DATA UNDERSTANDING

```
1 import numpy as np
2 import pandas as pd
3 import seaborn as sns
4 import matplotlib.pyplot as plt
5 import warnings
6 %matplotlib inline
7 from scipy.stats import normaltest, shapiro, anderson
8
9 warnings.filterwarnings('ignore')
```

```
1 df = pd.read_csv('/content/Basket_dataset.csv')
```

```
1 df.head(10)
```

	Member_number	Date	itemDescription
0	1808	21/07/2015	tropical fruit
1	2552	05/01/2015	whole milk
2	2300	19/09/2015	pip fruit
3	1187	12/12/2015	other vegetables
4	3037	01/02/2015	whole milk
5	4941	14/02/2015	rolls/buns
6	4501	08/05/2015	other vegetables
7	3803	23/12/2015	pot plants
8	2762	20/03/2015	whole milk
9	4119	12/02/2015	tropical fruit

Distribution Analysis

```
1 df.describe()
```

	Member_number
count	38765.000000
mean	3003.641868
std	1153.611031
min	1000.000000
25%	2002.000000
50%	3005.000000
75%	4007.000000
max	5000.000000

```
1 df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 38765 entries, 0 to 38764
Data columns (total 3 columns):
 #   Column           Non-Null Count  Dtype 
---  ------           --------------  ----- 
 0   Member_number    38765 non-null  int64 
 1   Date             38765 non-null  object
 2   itemDescription  38765 non-null  object
dtypes: int64(1), object(2)
memory usage: 908.7+ KB
```

```
1 df.shape
```

```
(38765, 3)
```

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

```
Member_number      0
Date               0
```

```
itemDescription    0
dtype: int64
```

```
df.dtypes
```

```
Member_number       int64
Date               object
itemDescription    object
dtype: object
```

Date needs to be datetime

```
df['Date'] = pd.to_datetime(df['Date'])
```

```
df.dtypes
```

```
Member_number              int64
Date              datetime64[ns]
itemDescription           object
dtype: object
```

Lets work on duplicates, for this problem statement, we only consider it a duplicate if all three columns have same value

```
duplicates = df[df.duplicated(subset=['Member_number', 'Date', 'itemDescription'], keep=False)]
sorted_duplicates = duplicates.sort_values(by=list(duplicates.columns))
print(sorted_duplicates)

```

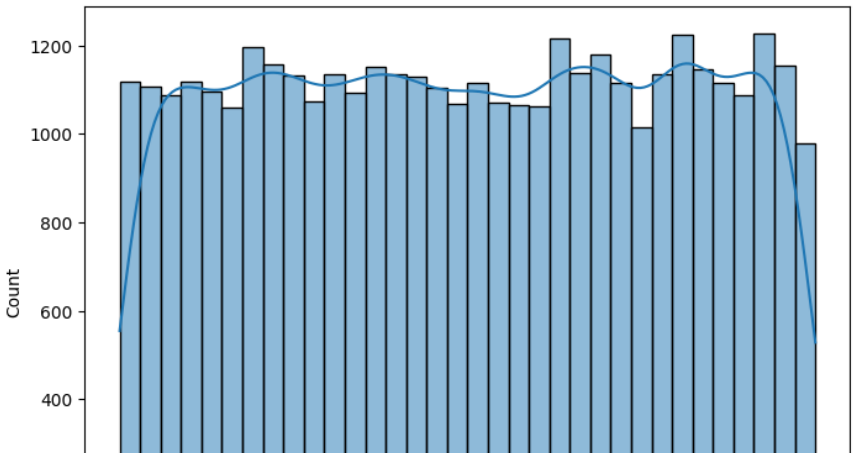
```
       Member_number       Date itemDescription
33098           1003 2014-02-27      rolls/buns
37649           1003 2014-02-27      rolls/buns
15099           1005 2014-09-01      rolls/buns
31248           1005 2014-09-01      rolls/buns
7532            1006 2015-06-14     frankfurter
...              ...        ...             ...
24043           4981 2015-10-01       margarine
8109            4988 2015-10-29      rolls/buns
24258           4988 2015-10-29      rolls/buns
33585           4992 2014-02-24       margarine
38136           4992 2014-02-24       margarine

[1491 rows x 3 columns]
```

```
df = df.drop_duplicates(subset=['Member_number', 'Date', 'itemDescription'])

