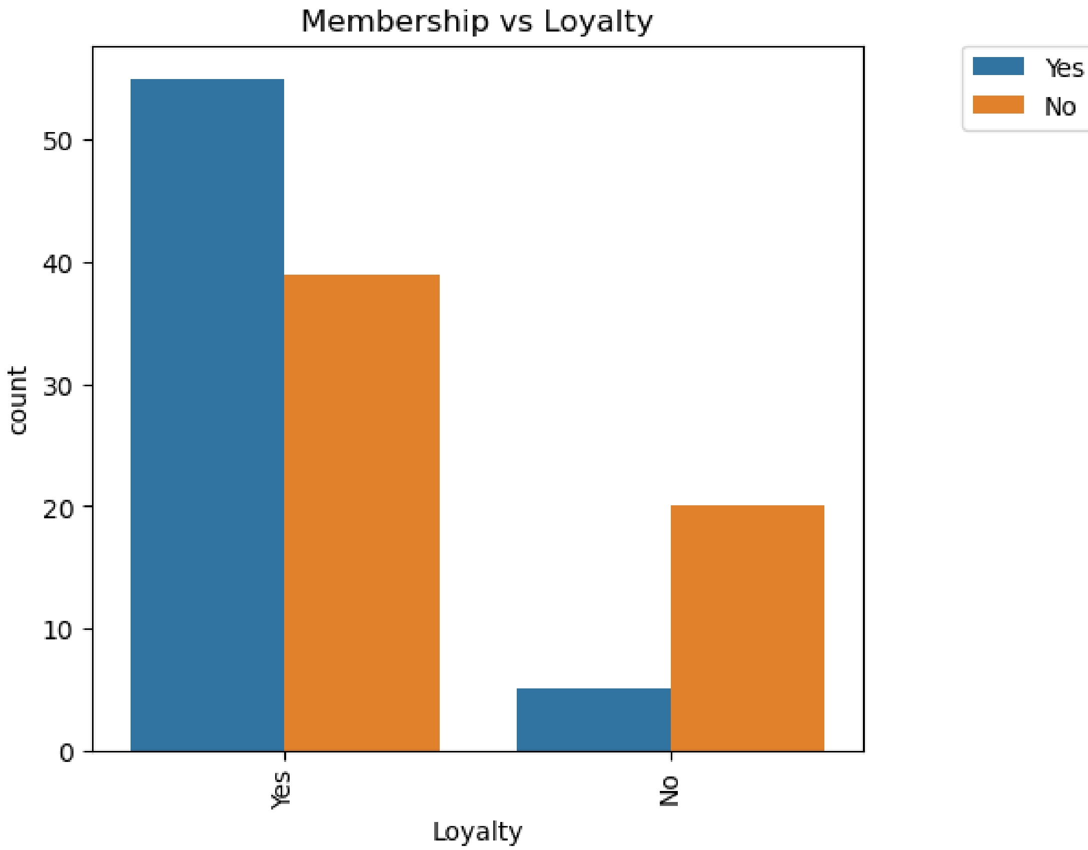
Visit_Frequency vs Loyalty
Rarely
Monthly
Weekly
Never
Daily
count
0
10
20
30
40
50
Yes
No
Loyalty



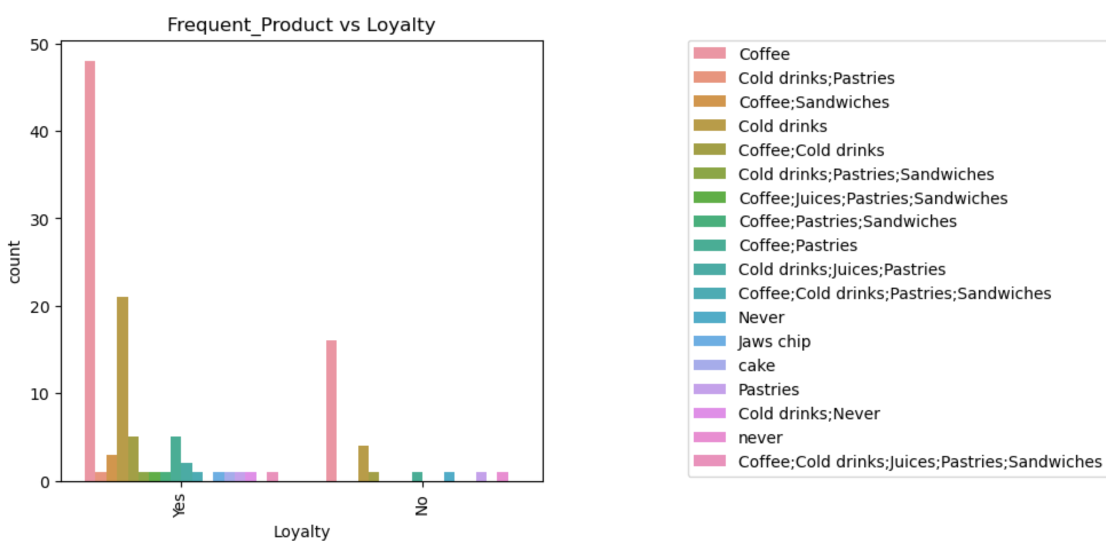
Service_preferred vs Loyalty
count
Loyalty
Yes
No
0
5
10
15
20
25
30
35
40
Dine in
Take away
Drive-thru
never
Never buy
I dont like coffee
Never


Time_Spent_Frequency vs Loyalty
Between 30 minutes to 1 hour
Below 30 minutes
More than 3 hours
Between 1 hour to 2 hours
Between 2 hours to 3 hours
count
0
10
20
30
40
50
Yes
No
Loyalty

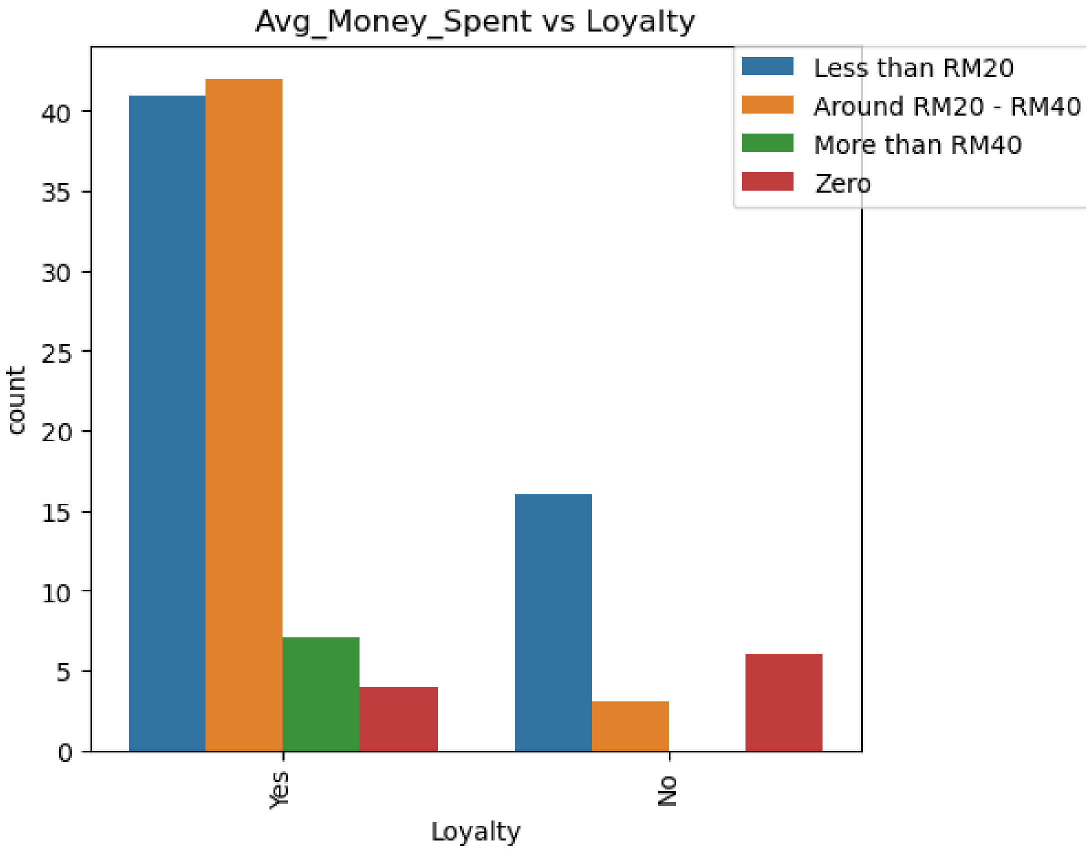

Nearest_Store_Distance vs Loyalty
within 1km
1km - 3km
more than 3km
count
0
10
20
30
40
Yes
No
Loyalty



