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

df=pd.read_csv('/content/ifood_df.csv')

df

{"type":"dataframe","variable_name":"df"}

df.head()

{"type":"dataframe","variable_name":"df"}

df.head(10)

{"type":"dataframe","variable_name":"df"}

df.shape

(2205, 39)

df.columns

Index(['Income', 'Kidhome', 'Teenhome', 'Recency', 'MntWines',
'MntFruits',
       'MntMeatProducts', 'MntFishProducts', 'MntSweetProducts',
       'MntGoldProds', 'NumDealsPurchases', 'NumWebPurchases',
       'NumCatalogPurchases', 'NumStorePurchases',
'NumWebVisitsMonth',
       'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
       'AcceptedCmp2', 'Complain', 'Z_CostContact', 'Z_Revenue',
'Response',
       'Age', 'Customer_Days', 'marital_Divorced', 'marital_Married',
       'marital_Single', 'marital_Together', 'marital_Widow',
       'education_2n Cycle', 'education_Basic',
'education_Graduation',
       'education_Master', 'education_PhD', 'MntTotal',
'MntRegularProds',
       'AcceptedCmpOverall'],
      dtype='object')

header=['Income', 'Num of kids', 'Num of teens', 'Recency',
'MntWines', 'MntFruits',
       'MntMeatProducts', 'MntFishProducts', 'MntSweetProducts',
       'MntGoldProds', 'NumDealsPurchases', 'NumWebPurchases',
       'NumCatalogPurchases', 'NumStorePurchases',
'NumWebVisitsMonth',
       'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
       'AcceptedCmp2', 'Complain', 'Z_CostContact', 'Z_Revenue',
'Response',
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       'Age', 'Customer_Days', 'marital_Divorced', 'marital_Married',
       'marital_Single', 'marital_Together', 'marital_Widow',
       'education_2n Cycle', 'education_Basic',
'education_Graduation',
       'education_Master', 'education_PhD', 'MntTotal',
'MntRegularProds',
       'AcceptedCmpOverall']
df.columns = header

df.head(10)
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{"type":"dataframe","variable_name":"df"}
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num_of_kids = df.index[df['Num of kids'] >= 1].tolist()
num_of_kids
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len(num_of_kids)
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```
num_of_teens = df.index[df['Num of teens'] >= 1].tolist()
num_of_teens
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 ...]
```

```
len(num_of_teens)
```

```
1066
```

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

{"type":"dataframe","variable_name":"df"}

```
df['CustomerID'] = df.index + 1
cols = ['CustomerID'] + [col for col in df.columns if col !=
```

```
'CustomerID']
df = df[cols]

df.head(10)
```


```
{"type":"dataframe","variable_name":"df"}
```


```
selected = ['Recency', 'MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds','MntTotal',
'MntRegularProds', 'NumDealsPurchases',
            'NumWebPurchases', 'NumCatalogPurchases',
'NumStorePurchases']
data=df[selected]

data.head(10)
```


```
{"summary":"{\n  \"name\": \"data\",\n  \"rows\": 2205,\n  \"fields\":
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\"samples\": [\n          45,\n          48,\n          10\
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\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntWines\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 337,\n        \"min\": 0,\n
\"max\": 1493,\n        \"num_unique_values\": 775,\n
\"samples\": [\n          840,\n          581,\n          465\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntFruits\",\n
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39,\n        \"min\": 0,\n        \"max\": 199,\n
\"num_unique_values\": 158,\n        \"samples\": [\n          62,\n
81,\n          57\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntMeatProducts\",\n      \"properties\": {\n        \"dtype\":
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\"max\": 1725,\n        \"num_unique_values\": 551,\n
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n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntFishProducts\",\n      \"properties\": {\n        \"dtype\":
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```

```
n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntGoldProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
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\"num_unique_values\": 212,\n        \"samples\": [\n          102,\n
166,\n          106\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntTotal\",\n      \"properties\": {\n        \"dtype\":
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\"max\": 2491,\n        \"num_unique_values\": 897,\n
\"samples\": [\n          155,\n          1555,\n          656\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntRegularProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
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\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
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\"num_unique_values\": 14,\n        \"samples\": [\n          12,\n
13,\n          4\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"data"}
```


```
data.shape
```

```
(2205, 13)
```

```
plt.figure(figsize=(12, 8))  # Set the figure size
num_rows = 5  # Increased num_rows to 5 to accommodate all 13 plots
num_cols = 3
```

```python
for i, column in enumerate(selected, 1):
    plt.subplot(num_rows, num_cols, i)  # Update subplot grid
    sns.boxplot(y=data[column],palette='rocket')
    plt.title(f'Box Plot of {column}')

plt.tight_layout()  # Adjust subplot parameters for a tight layout
plt.show()
```

```
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:
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```
Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

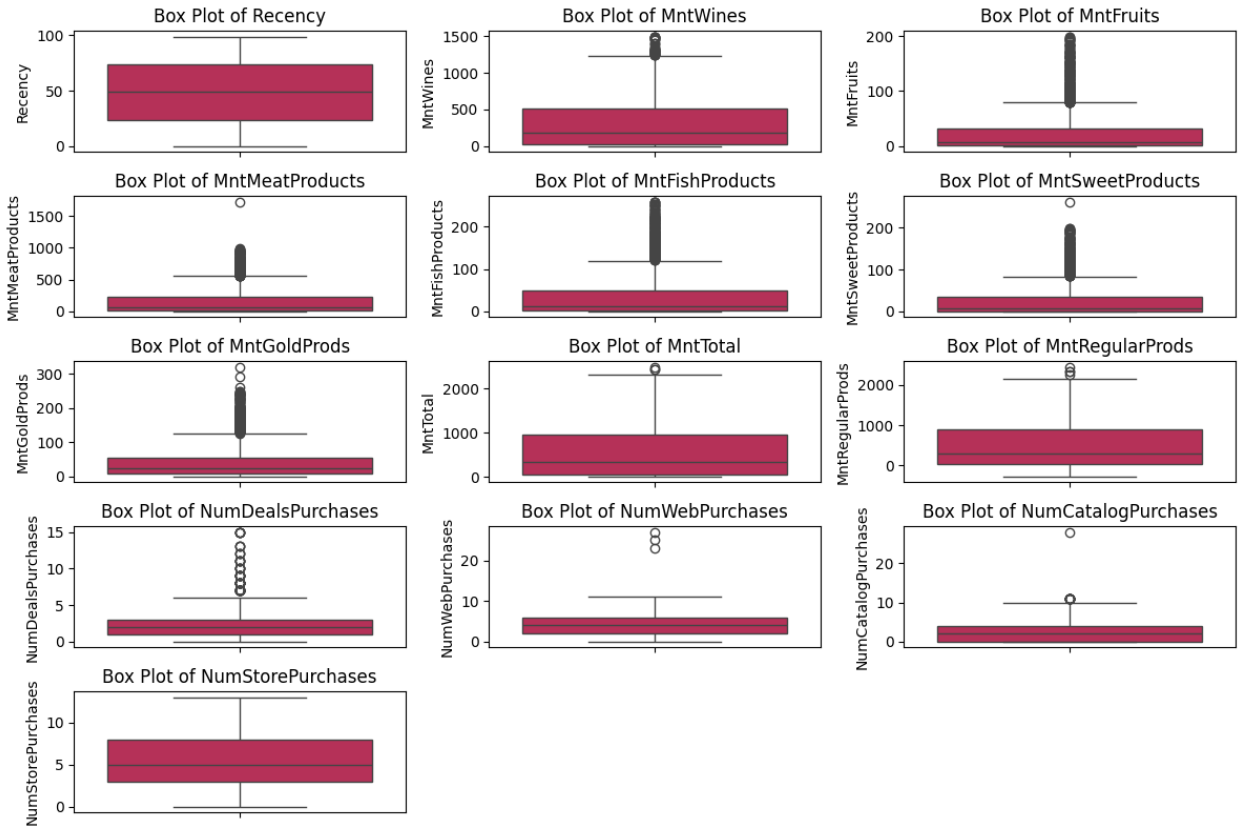
  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
<ipython-input-22-b97ef03e3e57>:7: FutureWarning:

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

  sns.boxplot(y=data[column],palette='rocket')
```




```
data.describe()
```


```
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\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
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n   }\n]\n}","type":"dataframe"}