```

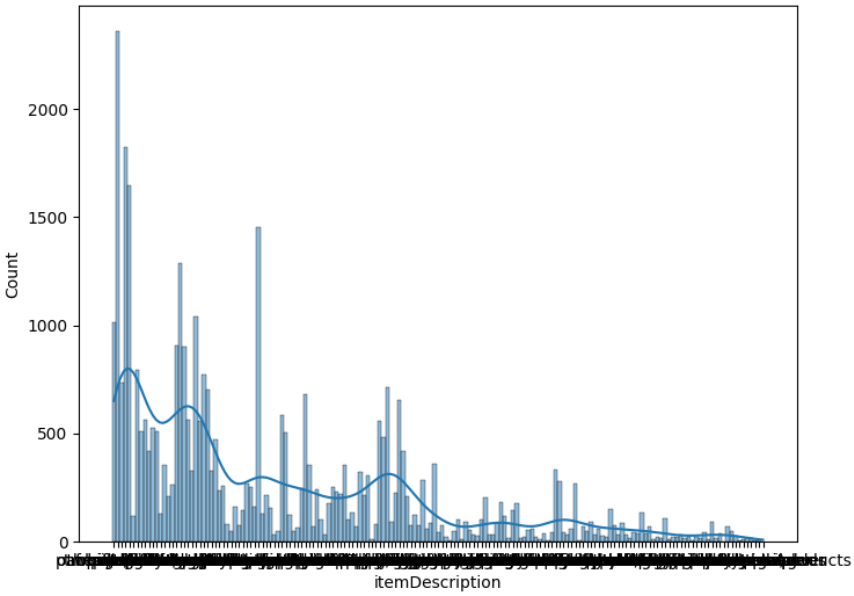
```
df.shape
```

```
(38006, 3)
```

```
import matplotlib.pyplot as plt
import seaborn as sns

plt.figure(figsize=(8, 6))
sns.histplot(df['Member_number'], kde=True)
plt.show()

print(df['Member_number'].describe())

```

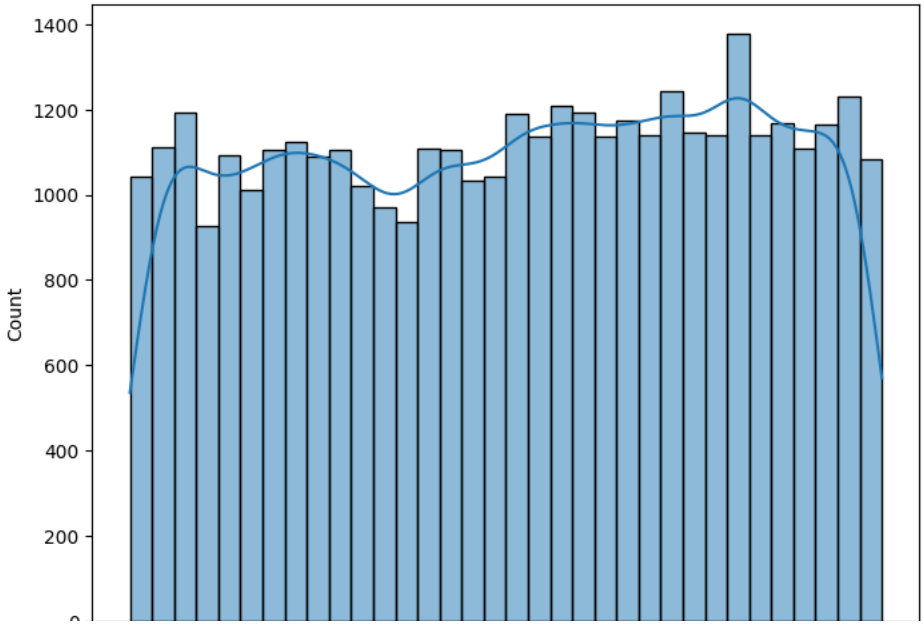



```
1 import matplotlib.pyplot as plt
2 import seaborn as sns
3
4 plt.figure(figsize=(8, 6))
5 sns.histplot(df['itemDescription'], kde=True)
6 plt.show()
7
8 print(df['itemDescription'].describe())
9
```