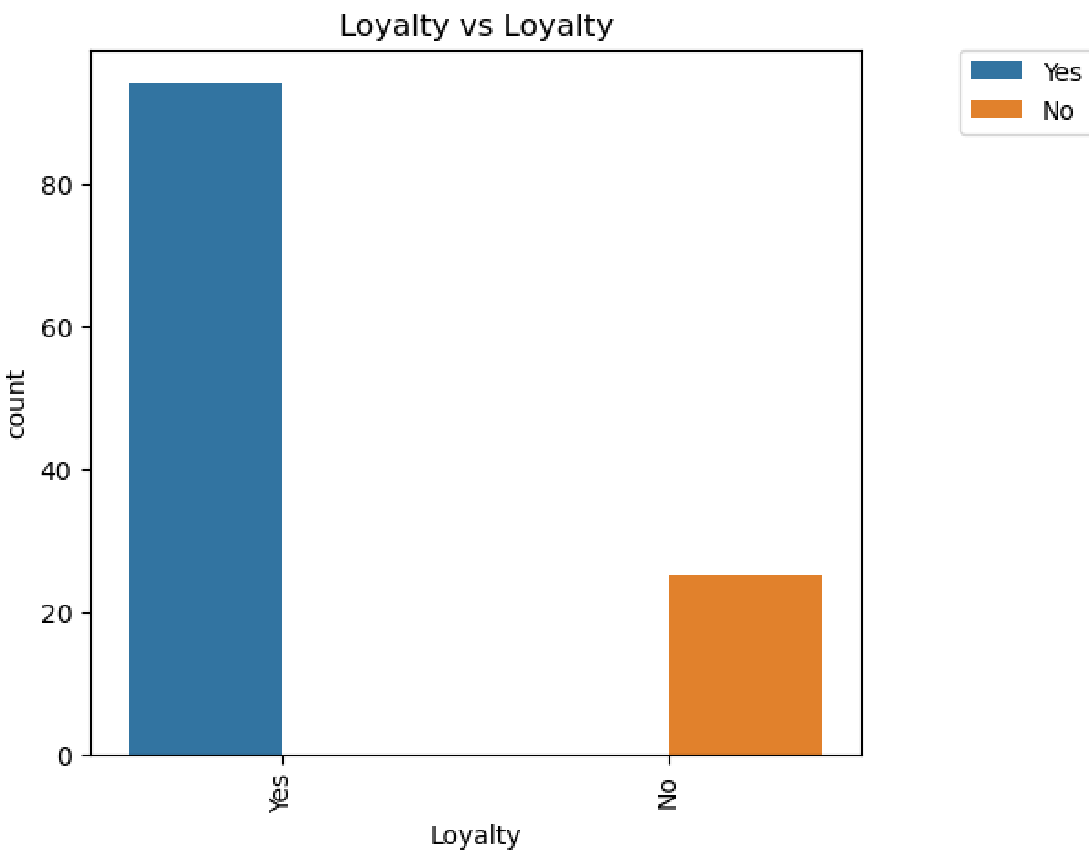
Membership vs Loyalty
count
Loyalty
Yes
No



Frequent_Product vs Loyalty
count
Loyalty
Yes
No
Coffee
Cold drinks;Pastries
Coffee;Sandwiches
Cold drinks
Coffee;Cold drinks
Cold drinks;Pastries;Sandwiches
Coffee;Juices;Pastries;Sandwiches
Coffee;Pastries;Sandwiches
Coffee;Pastries
Cold drinks;Juices;Pastries
Coffee;Cold drinks;Pastries;Sandwiches
Never
Jaws chip
cake
Pastries
Cold drinks;Never
never
Coffee;Cold drinks;Juices;Pastries;Sandwiches


Avg_Money_Spent vs Loyalty
count
0
5
10
15
20
25
30
35
40
Yes
No
Loyalty
Less than RM20
Around RM20 - RM40
More than RM40
Zero


Promotion_Source vs Loyalty
count
0
5
10
15
20
25
Yes
No
Loyalty
Starbucks Website/Apps;Social Media;Emails;Deal sites (fave, iprice, etc...)
Social Media;In Store displays
In Store displays;Billboards
Through friends and word of mouth
Starbucks Website/Apps;Social Media
Social Media
Starbucks Website/Apps;Social Media;Emails;Through friends and word of mouth
Starbucks Website/Apps;Social Media;Through friends and word of mouth
Social Media;Through friends and word of mouth
Social Media;Through friends and word of mouth;In Store displays
Starbucks Website/Apps
Emails
Social Media;Emails
Through friends and word of mouth;In Store displays
Social Media;In Store displays;Billboards
Application offer
Starbucks Website/Apps;Social Media;Through friends and word of mouth;In Store displays
In Store displays
Social Media;Through friends and word of mouth;Billboards
Starbucks Website/Apps;Social Media;Emails;Billboards
Social Media;Emails;Deal sites (fave, iprice, etc...);Through friends and word of mouth;In Store displays;Billboards
Starbucks Website/Apps;Social Media;Deal sites (fave, iprice, etc...);Through friends and word of mouth
Never hear
Social Media;Through friends and word of mouth;In Store displays;Billboards
Starbucks Website/Apps;Deal sites (fave, iprice, etc...)
Social Media;Deal sites (fave, iprice, etc...);Through friends and word of mouth
Social Media;Emails;Through friends and word of mouth
Social Media;Deal sites (fave, iprice, etc...)
Starbucks Website/Apps;Emails
Starbucks Website/Apps;Social Media;Emails;Deal sites (fave, iprice, etc...);Through friends and word of mouth;In Store displays;Billboards



- Gender doesn't seem to have impact on the Loyalty. Female customers are more in number
- Customers from age group 20-29 are major segment next comes 30-39 among both loyal and non-loyal customers
- Employed customers are major category among loyal customers whereas Students are major category among non-loyal customers
- Customers with annual_income 50k-100k are more in number among loyal customers
- Customers with visit frequency rarely
- Take away is the majority among loyal customers, whereas Dine in Non-Loyal customers
- Time spent and nearest store distance doesn't seem to have much influence on the loyalty. To be analysed futher
- Customers with membership are more loyal
- Coffee, cold drinks, pastries are major categories of frequently bought products
- Customers spent money more than RM20 are more loyal
- Social Media is the major Promotion source

Multi-Variate Analysis

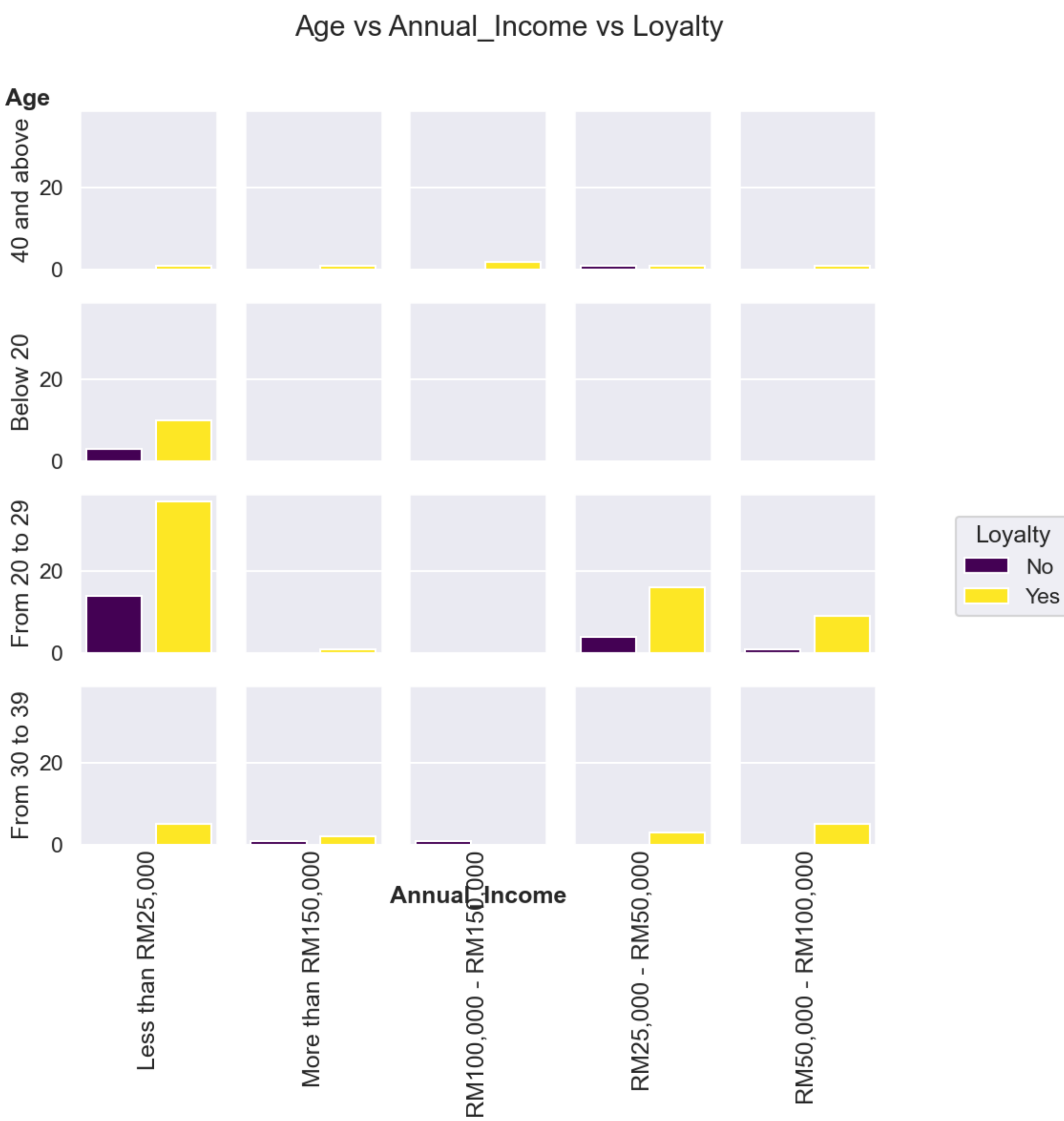
[86]:
```
def plot_fun(df, col1, col2, col3):

    plot_df = df[[col1, col2, col3]]
    plot_df['dummy'] = np.ones(len(plot_df), dtype=int)
```

```
    plot_df

    grouped_plot = plot_df.groupby([col1, col2, col3]).count().unstack(level=2)
    grouped_plot

    loyalty = grouped_plot.columns.levels[1]
    colors = [plt.get_cmap('viridis')(i) for i in np.linspace(0,1,len(loyalty))]
    colors

    sns.set(context='talk')
    nxplots = len(grouped_plot.index.levels[0])
    nyplots = len(grouped_plot.index.levels[1])
    fig, axes = plt.subplots(nrows=nxplots, ncols=nyplots, sharex=True,␣
↪sharey=True, figsize=(12,10))
    fig.suptitle(col1 +' vs '+col2+' vs '+col3)

    for a,i in enumerate(grouped_plot.index.levels[0]):
        for b,j in enumerate(grouped_plot.index.levels[1]):
            try:
                axes[a,b].bar(grouped_plot.columns.levels[1], grouped_plot.
↪loc[i,j], color=colors)
                print(i,j)
                axes[a,b].xaxis.set_ticks([])
            except:
                pass

    axeslabel = fig.add_subplot(111, frameon=False)
    plt.tick_params(labelcolor='none')
    plt.grid(False)
    axeslabel.set_ylabel(col1,rotation='horizontal',y=1,weight="bold")
    axeslabel.set_xlabel(col2,y=1,weight="bold")
    for i, j in enumerate(grouped_plot.index.levels[1]):
        axes[-1,i].set_xlabel(j, rotation=90)
    for i, j in enumerate(grouped_plot.index.levels[0]):
        axes[i,0].set_ylabel(j, rotation=90)

    fig.subplots_adjust(right=0.82)

    fig.legend([Patch(facecolor = i) for i in colors],
               grouped_plot.columns.levels[1],
               title="Loyalty",
               loc="center right")
    print(grouped_plot)
```