```
data.head(10)
```

{"summary":"{\n \"name\": \"data\",\n \"rows\": 2205,\n \"fields\":
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\"dtype\": \"number\",\n   \"std\": 28,\n   \"min\": 0,\n
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\"samples\": [\n   45,\n   48,\n   10\
n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"MntWines\",\n   \"properties\": {\n   \"dtype\":
\"number\",\n   \"std\": 337,\n   \"min\": 0,\n
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\"samples\": [\n   840,\n   581,\n   465\n
],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n
}\n   },\n   {\n   \"column\": \"MntFruits\",\n
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39,\n   \"min\": 0,\n   \"max\": 199,\n
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81,\n   57\n   ],\n   \"semantic_type\": \"\",\n
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\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"MntFishProducts\",\n   \"properties\": {\n   \"dtype\":
\"number\",\n   \"std\": 54,\n   \"min\": 0,\n
\"max\": 259,\n   \"num_unique_values\": 182,\n
\"samples\": [\n   20,\n   75,\n   94\
n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"MntSweetProducts\",\n   \"properties\": {\n   \"dtype\":
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\"max\": 262,\n   \"num_unique_values\": 176,\n
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}\n   },\n   {\n   \"column\": \"MntGoldProds\",\n
\"properties\": {\n   \"dtype\": \"number\",\n   \"std\":
51,\n   \"min\": 0,\n   \"max\": 321,\n
\"num_unique_values\": 212,\n   \"samples\": [\n   102,\n

```
166,\n          106\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntTotal\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 575,\n        \"min\": 4,\n
\"max\": 2491,\n        \"num_unique_values\": 897,\n
\"samples\": [\n          155,\n          1555,\n          656\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntRegularProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
553,\n        \"min\": -283,\n        \"max\": 2458,\n
\"num_unique_values\": 974,\n        \"samples\": [\n          749,\n
448,\n          919\n        ],\n        \"semantic_type\": \"\",\n
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\"max\": 15,\n        \"num_unique_values\": 15,\n        \"samples\":
[\n          0,\n          10,\n          3\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"NumWebPurchases\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
2,\n        \"min\": 0,\n        \"max\": 27,\n
\"num_unique_values\": 15,\n        \"samples\": [\n          0,\n
9,\n          8\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"NumCatalogPurchases\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 2,\n        \"min\": 0,\n
\"max\": 28,\n        \"num_unique_values\": 13,\n        \"samples\":
[\n          7,\n          5,\n          10\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"NumStorePurchases\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
3,\n        \"min\": 0,\n        \"max\": 13,\n
\"num_unique_values\": 14,\n        \"samples\": [\n          12,\n
13,\n          4\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"data"}
```


```
frequency = data[['MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds']].count()

frequency_data = frequency.reset_index()
frequency_data.columns = ['Product Category', 'Frequency of
Purchases']

frequency_data
```


```
{"summary":"{\n  \"name\": \"frequency_data\",\n  \"rows\": 6,\n
\"fields\": [\n    {\n      \"column\": \"Product Category\",\n
\"properties\": {\n        \"dtype\": \"string\",\n
\"num_unique_values\": 6,\n        \"samples\": [\n
```

```
\"MntWines\",\n          \"MntFruits\",\n          \"MntGoldProds\"\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"Frequency of Purchases\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
0,\n        \"min\": 2205,\n        \"max\": 2205,\n
\"num_unique_values\": 1,\n        \"samples\": [\n          2205\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    }\n  ]\n}","type":"dataframe","variable_name":"frequency_data"}
```

```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()

sc_df=sc.fit_transform(data)

sc_df
```

```
array([[ 0.31083003,  0.97456584,  1.54861372, ...,  1.42477184,
         2.62852614, -0.5626499 ],
       [-0.38060021, -0.8747762 , -0.63866448, ..., -1.13295709,
        -0.58804297, -1.17973173],
       [-0.79545835,  0.3551548 ,  0.5681097 , ...,  1.42477184,
        -0.2306464 ,  1.2885956 ],
       ...,
       [ 1.45168993,  1.78365298,  0.54296857, ..., -0.76756724,
         0.12675017,  2.21421835],
       [-1.41774556,  0.36108218,  0.09042825, ...,  0.69399214,
         0.8415433 ,  1.2885956 ],
       [-0.31145718, -0.6584269 , -0.58838223, ..., -0.4021774 ,
        -0.58804297, -0.5626499 ]])
```

```
from sklearn.decomposition import PCA

pca=PCA(n_components=3)
pca
```

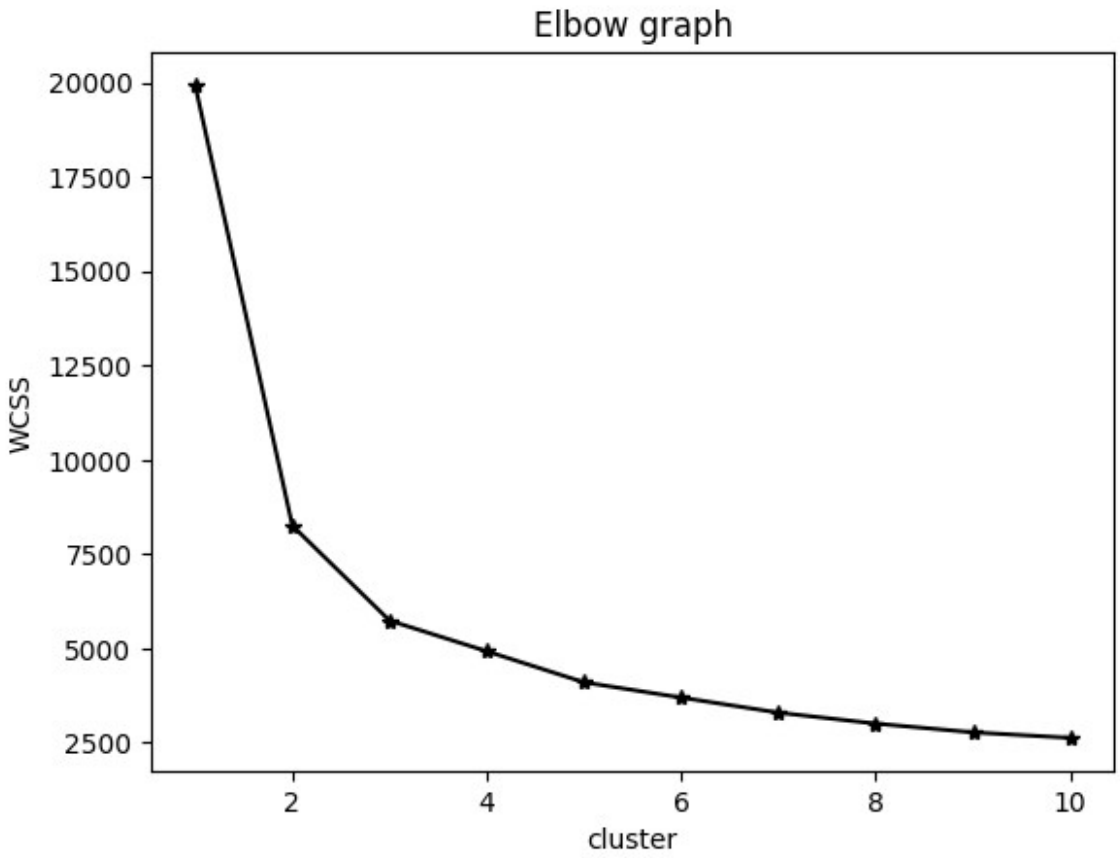
```
PCA(n_components=3)
```