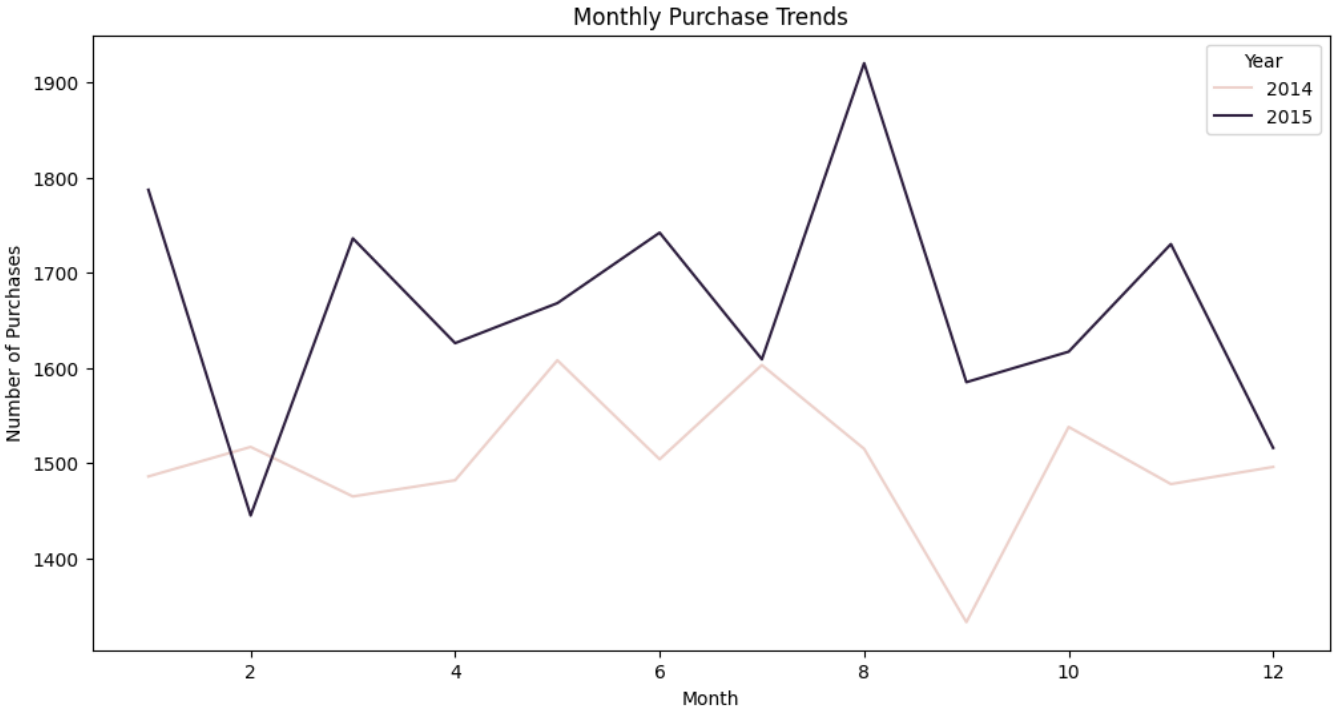

```
count          38006
unique           167
top       whole milk
freq            2363
Name: itemDescription, dtype: object
```

```
1 import matplotlib.pyplot as plt
2 import seaborn as sns
3
4 plt.figure(figsize=(8, 6))
5 sns.histplot(df['Date'], kde=True)
6 plt.show()
7
8 print(df['Date'].describe())
9
```