age_vs_AnnualIncome_vs_Loyalty

[87]:
```
plot_fun(df, 'Age','Annual_Income','Loyalty')
```

```
40 and above Less than RM25,000
40 and above More than RM150,000
40 and above RM100,000 - RM150,000
40 and above RM25,000 - RM50,000
40 and above RM50,000 - RM100,000
Below 20 Less than RM25,000
From 20 to 29 Less than RM25,000
From 20 to 29 More than RM150,000
From 20 to 29 RM25,000 - RM50,000
From 20 to 29 RM50,000 - RM100,000
From 30 to 39 Less than RM25,000
From 30 to 39 More than RM150,000
From 30 to 39 RM100,000 - RM150,000
From 30 to 39 RM25,000 - RM50,000
From 30 to 39 RM50,000 - RM100,000
                                    dummy
Loyalty                                No   Yes
Age           Annual_Income
40 and above  Less than RM25,000      NaN   1.0
              More than RM150,000     NaN   1.0
              RM100,000 - RM150,000   NaN   2.0
              RM25,000 - RM50,000     1.0   1.0
              RM50,000 - RM100,000    NaN   1.0
Below 20      Less than RM25,000      3.0  10.0
From 20 to 29 Less than RM25,000     14.0  37.0
              More than RM150,000     NaN   1.0
              RM25,000 - RM50,000     4.0  16.0
              RM50,000 - RM100,000    1.0   9.0
From 30 to 39 Less than RM25,000      NaN   5.0
              More than RM150,000     1.0   2.0
              RM100,000 - RM150,000   1.0   NaN
              RM25,000 - RM50,000     NaN   3.0
              RM50,000 - RM100,000    NaN   5.0
```



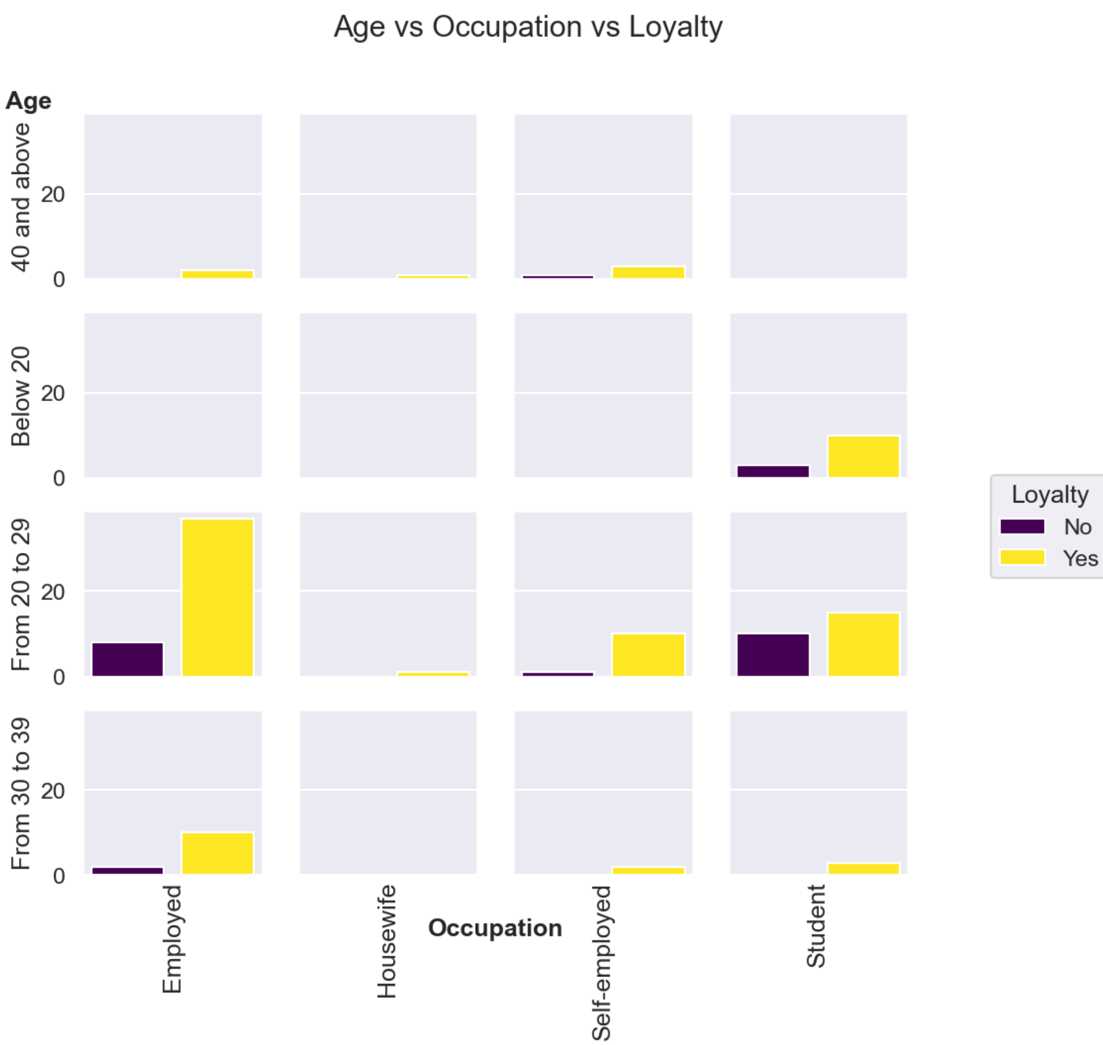
- Age group 20-29 is the majority group. Their loyality percentge is increasing with the increase in salary
- Age group below 20 customers have income lessthan RM25000
- Customer interest in the products is decreasing with the increase in age from 20

age_vs_Occupation_vs_Loyalty

[88]:
```
plot_fun(df, 'Age','Occupation','Loyalty')
```

```
40 and above Employed
40 and above Housewife
40 and above Self-employed
Below 20 Student
```

```
From 20 to 29 Employed
From 20 to 29 Housewife
From 20 to 29 Self-employed
From 20 to 29 Student
From 30 to 39 Employed
From 30 to 39 Self-employed
From 30 to 39 Student
                             dummy
Loyalty                         No   Yes
Age           Occupation
40 and above  Employed         NaN   2.0
              Housewife        NaN   1.0
              Self-employed    1.0   3.0
Below 20      Student          3.0  10.0
From 20 to 29 Employed         8.0  37.0
              Housewife        NaN   1.0
              Self-employed    1.0  10.0
              Student         10.0  15.0
From 30 to 39 Employed         2.0  10.0
              Self-employed    NaN   2.0
              Student          NaN   3.0
```