```
p_df=pca.fit_transform(sc_df)

p_df
```

```
array([[ 4.82741325, -0.43851246,  0.23116695],
       [-2.68372663, -0.61513288, -0.32448308],
       [ 1.39691763,  0.15630771, -0.95850715],
       ...,
       [ 1.99136827, -0.18868646,  1.54201403],
       [ 1.59304685,  0.35317397, -1.44944077],
       [-1.96342372,  0.25825981, -0.27628074]])
```

```
from sklearn.cluster import KMeans
```

```
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, init='k-means++', random_state=42)
    kmeans.fit(p_df)
    # Append inertia value to wcss within the loop
    wcss.append(kmeans.inertia_)

plt.plot(range(1, 11), wcss, marker='*', c='black')
plt.title('Elbow graph')
plt.xlabel('cluster')
plt.ylabel('WCSS')
plt.show()
```



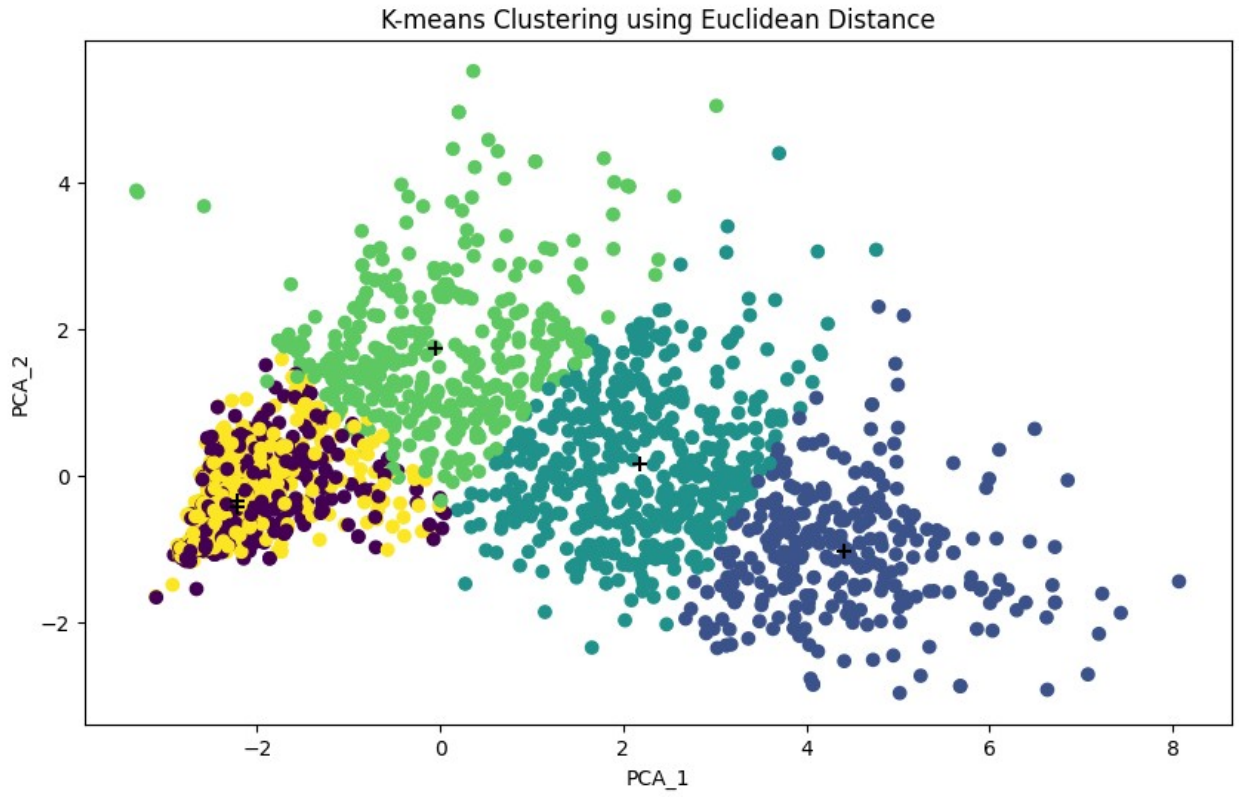

```
km1=KMeans(n_clusters=5,init='random',random_state=0)
km1.fit(p_df)
```

```
KMeans(init='random', n_clusters=5, random_state=0)
```

```
cluster_centers_km1 = km1.cluster_centers_
cluster_centers_km1
```

```
array([[-2.21852438, -0.43214454,  0.90089582],
       [ 4.41940644, -1.03584495,  0.07016189],
```

```
       [ 2.18940393,  0.16810662, -0.09184452],
       [-0.04657575,  1.7409655 ,  0.03601567],
       [-2.20863557, -0.35479209, -0.85278032]])

label1 = pd.Series(km1.labels_)

label1

0       1
1       4
2       2
3       4
4       3
       ..
2200    2
2201    3
2202    2
2203    2
2204    4
Length: 2205, dtype: int32

label1.value_counts()

4    540
0    520
2    467
3    375
1    303
Name: count, dtype: int64

plt.figure(figsize=(10, 6))
plt.scatter(p_df[:,0], p_df[:,1], c=label1, cmap='viridis')
plt.scatter(cluster_centers_km1[:, 0], cluster_centers_km1[:, 1],
s=50, c='black', marker='+', label='Cluster Centers')
plt.xlabel('PCA_1')
plt.ylabel('PCA_2')
plt.title('K-means Clustering using Euclidean Distance')
plt.show()
```




```
from sklearn.metrics import silhouette_score, calinski_harabasz_score

silhouette_man = silhouette_score(p_df, label1)
ch_man = calinski_harabasz_score(p_df, label1)

print("Silhouette Score:", silhouette_man)
print("Calinski-Harabasz Index:", ch_man)
```

```
Silhouette Score: 0.320231409107203
Calinski-Harabasz Index: 2122.1807642516346
```

```
data
```


```
{"summary":"{\n  \"name\": \"data\",\n  \"rows\": 2205,\n  \"fields\":
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\"samples\": [\n          45,\n          48,\n          10\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntWines\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 337,\n        \"min\": 0,\n
\"max\": 1493,\n        \"num_unique_values\": 775,\n
\"samples\": [\n          840,\n          581,\n          465\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntFruits\",\n
```

```
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
39,\n        \"min\": 0,\n        \"max\": 199,\n
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81,\n          57\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntMeatProducts\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 217,\n        \"min\": 0,\n
\"max\": 1725,\n        \"num_unique_values\": 551,\n
\"samples\": [\n          655,\n          21,\n          137\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntFishProducts\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 54,\n        \"min\": 0,\n
\"max\": 259,\n        \"num_unique_values\": 182,\n
\"samples\": [\n          20,\n          75,\n          94\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntSweetProducts\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 41,\n        \"min\": 0,\n
\"max\": 262,\n        \"num_unique_values\": 176,\n
\"samples\": [\n          2,\n          35,\n          55\n        ],\
n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntGoldProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
51,\n        \"min\": 0,\n        \"max\": 321,\n
\"num_unique_values\": 212,\n        \"samples\": [\n          102,\n
166,\n          106\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntTotal\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 575,\n        \"min\": 4,\n
\"max\": 2491,\n        \"num_unique_values\": 897,\n
\"samples\": [\n          155,\n          1555,\n          656\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntRegularProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
553,\n        \"min\": -283,\n        \"max\": 2458,\n
\"num_unique_values\": 974,\n        \"samples\": [\n          749,\n
448,\n          919\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"NumDealsPurchases\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 1,\n        \"min\": 0,\n
\"max\": 15,\n        \"num_unique_values\": 15,\n        \"samples\":
[\n          0,\n          10,\n          3\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"NumWebPurchases\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
2,\n        \"min\": 0,\n        \"max\": 27,\n
\"num_unique_values\": 15,\n        \"samples\": [\n          0,\n
9,\n          8\n        ],\n        \"semantic_type\": \"\",\n
```

\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"NumCatalogPurchases\",\n   \"properties\": {\n   \"dtype\":
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\"max\": 28,\n   \"num_unique_values\": 13,\n   \"samples\":
[\n   7,\n   5,\n   10\n   ],\n
\"semantic_type\": \"\",\n   \"description\": \"\"\n   }\
n   },\n   {\n   \"column\": \"NumStorePurchases\",\n
\"properties\": {\n   \"dtype\": \"number\",\n   \"std\":
3,\n   \"min\": 0,\n   \"max\": 13,\n
\"num_unique_values\": 14,\n   \"samples\": [\n   12,\n
13,\n   4\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   }\n]\
n}","type":"dataframe","variable_name":"data"}