Distribution of Purchases over time using Line plot

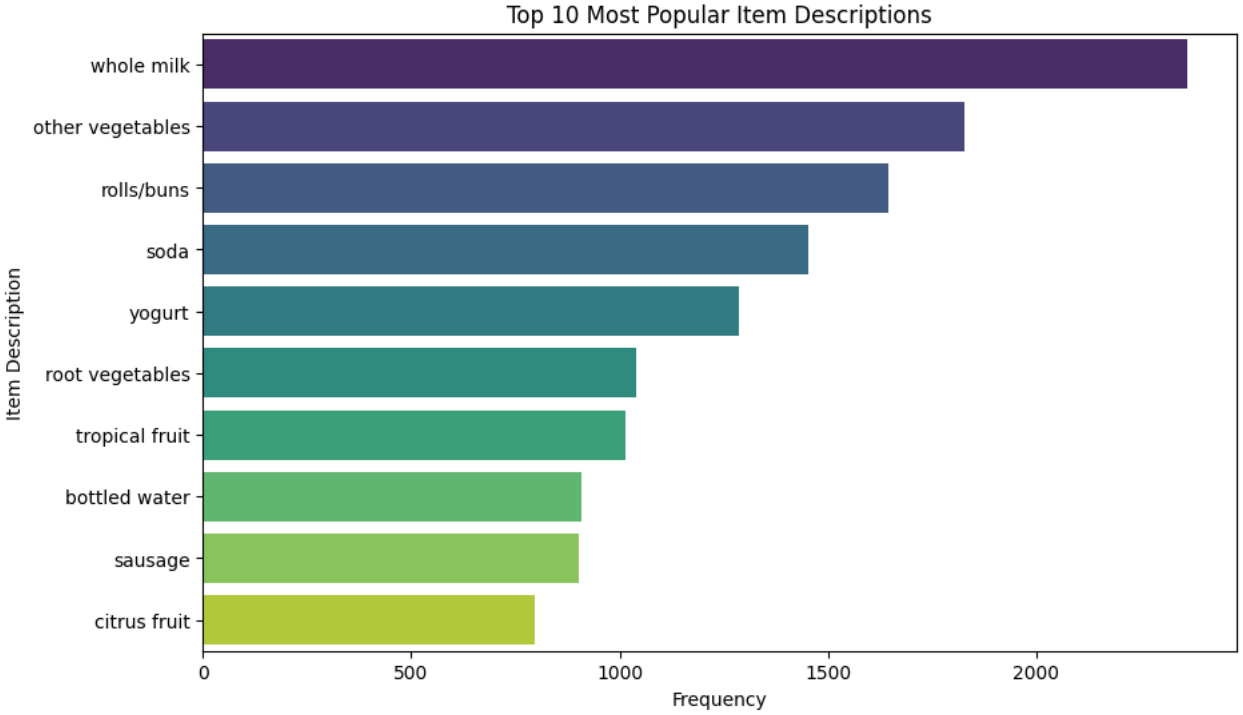
```
import matplotlib.pyplot as plt
import seaborn as sns

# Assuming 'Date' is in datetime format
df['Year'] = df['Date'].dt.year
df['Month'] = df['Date'].dt.month

monthly_purchases = df.groupby(['Year', 'Month']).size().reset_index(name='Count')
plt.figure(figsize=(12, 6))
sns.lineplot(x='Month', y='Count', hue='Year', data=monthly_purchases)
plt.title('Monthly Purchase Trends')
plt.xlabel('Month')
plt.ylabel('Number of Purchases')
plt.legend(title='Year')
plt.show()