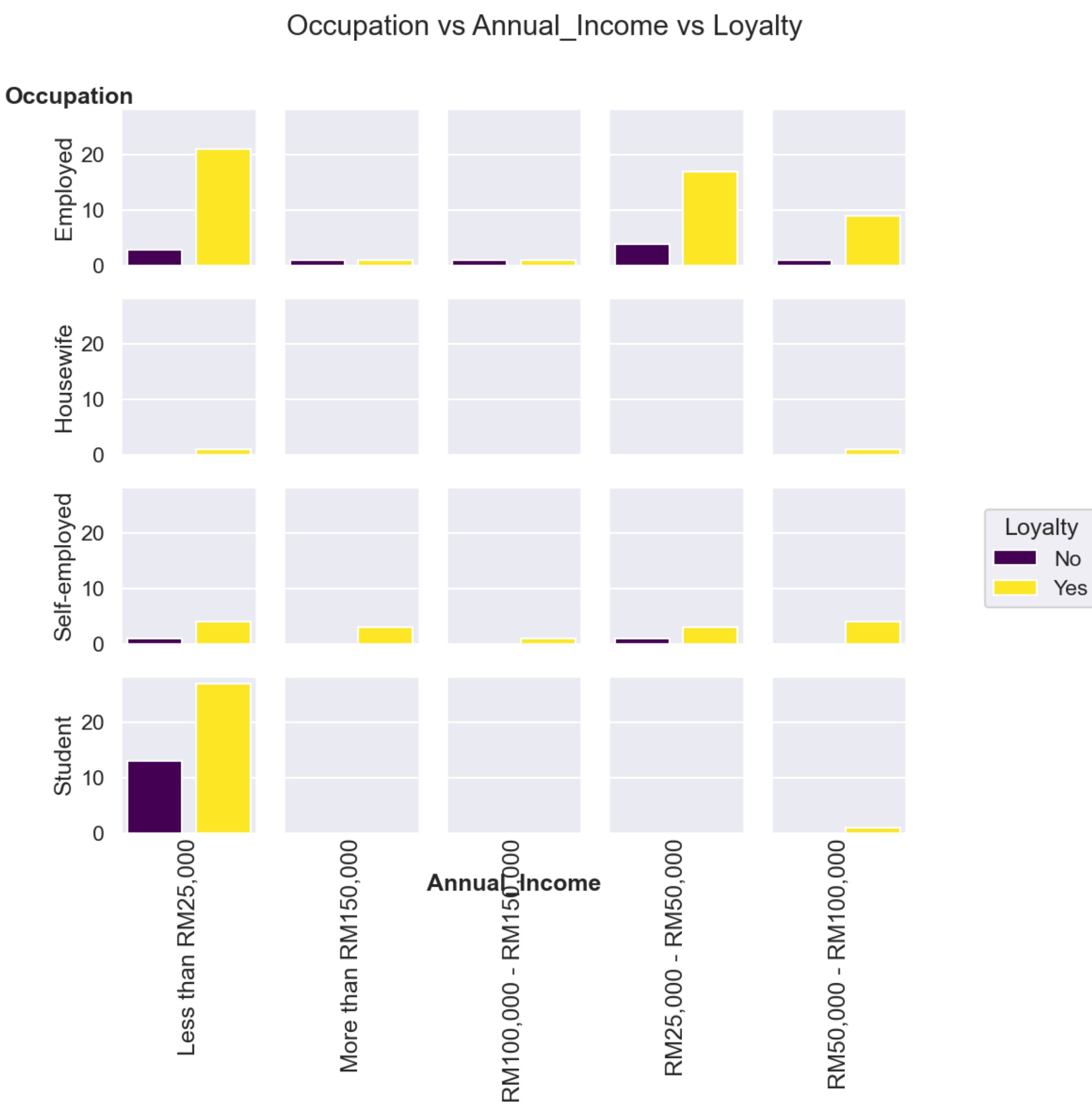
- Among customers from age group 20-29 Employed are the majority group next comes Student and then Self-Employeed
- Even the Self-Employeed are less in count they have high loyality percentage then comes Employees. Students have high negitive responses
- Customers below age group 20 have significantly high positive response
- Customers from aage group 30-39 have good positive response

Occupation_vs_AnnualIncome_vs_Loyalty

[89]:
```
plot_fun(df,'Occupation', 'Annual_Income','Loyalty')
```

```
Employed Less than RM25,000
Employed More than RM150,000
Employed RM100,000 - RM150,000
Employed RM25,000 - RM50,000
Employed RM50,000 - RM100,000
```

```
Housewife Less than RM25,000
Housewife RM50,000 - RM100,000
Self-employed Less than RM25,000
Self-employed More than RM150,000
Self-employed RM100,000 - RM150,000
Self-employed RM25,000 - RM50,000
Self-employed RM50,000 - RM100,000
Student Less than RM25,000
Student RM50,000 - RM100,000
                                    dummy
Loyalty                                No   Yes
Occupation    Annual_Income
Employed      Less than RM25,000      3.0  21.0
              More than RM150,000     1.0   1.0
              RM100,000 - RM150,000   1.0   1.0
              RM25,000 - RM50,000     4.0  17.0
              RM50,000 - RM100,000    1.0   9.0
Housewife     Less than RM25,000      NaN   1.0
              RM50,000 - RM100,000    NaN   1.0
Self-employed Less than RM25,000      1.0   4.0
              More than RM150,000     NaN   3.0
              RM100,000 - RM150,000   NaN   1.0
              RM25,000 - RM50,000     1.0   3.0
              RM50,000 - RM100,000    NaN   4.0
Student       Less than RM25,000     13.0  27.0
              RM50,000 - RM100,000    NaN   1.0
```



- Customers from Employeed category having income less than RM50000 have high postitve response
- Students have income less than RM250000 and they are high postive response as well significant negitive response

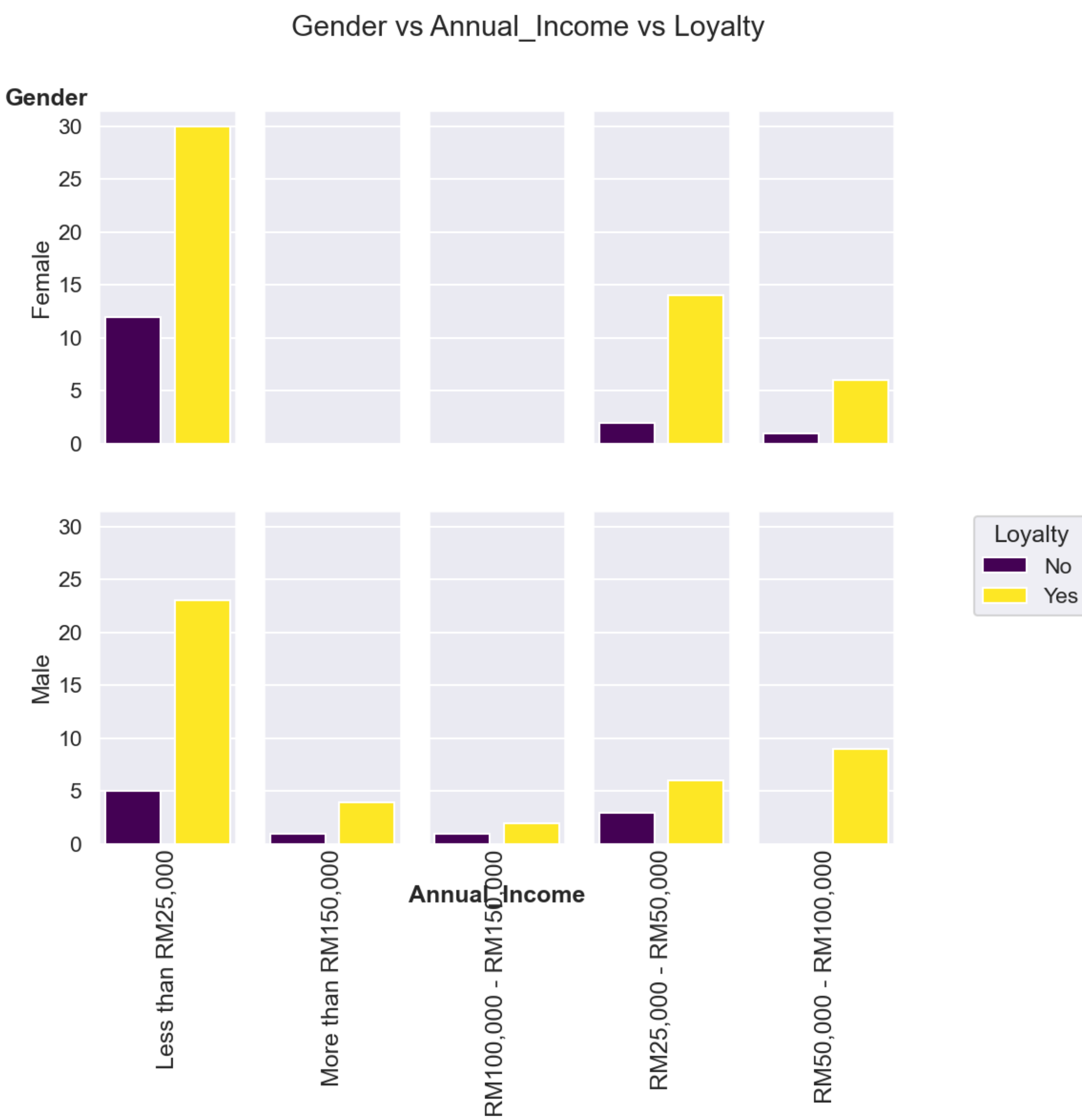
We have seens the Females and Males are comparale in count. Lets find out the if there are any interesting factors

Gender_vs_AnnualIncome_vs_Loyalty

[90]:
```
plot_fun(df,'Gender', 'Annual_Income','Loyalty')
```

```
Female Less than RM25,000
Female RM25,000 - RM50,000
Female RM50,000 - RM100,000
```

```
Male Less than RM25,000
Male More than RM150,000
Male RM100,000 - RM150,000
Male RM25,000 - RM50,000
Male RM50,000 - RM100,000
                            dummy
Loyalty                        No   Yes
Gender Annual_Income
Female Less than RM25,000     12.0  30.0
       RM25,000 - RM50,000     2.0  14.0
       RM50,000 - RM100,000    1.0   6.0
Male   Less than RM25,000      5.0  23.0
       More than RM150,000     1.0   4.0
       RM100,000 - RM150,000   1.0   2.0
       RM25,000 - RM50,000     3.0   6.0
       RM50,000 - RM100,000    NaN   9.0
```



- Female customers are more loyal than Male customers
- Above 100000 we seem to have more male customers than Females

Lets understand the difference in the Male and Female loyality based on their age, Occupation, Annual_Income details