```
labels1=pd.DataFrame(label1)
labels1.columns=['label']
labels1
```

{"summary":"{\n \"name\": \"labels1\",\n \"rows\": 2205,\n
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\"properties\": {\n   \"dtype\": \"int32\",\n
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0,\n   2\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   }\n]\
n}","type":"dataframe","variable_name":"labels1"}

```
l1_df = pd.concat([labels1, data],axis=True)
```

```
l1_df
```

{"summary":"{\n \"name\": \"l1_df\",\n \"rows\": 2205,\n
\"fields\": [\n   {\n   \"column\": \"label\",\n
\"properties\": {\n   \"dtype\": \"int32\",\n
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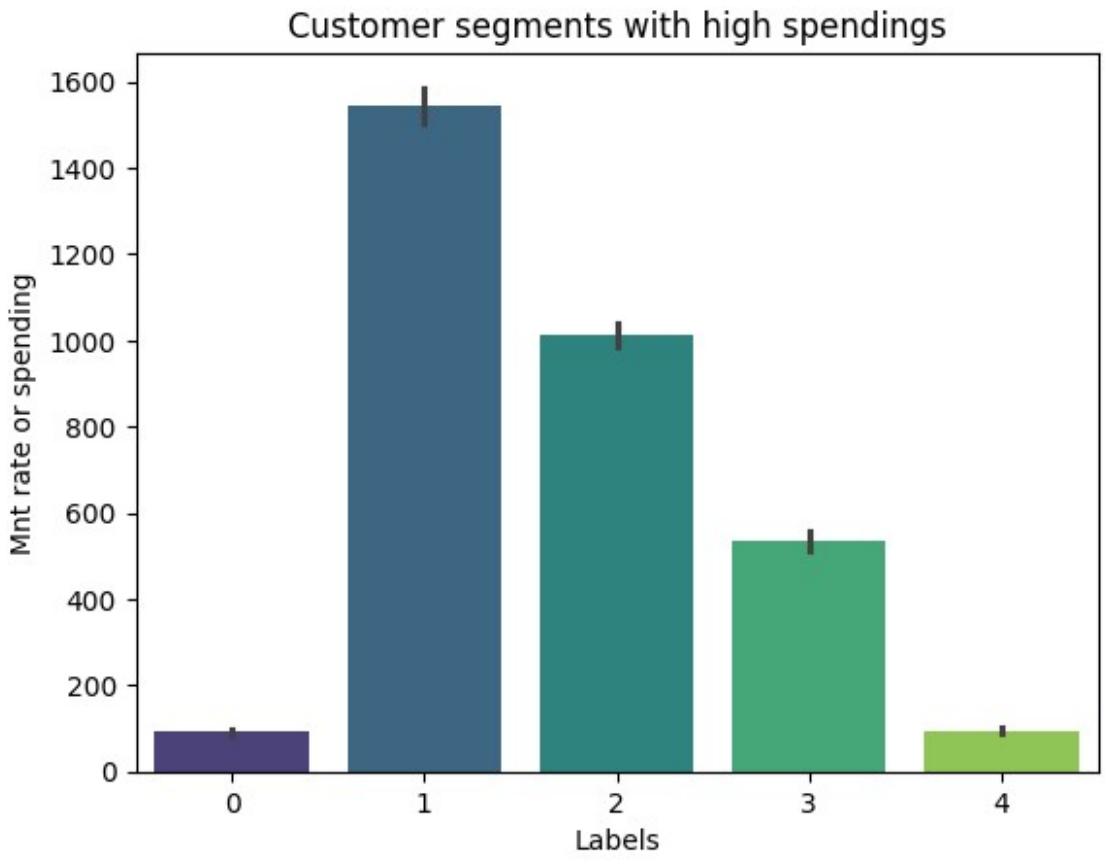
0,\n   2\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"Recency\",\n   \"properties\": {\n   \"dtype\": \"number\",\
n   \"std\": 28,\n   \"min\": 0,\n   \"max\": 99,\n
\"num_unique_values\": 100,\n   \"samples\": [\n   45,\n
48,\n   10\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"MntWines\",\n   \"properties\": {\n   \"dtype\":
\"number\",\n   \"std\": 337,\n   \"min\": 0,\n
\"max\": 1493,\n   \"num_unique_values\": 775,\n
\"samples\": [\n   840,\n   581,\n   465\n
],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n
}\n   },\n   {\n   \"column\": \"MntFruits\",\n
\"properties\": {\n   \"dtype\": \"number\",\n   \"std\":
39,\n   \"min\": 0,\n   \"max\": 199,\n
\"num_unique_values\": 158,\n   \"samples\": [\n   62,\n