```



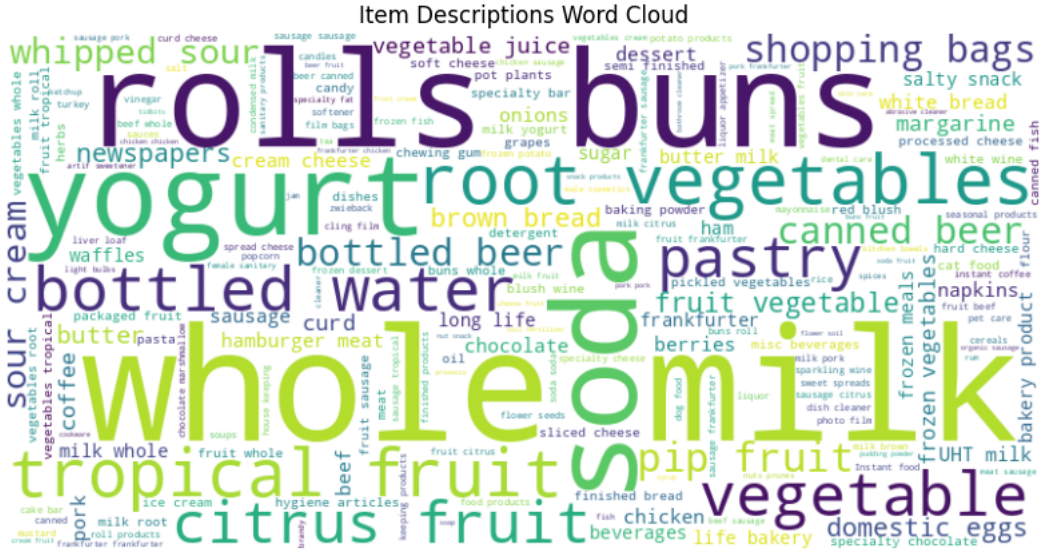
Item Frequency - Bar Plot

```
top_items = df['itemDescription'].value_counts().head(10)
plt.figure(figsize=(10, 6))
sns.barplot(x=top_items.values, y=top_items.index, palette='viridis')
```

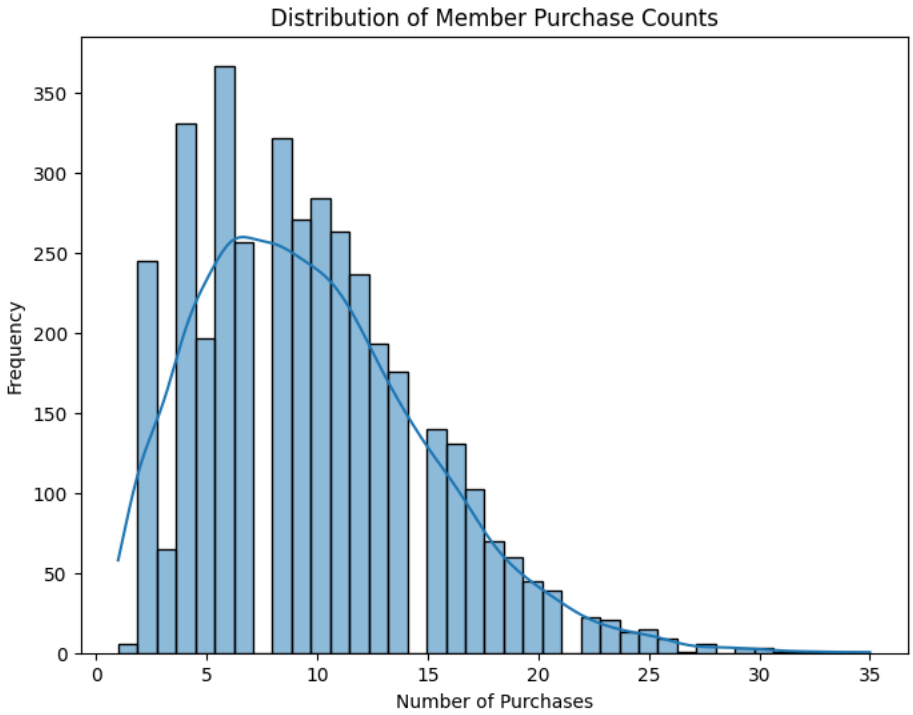
```
plt.title('Top 10 Most Popular Item Descriptions')
plt.xlabel('Frequency')
plt.ylabel('Item Description')
plt.show()

```




```
from wordcloud import WordCloud
import matplotlib.pyplot as plt

item_descriptions = ' '.join(df['itemDescription'])
wordcloud = WordCloud(width=800, height=400, background_color='white').generate(item_descriptions)

plt.figure(figsize=(10, 6))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.title('Item Descriptions Word Cloud')
plt.show()