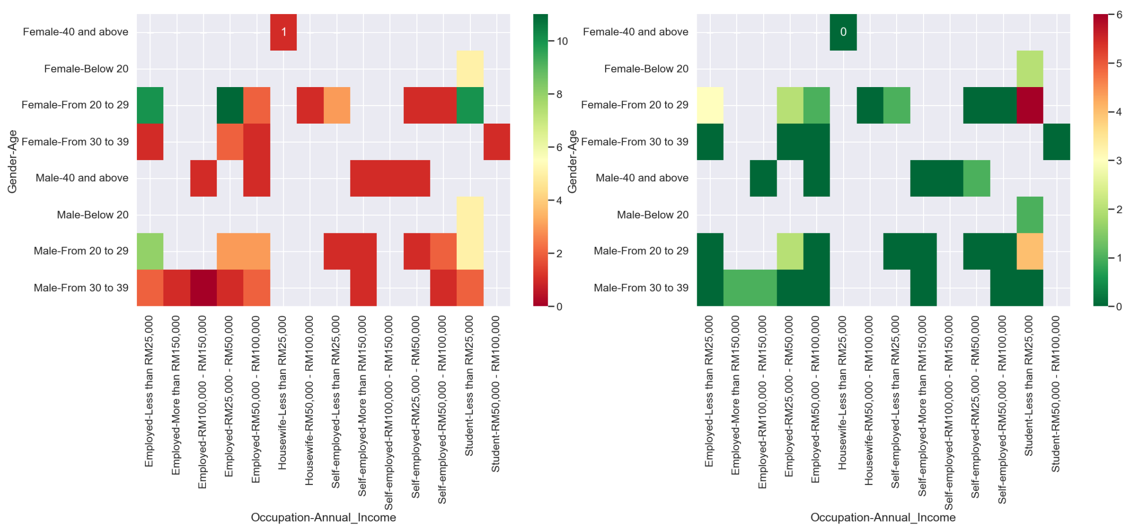
Lets convert the Loyalty column values yes to 1 and No to 0 Also create Loyalty_invert column with values yes as 0 and No as 1

[91]:
```
df.Loyalty = df.Loyalty.apply(lambda x: 1 if x=='Yes' else 0)
df['Loyalty_invert'] = df.Loyalty.apply(lambda x: 1 if x==0 else 0)
df.Loyalty_invert.value_counts()
```

[91]:
```
Loyalty_invert
0    94
1    25
Name: count, dtype: int64
```

Gender_vs_Age_vs_Occupation_vs_Annual_Income_vs_Loyalty

[92]:
```python
pivot_df = pd.pivot_table(data=df, index=['Gender','Age'],␣
↪columns=['Occupation','Annual_Income'], values='Loyalty', aggfunc='sum')

plt.figure(figsize=(28,8))
plt.subplot(1,2,1)
sns.heatmap(data=pivot_df, cmap='RdYlGn', annot=True)
pivot_df = pd.pivot_table(data=df, index=['Gender','Age'],␣
↪columns=['Occupation','Annual_Income'], values='Loyalty_invert',␣
↪aggfunc='sum')
plt.subplot(1,2,2)
sns.heatmap(data=pivot_df, cmap='RdYlGn_r', annot=True)
plt.show()
```



- Female in 20-29 age have 10 positive responses and 3 negitive responses. They are employees with income less than RM25000
- Female in 20-29 age have 11 positive responses and 2 negitive responses. They are employees with income greater than RM25000 and less then RM50000
- Employed Males of age 20 to 29 and income less than RM25000 have no negitive response. Whereas Males of same categories except income ranging between RM25000 to RM 50000 almost equal positive and negitive responses(3+vs, 2-vs)
- Males from 30 to 39 age from students lessthanRM25000 have almost equal positive and negitive responses(5+vs, 4-vs)
- Females from 20-29 who are students and income less than RM25000 have high positive and

negitive responses
- we can see only one 0 in the left heat map and corresponding value in the right heap map has either zero or less number. This says that all the different categories are having high loyal customers

lets check the different factors for the category female student, age 20-29 with income less than RM25000

[93]:
```
df3 = df.loc[(df.Gender== 'Female')&(df.Occupation == 'Student') & (df.Age ==␣
↪'From 20 to 29')&(df.Annual_Income=='Less than RM25,000'),:]
df3
```

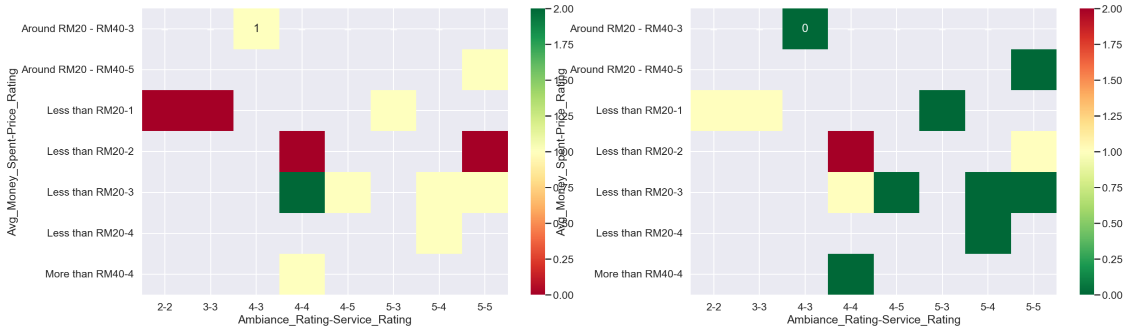
[93]:
```
                   Timestamp  Gender           Age Occupation  \
0   2019/10/01 12:38:43 PM GMT+8  Female  From 20 to 29    Student
1   2019/10/01 12:38:54 PM GMT+8  Female  From 20 to 29    Student
3   2019/10/01 12:39:08 PM GMT+8  Female  From 20 to 29    Student
5   2019/10/01 12:39:39 PM GMT+8  Female  From 20 to 29    Student
6   2019/10/01 12:39:42 PM GMT+8  Female  From 20 to 29    Student
8   2019/10/01 12:42:27 PM GMT+8  Female  From 20 to 29    Student
10  2019/10/01 12:47:00 PM GMT+8  Female  From 20 to 29    Student
11  2019/10/01 12:48:26 PM GMT+8  Female  From 20 to 29    Student
12  2019/10/01 12:49:25 PM GMT+8  Female  From 20 to 29    Student
13  2019/10/01 12:53:09 PM GMT+8  Female  From 20 to 29    Student
14  2019/10/01 12:53:16 PM GMT+8  Female  From 20 to 29    Student
23   2019/10/01 1:24:04 PM GMT+8  Female  From 20 to 29    Student
35   2019/10/01 1:51:56 PM GMT+8  Female  From 20 to 29    Student
59   2019/10/01 6:19:46 PM GMT+8  Female  From 20 to 29    Student
65   2019/10/02 7:15:27 PM GMT+8  Female  From 20 to 29    Student
78   2019/10/03 7:19:36 AM GMT+8  Female  From 20 to 29    Student

         Annual_Income Visit_Frequency Service_preferred  \
0   Less than RM25,000          Rarely           Dine in
1   Less than RM25,000          Rarely         Take away
3   Less than RM25,000          Rarely         Take away
5   Less than RM25,000          Rarely           Dine in
6   Less than RM25,000          Rarely           Dine in
8   Less than RM25,000          Rarely        Drive-thru
10  Less than RM25,000          Rarely           Dine in
11  Less than RM25,000          Rarely           Dine in
12  Less than RM25,000          Weekly         Take away
13  Less than RM25,000          Rarely         Take away
14  Less than RM25,000          Rarely         Take away
23  Less than RM25,000         Monthly        Drive-thru
35  Less than RM25,000          Rarely         Take away
59  Less than RM25,000          Rarely        Drive-thru
65  Less than RM25,000          Rarely           Dine in
78  Less than RM25,000          Rarely         Take away
```

```
              Time_Spent_Frequency Nearest_Store_Distance Membership  …  \
0   Between 30 minutes to 1 hour             within 1km        Yes  …   
1              Below 30 minutes              1km - 3km        Yes  …   
3              Below 30 minutes         more than 3km         No  …   
5   Between 30 minutes to 1 hour         more than 3km         No  …   
6              Below 30 minutes             within 1km        Yes  …   
8              Below 30 minutes         more than 3km        Yes  …   
10             Below 30 minutes         more than 3km         No  …   
11  Between 30 minutes to 1 hour         more than 3km         No  …   
12             Below 30 minutes              1km - 3km        Yes  …   
13             Below 30 minutes              1km - 3km        Yes  …   
14             Below 30 minutes             within 1km        Yes  …   
23     Between 1 hour to 2 hours              1km - 3km        Yes  …   
35             Below 30 minutes         more than 3km         No  …   
59             Below 30 minutes         more than 3km         No  …   
65  Between 30 minutes to 1 hour              1km - 3km         No  …   
78             Below 30 minutes         more than 3km         No  …   

   Quality_Rating_vs_Other_Brands Price_Rating Sales_Promotion_Importance  \
0                               4            3                          5   
1                               4            3                          4   
3                               2            1                          4   
5                               4            3                          5   
6                               5            5                          5   
8                               5            4                          4   
10                              4            1                          4   
11                              3            2                          4   
12                              4            3                          2   
13                              4            3                          4   
14                              5            2                          5   
23                              5            4                          4   
35                              4            2                          4   
59                              4            3                          4   
65                              4            3                          2   
78                              2            1                          5   

   Ambiance_Rating WiFi_Rating Service_Rating Meetings_hangouts_preference  \
0                5           4              4                            3   
1                4           4              5                            2   
3                3           3              3                            3   
5                5           4              5                            4   
6                5           3              5                            5   
8                4           4              4                            4   
10               5           3              3                            4   
11               4           3              4                            4   
12               4           4              3                            4   
13               4           4              4                            3   
```

```
14                 5            5              5                            2
23                 5            4              4                            3
35                 4            3              4                            1
59                 4            3              4                            3
65                 4            3              4                            4
78                 2            2              2                            2

                                   Promotion_Source Loyalty Loyalty_invert
0   Starbucks Website/Apps;Social Media;Emails;Dea…       1              0
1                    Social Media;In Store displays       1              0
3                 Through friends and word of mouth       0              1
5                                      Social Media       1              0
6               Starbucks Website/Apps;Social Media       1              0
8   Starbucks Website/Apps;Social Media;Through fr…       1              0
10                                     Social Media       1              0
11  Starbucks Website/Apps;Social Media;Through fr…       0              1
12                                     Social Media       1              0
13                                     Social Media       1              0
14  Social Media;Through friends and word of mouth…       0              1
23     Social Media;Through friends and word of mouth       1              0
35                                     Social Media       0              1
59              Starbucks Website/Apps;Social Media       1              0
65                Through friends and word of mouth       0              1
78     Social Media;Through friends and word of mouth       0              1

[16 rows x 22 columns]
```