```
81,\n          57\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntMeatProducts\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 217,\n        \"min\": 0,\n
\"max\": 1725,\n        \"num_unique_values\": 551,\n
\"samples\": [\n          655,\n          21,\n          137\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntFishProducts\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 54,\n        \"min\": 0,\n
\"max\": 259,\n        \"num_unique_values\": 182,\n
\"samples\": [\n          20,\n          75,\n          94\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntSweetProducts\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 41,\n        \"min\": 0,\n
\"max\": 262,\n        \"num_unique_values\": 176,\n
\"samples\": [\n          2,\n          35,\n          55\n        ],\
n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntGoldProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
51,\n        \"min\": 0,\n        \"max\": 321,\n
\"num_unique_values\": 212,\n        \"samples\": [\n          102,\n
166,\n          106\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"MntTotal\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 575,\n        \"min\": 4,\n
\"max\": 2491,\n        \"num_unique_values\": 897,\n
\"samples\": [\n          155,\n          1555,\n          656\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"MntRegularProds\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
553,\n        \"min\": -283,\n        \"max\": 2458,\n
\"num_unique_values\": 974,\n        \"samples\": [\n          749,\n
448,\n          919\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"NumDealsPurchases\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 1,\n        \"min\": 0,\n
\"max\": 15,\n        \"num_unique_values\": 15,\n        \"samples\":
[\n          0,\n          10,\n          3\n        ],\n
\"semantic_type\": \"\",\n        \"description\": \"\"\n      }\
n    },\n    {\n      \"column\": \"NumWebPurchases\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
2,\n        \"min\": 0,\n        \"max\": 27,\n
\"num_unique_values\": 15,\n        \"samples\": [\n          0,\n
9,\n          8\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"NumCatalogPurchases\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 2,\n        \"min\": 0,\n
```

\"max\": 28,\n   \"num_unique_values\": 13,\n   \"samples\": [\n   7,\n   5,\n   10\n   ],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n   }\n   },\n   {\n   \"column\": \"NumStorePurchases\",\n   \"properties\": {\n   \"dtype\": \"number\",\n   \"std\": 3,\n   \"min\": 0,\n   \"max\": 13,\n   \"num_unique_values\": 14,\n   \"samples\": [\n   12,\n   13,\n   4\n   ],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n   }\n   }\n]\n}","type":"dataframe","variable_name":"l1_df"}

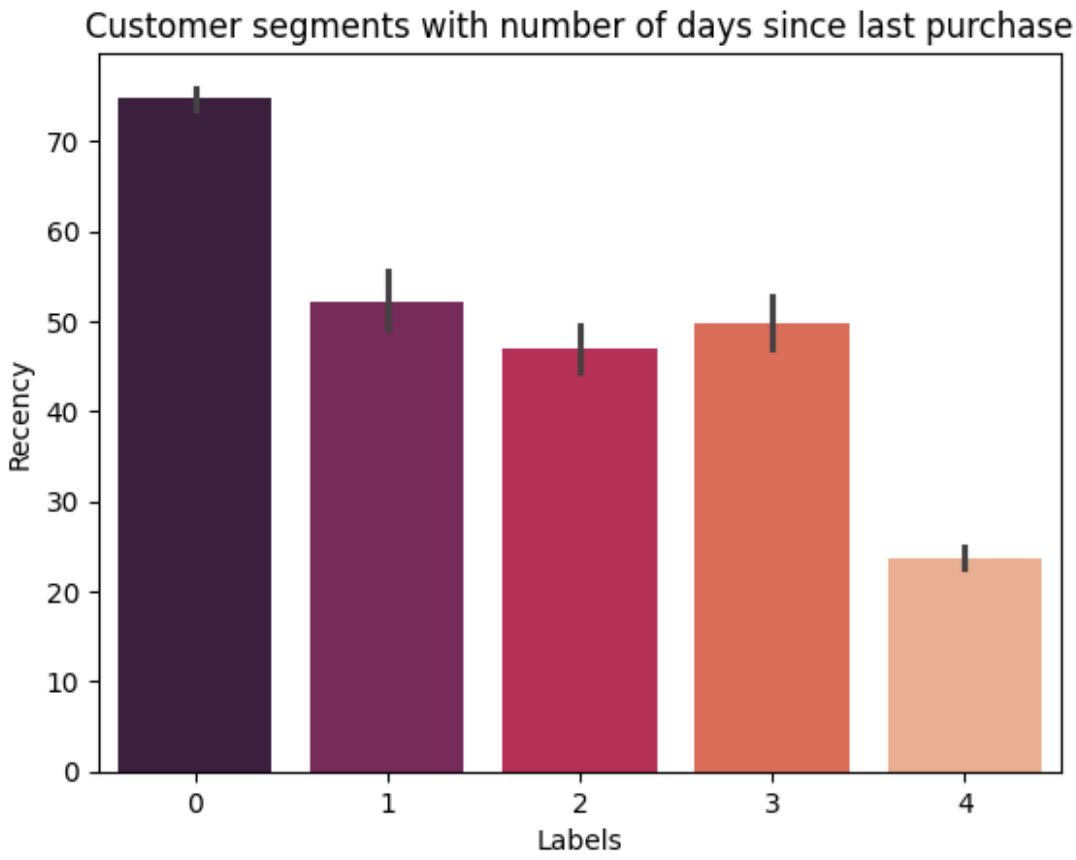
```
sns.barplot(x=l1_df['label'], y=l1_df['MntTotal'], palette='viridis')
plt.title('Customer segments with high spendings')
plt.xlabel('Labels')
plt.ylabel('Mnt rate or spending')
plt.show()
```

```
<ipython-input-47-ddabbf3f6367>:1: FutureWarning:

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

  sns.barplot(x=l1_df['label'], y=l1_df['MntTotal'], palette='viridis')
```

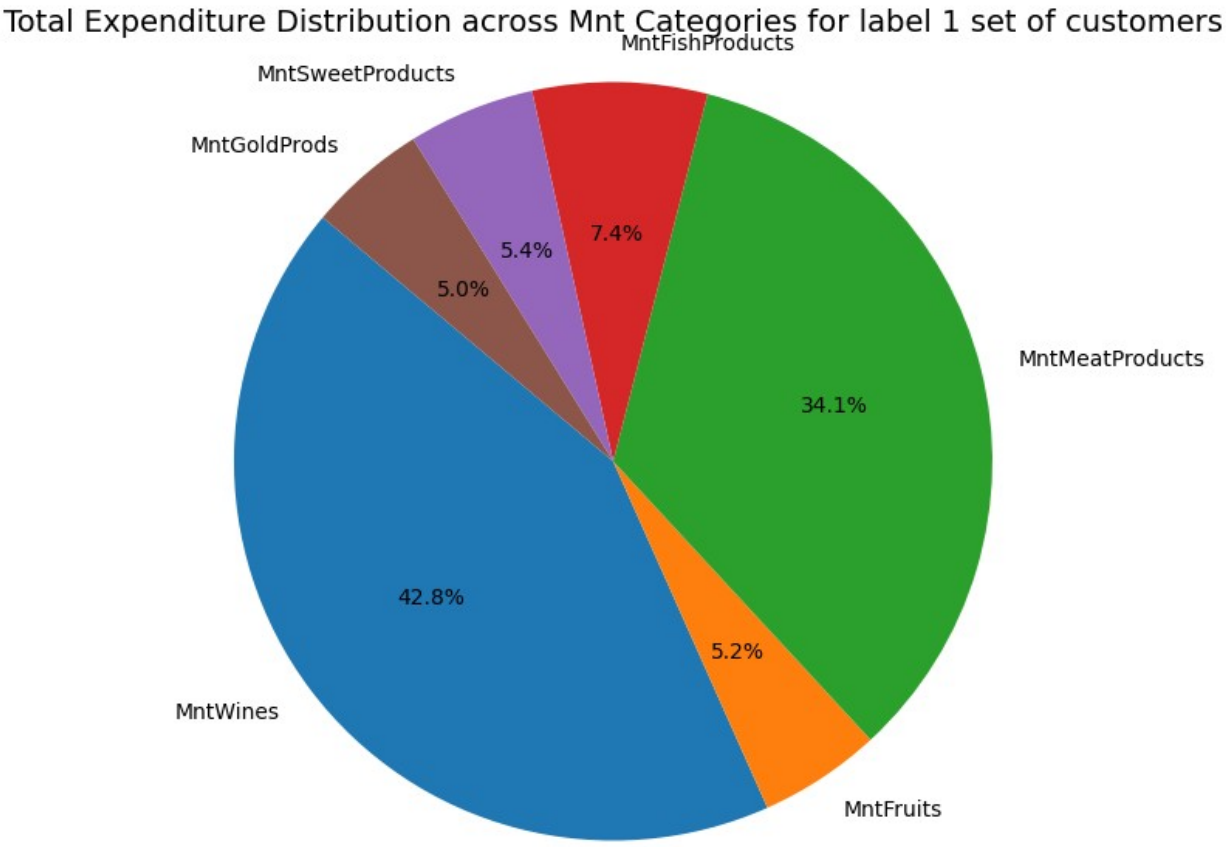