```




```
member_purchase_counts = df['Member_number'].value_counts()
plt.figure(figsize=(8, 6))
sns.histplot(member_purchase_counts, kde=True)
plt.title('Distribution of Member Purchase Counts')
plt.xlabel('Number of Purchases')
plt.ylabel('Frequency')
plt.show()

```



RFM SEGMENTATION

```
1 max(df['Date'])
```

```
Timestamp('2015-12-30 00:00:00')
```

```
1 day = '2016-01-01'
2 day = pd.to_datetime(day)
3 recency = df.groupby(["Member_number"]).agg({"Date": lambda x: ((day-x.max()).days)})
```

```
1 recency.shape
```

```
(3898, 1)
```

```
1 frequency = df['Member_number'].value_counts()
2 freq = pd.DataFrame(frequency)
3
```

```
1 freq.shape
```

```
(3898, 1)
```

```
1 type(freq)
```

```
pandas.core.frame.DataFrame
```

```
1 df
```

	Member_number	Date	itemDescription	Year	Month
0	1808	2015-07-21	tropical fruit	2015	7

```
columns_to_drop = ['Year', 'Month']
df = df.drop(columns=columns_to_drop)

```

3	1187	2015-12-12	other vegetables	2015	12

```
df['Quantity'] = df.groupby(['Member_number', 'Date'])['itemDescription'].transform('nunique')

```

...	...	...	...	...	...

```
df
```

	Member_number	Date	itemDescription	Quantity
0	1808	2015-07-21	tropical fruit	3
1	2552	2015-05-01	whole milk	3
2	2300	2015-09-19	pip fruit	3
3	1187	2015-12-12	other vegetables	3
4	3037	2015-01-02	whole milk	3
...	...	...	...	...
38760	4471	2014-08-10	sliced cheese	3
38761	2022	2014-02-23	candy	3
38762	1097	2014-04-16	cake bar	3
38763	1510	2014-03-12	fruit/vegetable juice	3
38764	1521	2014-12-26	cat food	3

38006 rows × 4 columns

```
agg_df = df.groupby(['Member_number', 'Date']).agg({
    'itemDescription': ', '.join,
    'Quantity': 'first'
}).reset_index()

agg_df.head(10)
```

	Member_number	Date	itemDescription	Quantity
0	1000	2014-06-24	whole milk, pastry, salty snack	3
1	1000	2015-03-15	sausage, whole milk, semi-finished bread, yogurt	4
2	1000	2015-05-27	soda, pickled vegetables	2
3	1000	2015-07-24	canned beer, misc. beverages	2
4	1000	2015-11-25	sausage, hygiene articles	2
5	1001	2014-07-02	sausage, whole milk, rolls/buns	3
6	1001	2014-12-12	whole milk, soda	2
7	1001	2015-01-20	frankfurter, soda, whipped/sour cream	3
8	1001	2015-02-05	frankfurter, curd	2
9	1001	2015-04-14	beef, white bread	2

```
fixed_price = 1.0

# Calculate the monetary value by multiplying 'Quantity' by the fixed price
agg_df['Monetary_Value'] = agg_df['Quantity'] * fixed_price

agg_df.head(10)
```

	Member_number	Date	itemDescription	Quantity	Monetary_Value
0	1000	2014-06-24	whole milk, pastry, salty snack	3	3.0
1	1000	2015-03-15	sausage, whole milk, semi-finished bread, yogurt	4	4.0
2	1000	2015-05-27	soda, pickled vegetables	2	2.0

```
monetary = agg_df.groupby(['Member_number'])[["Monetary_Value"]].sum()
```

4	1000	2015-11-25	sausage, hygiene articles	2	2.0

```
monetary.shape
```

```
(3898, 1)
```

7	1001	2015-01-20	frankfurter, soda, whipped/sour cream	3	3.0

```
RFM = pd.concat([recency, freq, monetary],axis=1)
recency.columns=["Recency"]
freq.columns=["Frequency"]
monetary.columns=["Monetary"]
```

```
RFM
```