AvgMoneySpent_vs_PriceRating_vs_AmbianceRating_vs_ServiceRating_vs_Loyalty of the above category

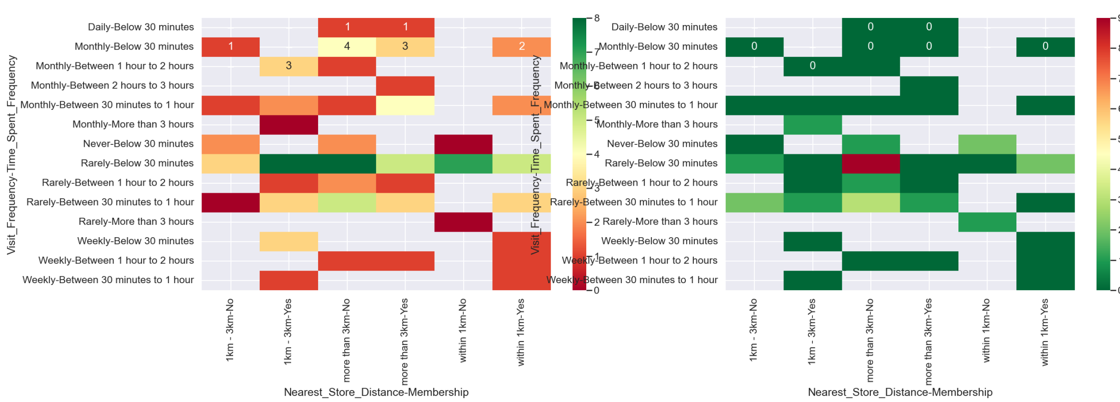
[94]:
```python
pivot_df = pd.pivot_table(data=df3, index=['Avg_Money_Spent','Price_Rating'],
 ↪columns=['Ambiance_Rating','Service_Rating'], values='Loyalty',
 ↪aggfunc='sum')

plt.figure(figsize=(28,8))
plt.subplot(1,2,1)
sns.heatmap(data=pivot_df, cmap='RdYlGn', annot=True)
pivot_df = pd.pivot_table(data=df3, index=['Avg_Money_Spent','Price_Rating'],
 ↪columns=['Ambiance_Rating','Service_Rating'], values='Loyalty_invert',
 ↪aggfunc='sum')
plt.subplot(1,2,2)
sns.heatmap(data=pivot_df, cmap='RdYlGn_r', annot=True)
plt.show()
```



- customer with ambiance and service rating between 3 -5 are more loyal
- cusstomers with less price rating are less loyal

VisitFrequency_vs_TimeSpentFrequency_vs_NearestStoreDistance_vs_Membership_vs_Loyalty

[95]:
```
pivot_df = pd.pivot_table(data=df,␣
↪index=['Visit_Frequency','Time_Spent_Frequency'],␣
↪columns=['Nearest_Store_Distance','Membership'], values='Loyalty',␣
↪aggfunc='sum')

plt.figure(figsize=(28,8))
plt.subplot(1,2,1)
sns.heatmap(data=pivot_df, cmap='RdYlGn', annot=True)
pivot_df = pd.pivot_table(data=df,␣
↪index=['Visit_Frequency','Time_Spent_Frequency'],␣
↪columns=['Nearest_Store_Distance','Membership'], values='Loyalty_invert',␣
↪aggfunc='sum')
plt.subplot(1,2,2)
sns.heatmap(data=pivot_df, cmap='RdYlGn_r', annot=True)
plt.show()
```



- It is evident that customers having membership are more loyal compared to customers without membership

- Customers visiting rarely, time_spent_frequency below 30min, nearesr store more than 3km and doesn't have membership, they have almost equal postive and negitive responses. whereas nearest store 1km-3km and have membership, they are positively responding
- Weekly visiting customers are very low but stores within 1km they are postively responding
- The green color in the 2nd graph says we don't have much negitive responses. Whereas the red color in the 1st graph says we don't have more postive responses as well. Only few group of customers are exibiting high postitive responses which is evident
- Both customers with visiting daily spending 30 mins and monthly visiting customers are all loyal except one with time spending more than 3 hours.

Lets analyse the data for the category with most non-loyal customers (9) in the above graph

[96]:
```
df2 = df.loc[(df.Visit_Frequency== 'Rarely')&(df.Time_Spent_Frequency == 'Below␣
↪30 minutes') & (df.Nearest_Store_Distance == 'more than 3km')&(df.
↪Membership=='No'),:]
```

[97]:
```
pd.set_option('display.max_columns', 50)
df2
```

[97]:
```
                       Timestamp  Gender          Age     Occupation  \
3    2019/10/01 12:39:08 PM GMT+8  Female  From 20 to 29        Student
10   2019/10/01 12:47:00 PM GMT+8  Female  From 20 to 29        Student
32    2019/10/01 1:45:12 PM GMT+8  Female  From 30 to 39       Employed
35    2019/10/01 1:51:56 PM GMT+8  Female  From 20 to 29        Student
51    2019/10/01 3:16:32 PM GMT+8  Female       Below 20        Student
53    2019/10/01 3:21:16 PM GMT+8  Female       Below 20        Student
59    2019/10/01 6:19:46 PM GMT+8  Female  From 20 to 29        Student
64    2019/10/02 7:15:13 PM GMT+8  Female  From 20 to 29       Employed
68    2019/10/02 7:29:53 PM GMT+8  Female  From 20 to 29       Employed
74    2019/10/02 8:31:21 PM GMT+8  Female  From 20 to 29      Housewife
78    2019/10/03 7:19:36 AM GMT+8  Female  From 20 to 29        Student
79    2019/10/03 7:21:08 AM GMT+8  Female       Below 20        Student
96    2019/10/03 3:44:13 PM GMT+8  Female  From 20 to 29  Self-employed
106   2019/10/03 6:46:53 PM GMT+8    Male  From 20 to 29        Student
109   2019/10/03 7:40:31 PM GMT+8    Male  From 20 to 29        Student
110   2019/10/03 7:43:00 PM GMT+8    Male  From 20 to 29        Student
113   2019/10/03 8:58:26 PM GMT+8  Female       Below 20        Student

           Annual_Income Visit_Frequency Service_preferred  \
3      Less than RM25,000          Rarely         Take away
10     Less than RM25,000          Rarely           Dine in
32    RM25,000 - RM50,000          Rarely         Take away
35     Less than RM25,000          Rarely         Take away
51     Less than RM25,000          Rarely           Dine in
53     Less than RM25,000          Rarely        Drive-thru
59     Less than RM25,000          Rarely        Drive-thru
64     Less than RM25,000          Rarely         Take away
```

```
68     Less than RM25,000          Rarely          Dine in
74   RM50,000 - RM100,000          Rarely       Drive-thru
78     Less than RM25,000          Rarely        Take away
79     Less than RM25,000          Rarely        Take away
96     Less than RM25,000          Rarely        Take away
106    Less than RM25,000          Rarely        Take away
109    Less than RM25,000          Rarely          Dine in
110    Less than RM25,000          Rarely        Take away
113    Less than RM25,000          Rarely        Take away

    Time_Spent_Frequency Nearest_Store_Distance Membership  \
3       Below 30 minutes          more than 3km         No
10      Below 30 minutes          more than 3km         No
32      Below 30 minutes          more than 3km         No
35      Below 30 minutes          more than 3km         No
51      Below 30 minutes          more than 3km         No
53      Below 30 minutes          more than 3km         No
59      Below 30 minutes          more than 3km         No
64      Below 30 minutes          more than 3km         No
68      Below 30 minutes          more than 3km         No
74      Below 30 minutes          more than 3km         No
78      Below 30 minutes          more than 3km         No
79      Below 30 minutes          more than 3km         No
96      Below 30 minutes          more than 3km         No
106     Below 30 minutes          more than 3km         No
109     Below 30 minutes          more than 3km         No
110     Below 30 minutes          more than 3km         No
113     Below 30 minutes          more than 3km         No

       Frequent_Product     Avg_Money_Spent Quality_Rating_vs_Other_Brands  \
3                Coffee      Less than RM20                              2
10          Cold drinks      Less than RM20                              4
32               Coffee  Around RM20 - RM40                              2
35               Coffee      Less than RM20                              4
51          Cold drinks      Less than RM20                              3
53               Coffee  Around RM20 - RM40                              3
59          Cold drinks      Less than RM20                              4
64               Coffee                Zero                              3
68               Coffee                Zero                              2
74   Coffee;Cold drinks  Around RM20 - RM40                              3
78               Coffee      Less than RM20                              2
79          Cold drinks      Less than RM20                              2
96          Cold drinks      Less than RM20                              3
106              Coffee  Around RM20 - RM40                              3
109     Coffee;Pastries      Less than RM20                              3
110         Cold drinks                Zero                              4
113         Cold drinks      Less than RM20                              3
```

```
     Price_Rating Sales_Promotion_Importance Ambiance_Rating WiFi_Rating  \
3               1                          4               3           3
10              1                          4               5           3
32              3                          5               5           3
35              2                          4               4           3
51              3                          2               2           2
53              3                          2               3           3
59              3                          4               4           3
64              1                          5               3           4
68              1                          5               4           4
74              2                          3               3           3
78              1                          5               2           2
79              2                          3               2           2
96              3                          1               4           3
106             3                          3               3           3
109             3                          3               3           3
110             2                          3               5           4
113             4                          5               5           5

     Service_Rating Meetings_hangouts_preference  \
3                 3                            3
10                3                            4
32                5                            5
35                4                            1
51                4                            3
53                3                            3
59                4                            3
64                4                            5
68                4                            1
74                5                            4
78                2                            2
79                2                            2
96                4                            4
106               3                            3
109               3                            2
110               4                            2
113               4                            4

                                  Promotion_Source  Loyalty  \
3                 Through friends and word of mouth        0
10                                     Social Media        1
32                                     Social Media        1
35                                     Social Media        0
51    Social Media;Through friends and word of mouth        0
53                                     Social Media        1
59                Starbucks Website/Apps;Social Media        1
```