```
sns.barplot(x=l1_df['label'], y=l1_df['Recency'], palette='rocket')
plt.title('Customer segments with number of days since last purchase')
plt.xlabel('Labels')
plt.ylabel('Recency')
plt.show()
```

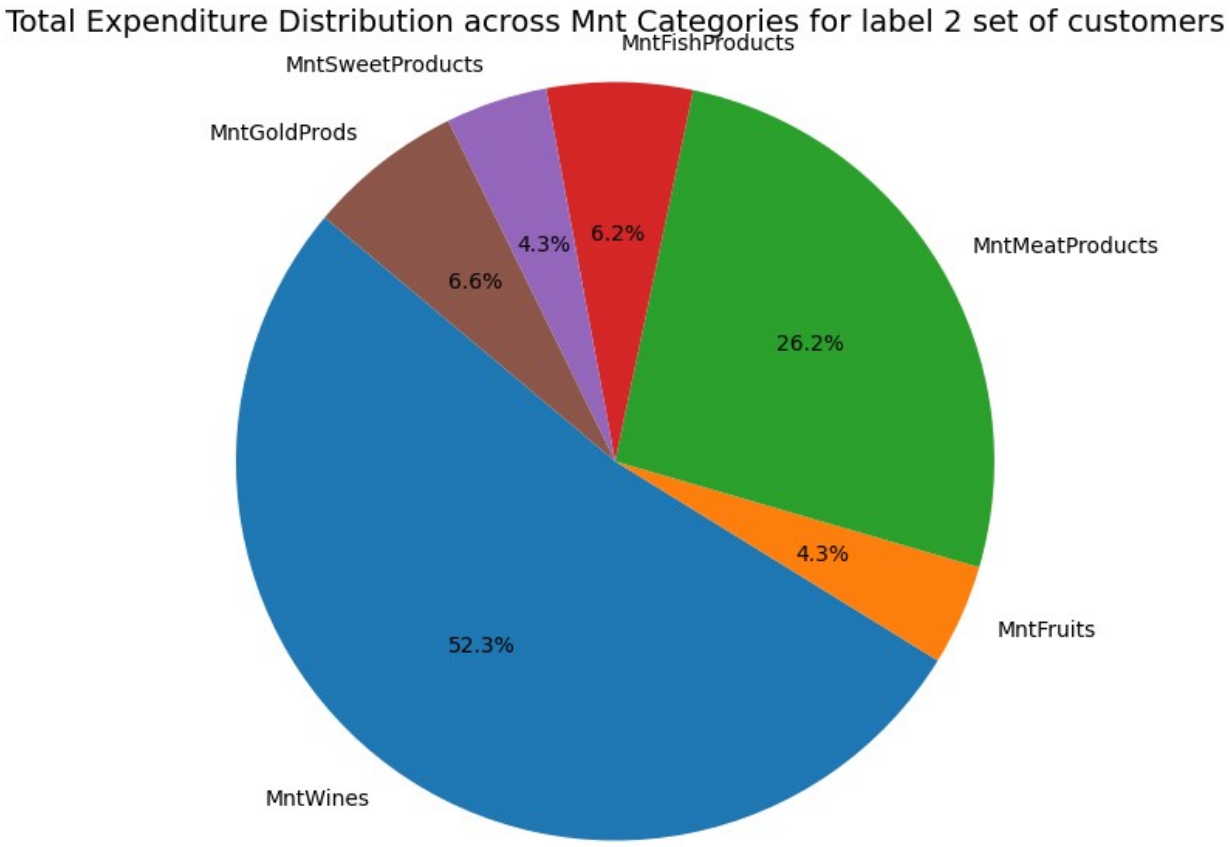
```
<ipython-input-48-b9cff904f928>:1: FutureWarning:

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

  sns.barplot(x=l1_df['label'], y=l1_df['Recency'], palette='rocket')
```



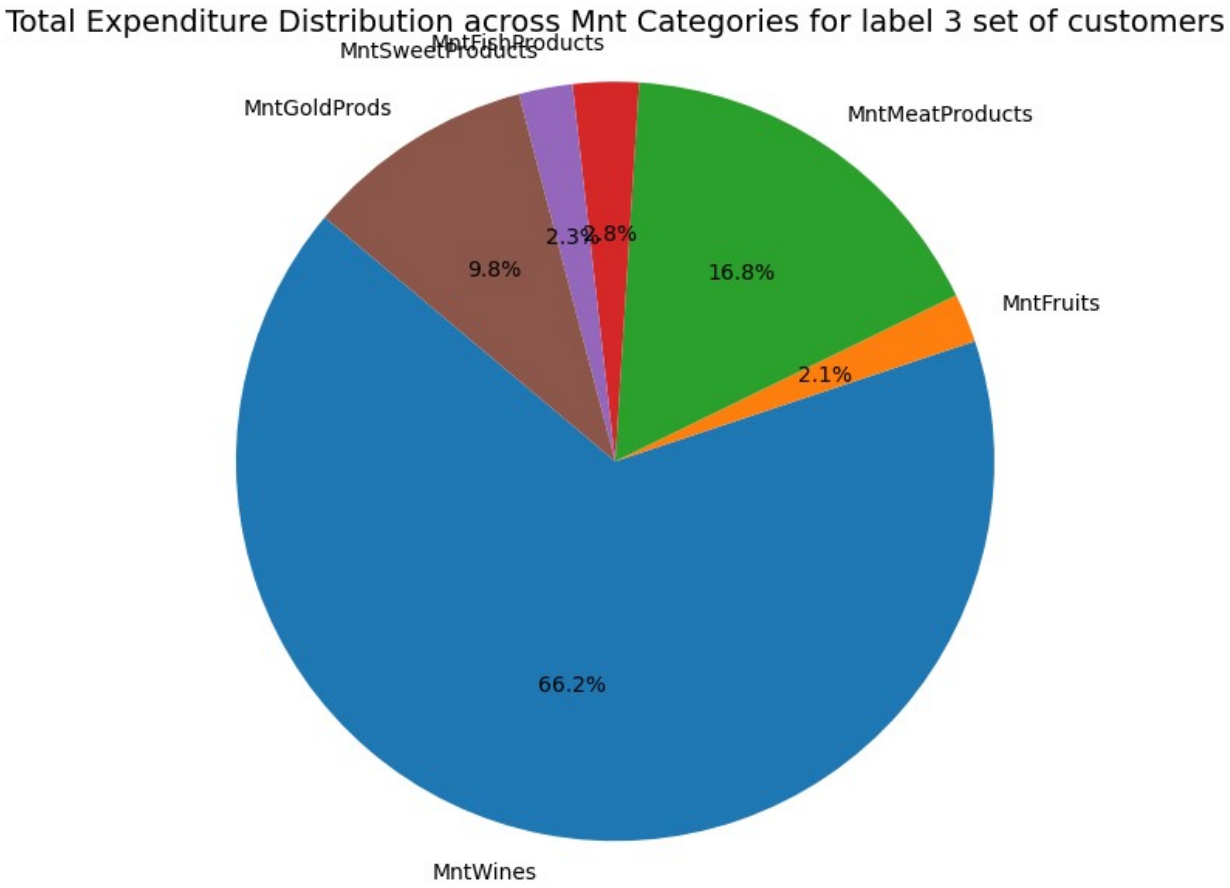

```
l1_data=l1_df[l1_df['label']==1]
mnt_terms = ['MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds']
total_expenditure = l1_data[mnt_terms].sum()