	Recency	Frequency	Monetary
1000	37	13	13.0
1001	262	12	12.0
1002	124	8	8.0
1003	91	7	7.0
1004	323	21	21.0
...	...	...	...
4996	38	10	10.0
4997	5	6	6.0
4998	79	2	2.0
4999	6	16	16.0
5000	91	7	7.0

3898 rows × 3 columns

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
scaled = scaler.fit_transform(RFM)
```

```
from sklearn.cluster import KMeans

inertia = []
for i in np.arange(1,11):
  kmeans = KMeans(n_clusters=i)
  kmeans.fit(scaled)
  inertia.append(kmeans.inertia_)

plt.plot(inertia,marker="o")
```

```
[<matplotlib.lines.Line2D at 0x7901cdf48280>]
```

```
kmeans = KMeans(n_clusters=3)
kmeans.fit(scaled)
RFM["Clusters"] = (kmeans.labels_+1)
```

```
RFM
```

	Recency	Frequency	Monetary	Clusters
1000	37	13	13.0	1
1001	262	12	12.0	3
1002	124	8	8.0	3
1003	91	7	7.0	3
1004	323	21	21.0	1
...	...	...	...	...
4996	38	10	10.0	3
4997	5	6	6.0	3
4998	79	2	2.0	3
4999	6	16	16.0	1
5000	91	7	7.0	3

3898 rows × 4 columns

```
group = RFM.groupby(["Clusters"])["Recency","Frequency","Monetary"].mean()
group
```

Clusters	Recency	Frequency	Monetary
1	107.491928	16.536562	16.536562
2	421.988248	5.213675	5.213675
3	119.640126	8.231011	8.231011

```
def func(row):
  if row["Clusters"] == 2 :
    return 'Avg_Customers'
  elif row["Clusters"] == 1:
    return 'Whales'
  else:
    return 'Lapsed Customers'
```

```
RFM["Category"] = RFM.apply(func,axis=1)
```

```
RFM
```

	Recency	Frequency	Monetary	Clusters	Category
1000	37	13	13.0	1	Whales
1001	262	12	12.0	3	Lapsed Customers
1002	124	8	8.0	3	Lapsed Customers
1003	91	7	7.0	3	Lapsed Customers
1004	323	21	21.0	1	Whales
...	...	...	...	...	...
4996	38	10	10.0	3	Lapsed Customers
4997	5	6	6.0	3	Lapsed Customers
4998	79	2	2.0	3	Lapsed Customers
4999	6	16	16.0	1	Whales
5000	91	7	7.0	3	Lapsed Customers

3898 rows × 5 columns

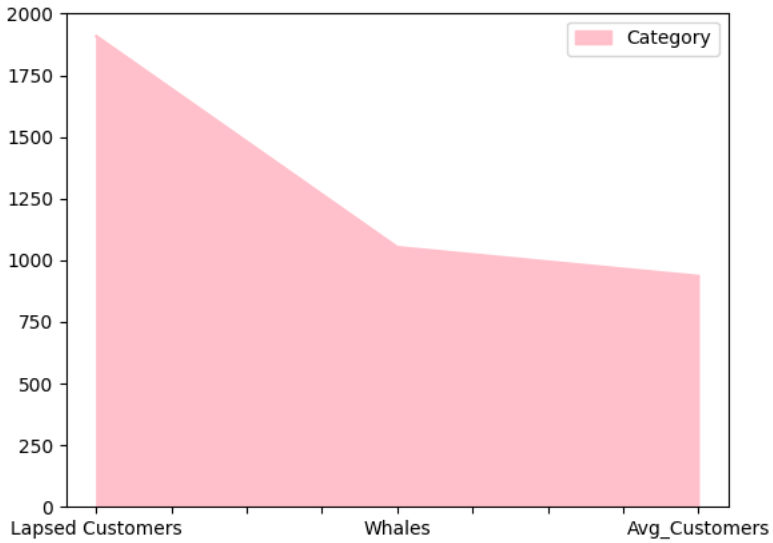
```
result = RFM["Category"].value_counts()
```

```
1 result
```

	Category
Lapsed Customers	1909
Whales	1053
Avg_Customers	936

```
1 result.plot(kind='area',color=["Pink"])
```

```
<Axes: >
```




```
1
```