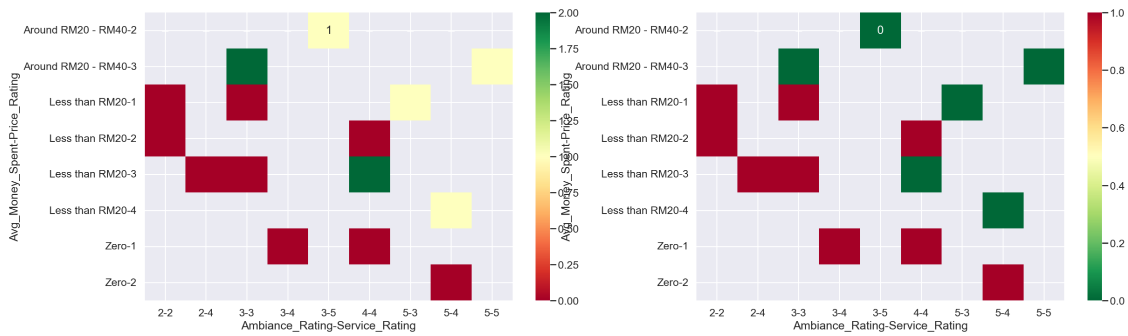
```
64                                               Social Media        0
68   Starbucks Website/Apps;Social Media;Through fr…        0
74                                               Social Media        1
78      Social Media;Through friends and word of mouth        0
79      Social Media;Deal sites (fave, iprice, etc…)        0
96      Social Media;Through friends and word of mouth        1
106                  Starbucks Website/Apps;Social Media        1
109                                              Social Media        0
110                                              Social Media        0
113                                              Social Media        1

     Loyalty_invert
3                 1
10                0
32                0
35                1
51                1
53                0
59                0
64                1
68                1
74                0
78                1
79                1
96                0
106               0
109               1
110               1
113               0
```

- majorty of the customers are Female
- the customers visit frequency is Rare
- Time spent frequency below 30mins
- Nearest store more tha 3km
- The customers don't have membership

AvgMoneySpent_vs_PriceRating_vs_AmbianceRating_vs_ServiceRating_vs_Loyalty for above category

[98]:
```
pivot_df = pd.pivot_table(data=df2, index=['Avg_Money_Spent','Price_Rating'],␣
↪columns=['Ambiance_Rating','Service_Rating'], values='Loyalty',␣
↪aggfunc='sum')

plt.figure(figsize=(28,8))
plt.subplot(1,2,1)
sns.heatmap(data=pivot_df, cmap='RdYlGn', annot=True)
```

```python
pivot_df = pd.pivot_table(data=df2, index=['Avg_Money_Spent','Price_Rating'],␣
↪columns=['Ambiance_Rating','Service_Rating'], values='Loyalty_invert',␣
↪aggfunc='sum')
plt.subplot(1,2,2)
sns.heatmap(data=pivot_df, cmap='RdYlGn_r', annot=True)
plt.show()
```



- Customers with Price_rating 1 or 2 are mot loyal even the ambiance and Serivce rating is >=3
- customer with Price_rating > 3 are more loyal and the ambiance and Service rating with high rating has positive impact

Lets understand these features impact on complete data

[99]:
```python
df3 = df.loc[(df.Visit_Frequency== 'Daily')|(df.Visit_Frequency== 'Monthly'),:]
df3
```

[99]:

	Timestamp	Gender	Age	Occupation \
2	2019/10/01 12:38:56 PM GMT+8	Male	From 20 to 29	Employed
4	2019/10/01 12:39:20 PM GMT+8	Male	From 20 to 29	Student
9	2019/10/01 12:43:36 PM GMT+8	Male	From 20 to 29	Employed
16	2019/10/01 12:59:11 PM GMT+8	Male	From 30 to 39	Employed
23	2019/10/01 1:24:04 PM GMT+8	Female	From 20 to 29	Student
25	2019/10/01 1:25:56 PM GMT+8	Male	From 30 to 39	Employed
27	2019/10/01 1:33:54 PM GMT+8	Male	From 20 to 29	Self-employed
30	2019/10/01 1:39:16 PM GMT+8	Female	From 20 to 29	Employed
41	2019/10/01 2:06:24 PM GMT+8	Male	From 20 to 29	Employed
43	2019/10/01 2:35:40 PM GMT+8	Female	From 20 to 29	Employed
52	2019/10/01 3:20:55 PM GMT+8	Female	40 and above	Housewife
55	2019/10/01 4:02:35 PM GMT+8	Female	From 20 to 29	Employed
57	2019/10/01 4:03:57 PM GMT+8	Male	Below 20	Student
58	2019/10/01 4:05:59 PM GMT+8	Male	Below 20	Student
66	2019/10/02 7:23:55 PM GMT+8	Female	From 20 to 29	Self-employed
72	2019/10/02 8:08:37 PM GMT+8	Female	From 20 to 29	Employed
77	2019/10/02 9:19:50 PM GMT+8	Male	From 20 to 29	Employed

```
80    2019/10/03 8:46:25 AM GMT+8  Female  From 20 to 29       Employed
85   2019/10/03 11:17:27 AM GMT+8    Male  From 30 to 39  Self-employed
91   2019/10/03 12:13:56 PM GMT+8  Female  From 30 to 39       Employed
94    2019/10/03 2:34:09 PM GMT+8    Male  From 20 to 29       Employed
102   2019/10/03 6:35:21 PM GMT+8    Male  From 20 to 29  Self-employed
105   2019/10/03 6:45:28 PM GMT+8    Male   40 and above       Employed
111   2019/10/03 7:47:00 PM GMT+8  Female  From 20 to 29       Employed
115  2019/10/03 10:38:42 PM GMT+8    Male       Below 20        Student
116  2019/10/03 11:24:55 PM GMT+8    Male  From 30 to 39        Student
117  2019/10/04 12:24:26 AM GMT+8    Male   40 and above  Self-employed
118   2019/10/04 9:30:09 AM GMT+8    Male  From 20 to 29       Employed

            Annual_Income Visit_Frequency Service_preferred  \
2      Less than RM25,000         Monthly           Dine in
4      Less than RM25,000         Monthly         Take away
9      Less than RM25,000         Monthly         Take away
16   RM50,000 - RM100,000         Monthly        Drive-thru
23     Less than RM25,000         Monthly        Drive-thru
25    More than RM150,000         Monthly           Dine in
27     Less than RM25,000         Monthly         Take away
30    RM25,000 - RM50,000         Monthly         Take away
41     Less than RM25,000         Monthly           Dine in
43     Less than RM25,000         Monthly         Take away
52     Less than RM25,000         Monthly         Take away
55    RM25,000 - RM50,000         Monthly         Take away
57     Less than RM25,000         Monthly           Dine in
58     Less than RM25,000         Monthly           Dine in
66    RM25,000 - RM50,000         Monthly           Dine in
72     Less than RM25,000         Monthly         Take away
77   RM50,000 - RM100,000         Monthly           Dine in
80   RM50,000 - RM100,000         Monthly        Drive-thru
85    More than RM150,000         Monthly           Dine in
91    RM25,000 - RM50,000         Monthly         Take away
94   RM50,000 - RM100,000         Monthly         Take away
102  RM50,000 - RM100,000           Daily        Drive-thru
105  RM50,000 - RM100,000         Monthly        Drive-thru
111    Less than RM25,000         Monthly         Take away
115    Less than RM25,000           Daily         Take away
116    Less than RM25,000         Monthly           Dine in
117   RM25,000 - RM50,000         Monthly           Dine in
118    Less than RM25,000         Monthly           Dine in

             Time_Spent_Frequency Nearest_Store_Distance Membership  \
2    Between 30 minutes to 1 hour         more than 3km        Yes
4    Between 30 minutes to 1 hour             1km - 3km         No
9               Below 30 minutes          more than 3km         No
16              Below 30 minutes             within 1km        Yes
```

23	Between 1 hour to 2 hours	1km - 3km	Yes
25	Between 30 minutes to 1 hour	1km - 3km	Yes
27	Below 30 minutes	more than 3km	No
30	Between 30 minutes to 1 hour	more than 3km	Yes
41	Between 30 minutes to 1 hour	within 1km	Yes
43	Below 30 minutes	more than 3km	No
52	Below 30 minutes	more than 3km	Yes
55	Between 30 minutes to 1 hour	1km - 3km	Yes
57	Between 30 minutes to 1 hour	more than 3km	Yes
58	Below 30 minutes	1km - 3km	No
66	Below 30 minutes	within 1km	Yes
72	Below 30 minutes	more than 3km	Yes
77	Between 30 minutes to 1 hour	more than 3km	Yes
80	More than 3 hours	1km - 3km	Yes
85	Between 2 hours to 3 hours	more than 3km	Yes
91	Between 30 minutes to 1 hour	within 1km	Yes
94	Below 30 minutes	more than 3km	Yes
102	Below 30 minutes	more than 3km	Yes
105	Between 30 minutes to 1 hour	more than 3km	No
111	Below 30 minutes	more than 3km	No
115	Below 30 minutes	more than 3km	No
116	Between 1 hour to 2 hours	more than 3km	No
117	Between 1 hour to 2 hours	1km - 3km	Yes
118	Between 1 hour to 2 hours	1km - 3km	Yes