plt.figure(figsize=(10, 7))
plt.pie(total_expenditure, labels=total_expenditure.index,
autopct='%1.1f%%', startangle=140)
plt.title('Total Expenditure Distribution across Mnt Categories for
label 1 set of customers', fontsize=14)
plt.axis('equal')
plt.show()
```



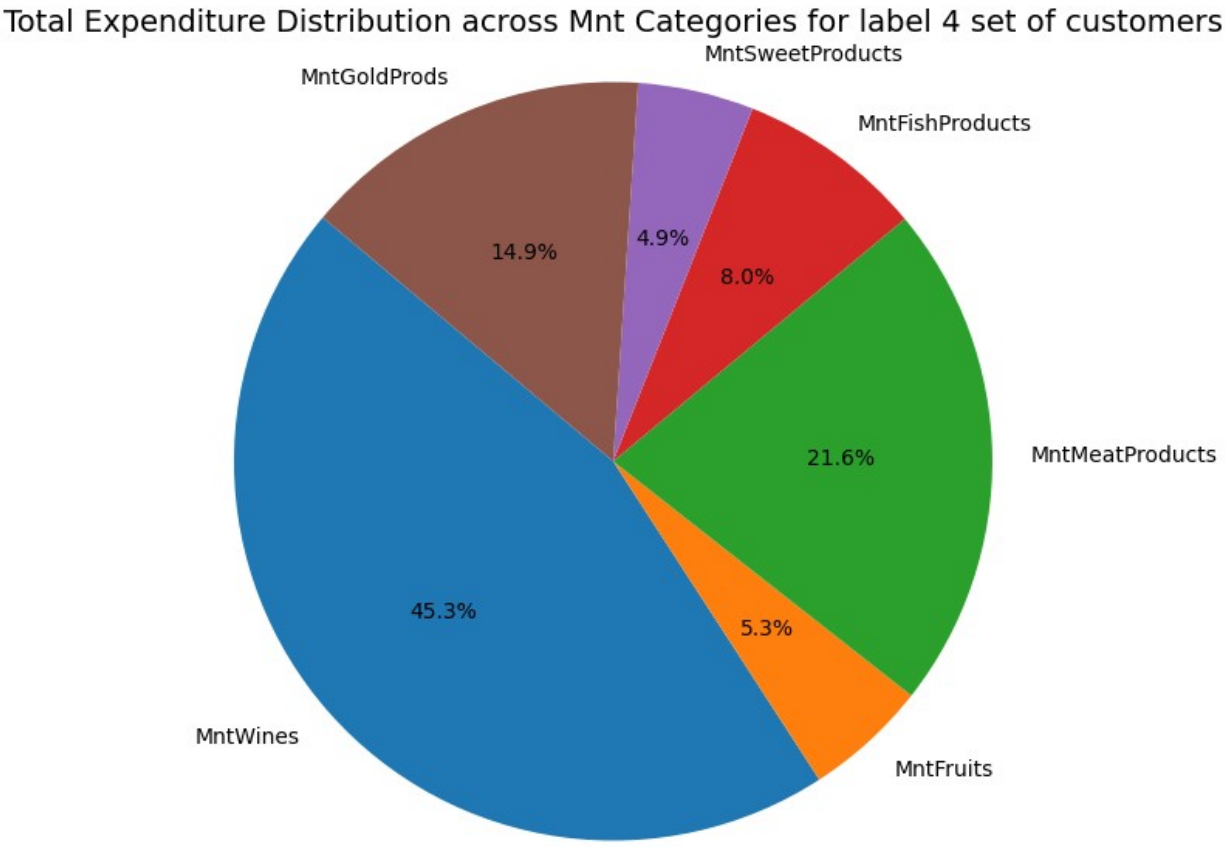

```
l2_data=l1_df[l1_df['label']==2]
mnt_terms = ['MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds']
total_expenditure = l2_data[mnt_terms].sum()

plt.figure(figsize=(10, 7))
plt.pie(total_expenditure, labels=total_expenditure.index,
autopct='%1.1f%%', startangle=140)
plt.title('Total Expenditure Distribution across Mnt Categories for
label 2 set of customers', fontsize=14)
plt.axis('equal')
plt.show()
```



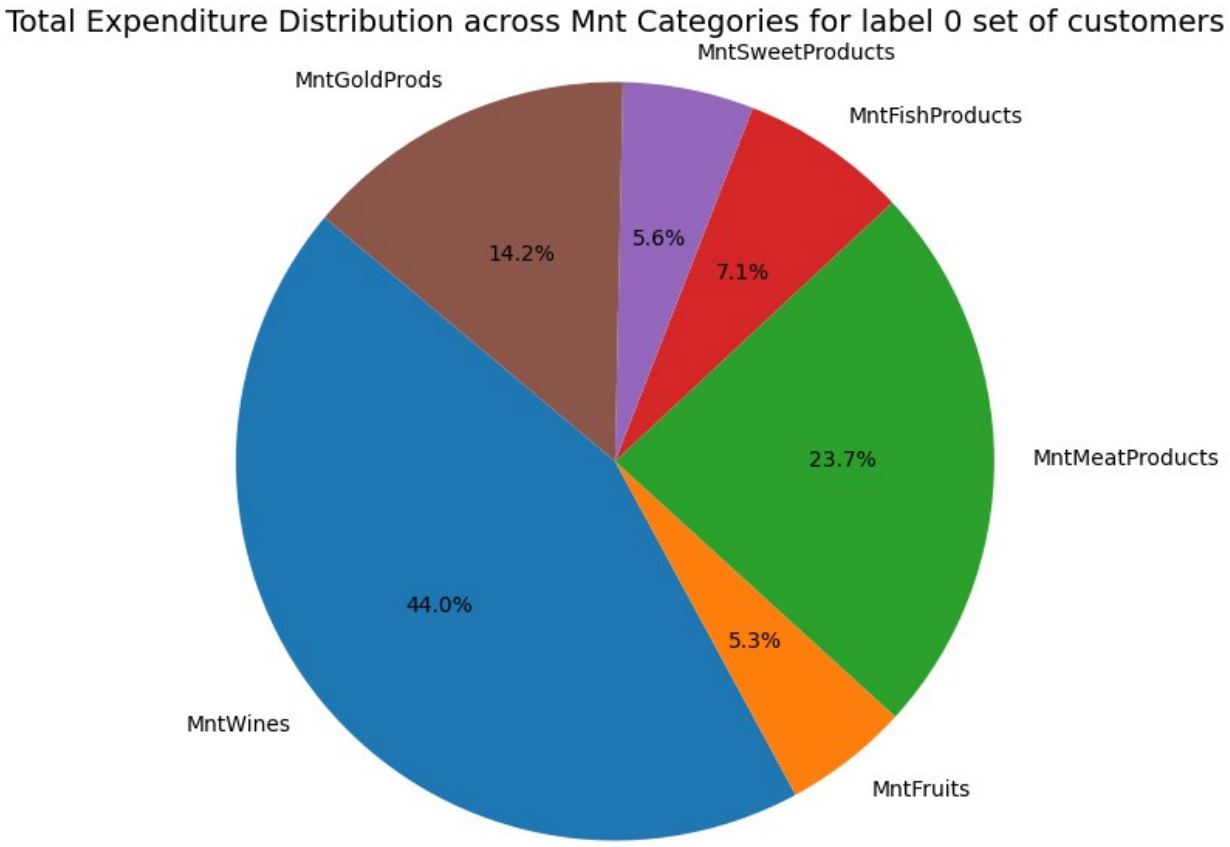

```
l3_data=l1_df[l1_df['label']==3]
mnt_terms = ['MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds']
total_expenditure = l3_data[mnt_terms].sum()

plt.figure(figsize=(10, 7))
plt.pie(total_expenditure, labels=total_expenditure.index,
autopct='%1.1f%%', startangle=140)
plt.title('Total Expenditure Distribution across Mnt Categories for
label 3 set of customers', fontsize=14)
plt.axis('equal')
plt.show()
```