	Frequent_Product	Avg_Money_Spent \
2	Coffee	Less than RM20
4	Coffee;Sandwiches	Around RM20 - RM40
9	Coffee	Around RM20 - RM40
16	Coffee	Around RM20 - RM40
23	Cold drinks;Pastries;Sandwiches	Less than RM20
25	Coffee;Cold drinks	Around RM20 - RM40
27	Coffee	Around RM20 - RM40
30	Coffee;Pastries;Sandwiches	Around RM20 - RM40
41	Coffee	Around RM20 - RM40
43	Coffee;Pastries	Around RM20 - RM40
52	Cold drinks;Juices;Pastries	More than RM40
55	Coffee	Less than RM20
57	Coffee	Less than RM20
58	Coffee	Less than RM20
66	Coffee;Cold drinks;Pastries;Sandwiches	Around RM20 - RM40
72	Coffee	Less than RM20
77	Coffee	Around RM20 - RM40
80	Coffee	Around RM20 - RM40
85	Jaws chip	Around RM20 - RM40
91	Coffee;Pastries	Around RM20 - RM40
94	Coffee	Around RM20 - RM40

102	Coffee	Around RM20 - RM40
105	Cold drinks	Around RM20 - RM40
111	Cold drinks	Less than RM20
115	Cold drinks	Around RM20 - RM40
116	Cold drinks	Less than RM20
117	Coffee	Around RM20 - RM40
118	Coffee;Cold drinks;Juices;Pastries;Sandwiches	More than RM40

	Quality_Rating_vs_Other_Brands	Price_Rating	Sales_Promotion_Importance \
2	4	3	4
4	3	3	4
9	4	3	3
16	4	3	3
23	5	4	4
25	4	3	1
27	5	3	4
30	3	1	4
41	5	4	5
43	4	4	5
52	5	4	3
55	4	3	4
57	5	5	5
58	3	3	3
66	4	3	4
72	4	2	4
77	4	2	1
80	3	2	4
85	4	3	4
91	4	3	4
94	3	1	3
102	4	2	4
105	4	3	5
111	5	4	4
115	5	5	5
116	4	4	5
117	3	3	5
118	5	5	5

	Ambiance_Rating	WiFi_Rating	Service_Rating	Meetings_hangouts_preference \
2	4	4	4	3
4	2	2	3	3
9	4	3	3	4
16	4	3	3	3
23	5	4	4	3
25	4	4	5	4
27	4	3	4	3
30	4	3	4	4

41	5	3	5	5
43	4	4	5	5
52	5	3	5	5
55	3	2	3	4
57	5	5	5	5
58	3	4	3	3
66	5	4	4	4
72	4	3	4	3
77	4	1	4	4
80	3	1	3	3
85	4	3	4	4
91	5	5	4	5
94	3	1	3	2
102	4	3	3	3
105	4	4	4	4
111	4	4	4	4
115	5	5	5	5
116	4	2	3	4
117	3	2	4	4
118	5	5	5	5

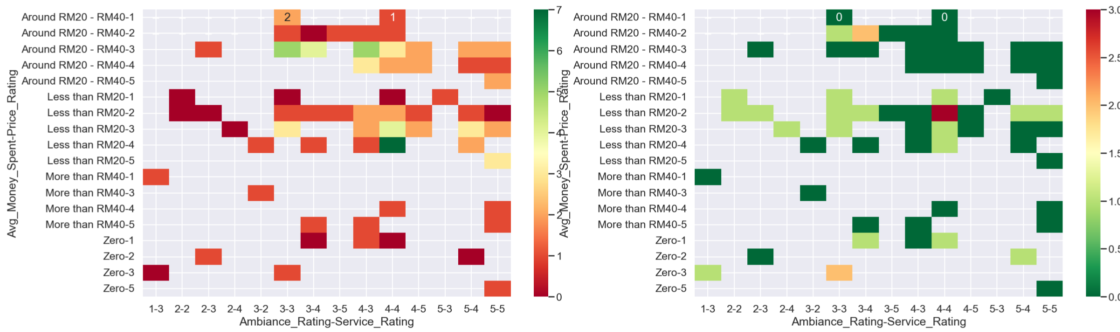
	Promotion_Source	Loyalty \
2	In Store displays;Billboards	1
4	Starbucks Website/Apps;Social Media	1
9	Social Media;Through friends and word of mouth	1
16	Social Media	1
23	Social Media;Through friends and word of mouth	1
25	Social Media;In Store displays;Billboards	1
27	Social Media	1
30	Starbucks Website/Apps;Social Media;Emails;Thr…	1
41	Starbucks Website/Apps;Social Media	1
43	Starbucks Website/Apps;Social Media;Emails;Bil…	1
52	Starbucks Website/Apps;Social Media;Deal sites…	1
55	Starbucks Website/Apps	1
57	Through friends and word of mouth	1
58	Social Media	1
66	Starbucks Website/Apps;Social Media;Emails;Thr…	1
72	Through friends and word of mouth	1
77	Social Media	1
80	Starbucks Website/Apps	0
85	Starbucks Website/Apps;Emails	1
91	Starbucks Website/Apps;Social Media;Emails;Thr…	1
94	Social Media;Through friends and word of mouth	1
102	Social Media;Emails	1
105	Starbucks Website/Apps	1
111	Social Media;Through friends and word of mouth…	1
115	Social Media;Through friends and word of mouth	1

```
116                                        Social Media        1
117                Starbucks Website/Apps;Social Media        1
118  Starbucks Website/Apps;Social Media;Emails;Dea…        1

     Loyalty_invert
2                 0
4                 0
9                 0
16                0
23                0
25                0
27                0
30                0
41                0
43                0
52                0
55                0
57                0
58                0
66                0
72                0
77                0
80                1
85                0
91                0
94                0
102               0
105               0
111               0
115               0
116               0
117               0
118               0
```

AvgMoneySpent_vs_PriceRating_vs_AmbianceRating_vs_ServiceRating_vs_Loyalty

[100]:
```
pivot_df = pd.pivot_table(data=df, index=['Avg_Money_Spent','Price_Rating'],␣
 ↪columns=['Ambiance_Rating','Service_Rating'], values='Loyalty',␣
 ↪aggfunc='sum')

plt.figure(figsize=(28,8))
plt.subplot(1,2,1)
sns.heatmap(data=pivot_df, cmap='RdYlGn', annot=True)
pivot_df = pd.pivot_table(data=df, index=['Avg_Money_Spent','Price_Rating'],␣
 ↪columns=['Ambiance_Rating','Service_Rating'], values='Loyalty_invert',␣
 ↪aggfunc='sum')
plt.subplot(1,2,2)
```

```
sns.heatmap(data=pivot_df, cmap='RdYlGn_r', annot=True)
plt.show()
```



- Loyality increasing with the increase in Price rating, ambiance rating, service rating
- Customer giving high ambiance rating, Service rating are more loyal if the average money spent greater than RM20. Price rating doesn't have much impact on this. These are customers who are more interested in Services and ambiance

Create a temp feature to calculate the categories count for the chi-square test

[101]:
```
df['temp'] = 1
df.temp
```

[101]:
```
0      1
1      1
2      1
3      1
4      1
      ..
116    1
117    1
118    1
119    1
120    1
Name: temp, Length: 119, dtype: int64
```

[102]:
```
def chiSquareTest(df, col1, col2, col_list):
    cont_table = df.groupby([col1, col2])['temp'].count().unstack()
    cont_table.fillna(0, inplace=True)
    stat, p, dof, expected = st.chi2_contingency(cont_table)

    prob = 0.90
    critical = st.chi2.ppf(prob, dof)
    if abs(stat) >= critical:
        print('Dependent (reject H0) and the features are: '+ col1)
        print(stat, critical)
```

```
        col_list.append(col1)
```

[103]:
```
cols = df.columns
```

[104]:
```
col_list = []
for  i in cols[1:-4]:
    #print("Correlation of Col: "+i)
    chiSquareTest(df, i, 'Loyalty', col_list)
```

```
Dependent (reject H0) and the features are: Visit_Frequency
11.76312078559738 7.779440339734858
Dependent (reject H0) and the features are: Time_Spent_Frequency
8.949119650202958 7.779440339734858
Dependent (reject H0) and the features are: Membership
10.225935779540809 2.705543454095404
Dependent (reject H0) and the features are: Avg_Money_Spent
18.313651362448674 6.251388631170325
Dependent (reject H0) and the features are: Quality_Rating_vs_Other_Brands
17.992995327213645 6.251388631170325
Dependent (reject H0) and the features are: Price_Rating
24.535001253671467 7.779440339734858
Dependent (reject H0) and the features are: Ambiance_Rating
13.032220403709768 7.779440339734858
Dependent (reject H0) and the features are: Service_Rating
7.203973586636884 6.251388631170325
Dependent (reject H0) and the features are: Meetings_hangouts_preference
14.929696630357324 7.779440339734858
```

The columns with significant difference with the loyalty

[105]:
```
print(col_list)
```

```
['Visit_Frequency', 'Time_Spent_Frequency', 'Membership', 'Avg_Money_Spent',
'Quality_Rating_vs_Other_Brands', 'Price_Rating', 'Ambiance_Rating',
'Service_Rating', 'Meetings_hangouts_preference']
```

Found different categories among loyal and non-loyal customers. As the number of customers belonging to those categories are very less, need more data to understand their behaviour stability.