```
l4_data=l1_df[l1_df['label']==4]
mnt_terms = ['MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds']
total_expenditure = l4_data[mnt_terms].sum()

plt.figure(figsize=(10, 7))
plt.pie(total_expenditure, labels=total_expenditure.index,
autopct='%1.1f%%', startangle=140)
plt.title('Total Expenditure Distribution across Mnt Categories for
label 4 set of customers', fontsize=14)
plt.axis('equal')
plt.show()
```

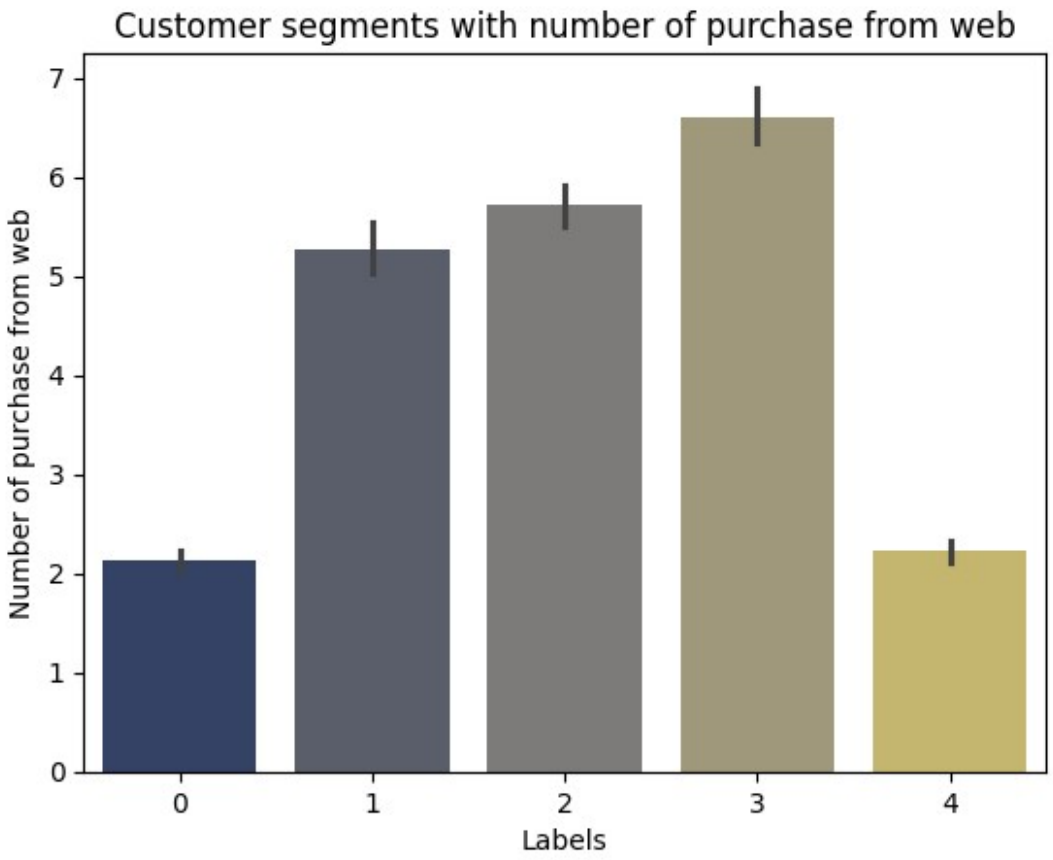



```
l0_data=l1_df[l1_df['label']==0]
mnt_terms = ['MntWines', 'MntFruits', 'MntMeatProducts',
'MntFishProducts', 'MntSweetProducts', 'MntGoldProds']
total_expenditure = l0_data[mnt_terms].sum()

plt.figure(figsize=(10, 7))
plt.pie(total_expenditure, labels=total_expenditure.index,
autopct='%1.1f%%', startangle=140)
plt.title('Total Expenditure Distribution across Mnt Categories for
label 0 set of customers', fontsize=14)
plt.axis('equal')
plt.show()
```



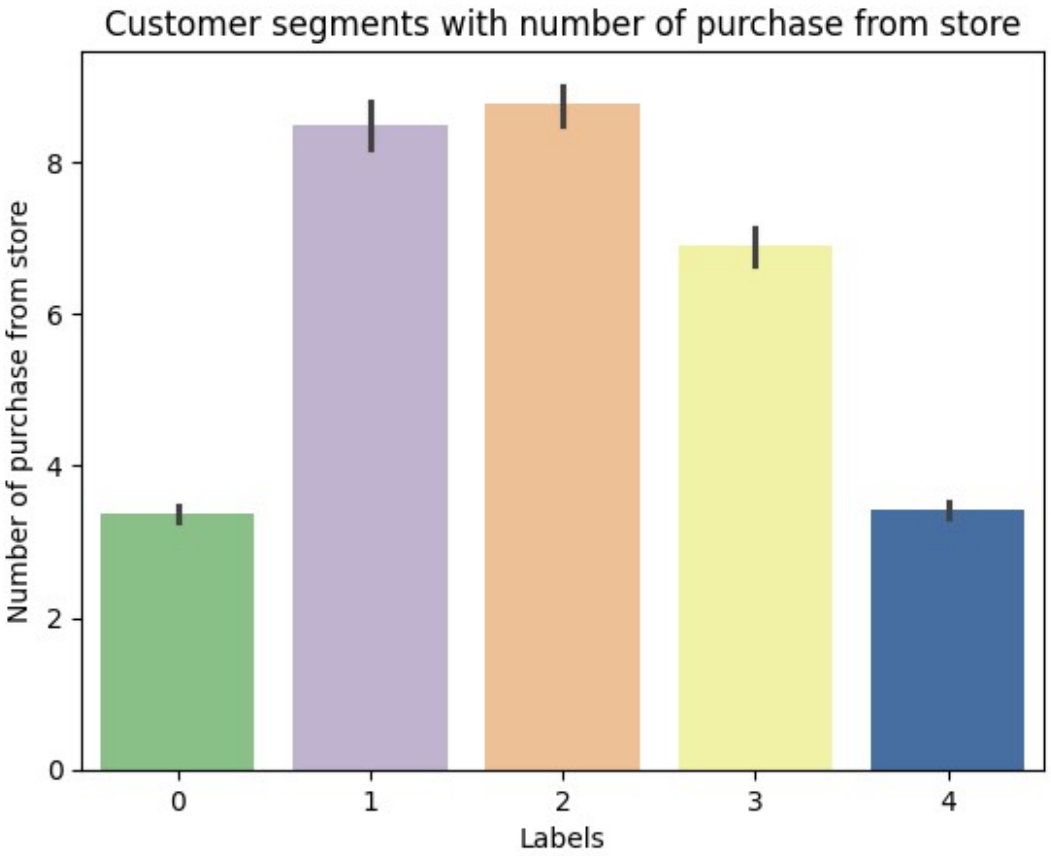

```
sns.barplot(x=l1_df['label'], y=l1_df['NumWebPurchases'],
palette='cividis')
plt.title('Customer segments with number of purchase from web')
plt.xlabel('Labels')
plt.ylabel('Number of purchase from web')
plt.show()
```

```
<ipython-input-60-1c6241ec4c9e>:1: FutureWarning:

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

  sns.barplot(x=l1_df['label'], y=l1_df['NumWebPurchases'],
palette='cividis')
```




```
sns.barplot(x=l1_df['label'], y=l1_df['NumStorePurchases'],
palette='Accent')
plt.title('Customer segments with number of purchase from store')
plt.xlabel('Labels')
plt.ylabel('Number of purchase from store')
plt.show()
```

```
<ipython-input-62-caabf348b552>:1: FutureWarning:

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

  sns.barplot(x=l1_df['label'], y=l1_df['NumStorePurchases'],
palette='Accent')
```



Insights and Recommendations:

- Label 1 set of customer have highest spending where as 0/4 has lowest and 2/3 have average spending.
- So customer with label 0 have high Recency also customer with label 4 have less recency that means there are more customer who purchased some stuff recently. So store should focus on attracting cuutomer with 0 label more.
- So most of the set of customer are focusing on wine and meat product. So we need to focus on different product to increae sell.
- So customer in label 1/2/4/0 are also interested in fish product so we can provide them with some offer on fish to just increase more sell on fish product too.
- If we took closer look at Gold product then customer with label 4 and 0 are interseted in gold than other so we can suppose that they are investor and are more into investing.
- Now sweet and fruit product are have very low purchase rate. So people are more toowards gold, wine product, fish and meat product. so suggesion is people need

some offer on sweet product and fruits. So its necessary to introduce some offer discount over such product.