Codetech IT Solutions (Tasks)

Task - 2 --- CUSTOMER SEGMENTATION AND ANALYSIS

In [1]:
```
import pandas as pd
import numpy as np
from datetime import datetime
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import silhouette_score
```

In [2]:
```
# Load the dataset
data = pd.read_csv('retail_dataset.csv')
```

In [3]:
```
# Remove rows with missing CustomerID
data.dropna(subset=['CustomerID'], inplace=True)
```

In [4]:
```
data
```

Out[4]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	C
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	K
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	K
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/2010 8:26	2.75	17850.0	K
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	12/1/2010 8:26	3.39	17850.0	K
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	12/1/2010 8:26	3.39	17850.0	K
...	...	...	...	...	...	...	...	
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	12/9/2011 12:50	0.85	12680.0	
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	12/9/2011 12:50	2.10	12680.0	
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	12/9/2011 12:50	4.15	12680.0	
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	12/9/2011 12:50	4.15	12680.0	
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	12/9/2011 12:50	4.95	12680.0	

406829 rows × 8 columns

In [5]:
```
# Calculate TotalPurchaseAmount
data['TotalPurchaseAmount'] = data['Quantity'] * data['UnitPrice']
```

In [6]:
```
# Convert InvoiceDate to datetime
data['InvoiceDate'] = pd.to_datetime(data['InvoiceDate'])
```

In [7]:
```
# Calculate the Recency, Frequency, and Monetary value
snapshot_date = data['InvoiceDate'].max() + pd.Timedelta(days=1)
```

In [8]:
```
# Aggregate data to get RFM values for each customer
rfm = data.groupby('CustomerID').agg({
    'InvoiceDate': lambda x: (snapshot_date - x.max()).days,  # Recency
    'InvoiceNo': 'count',                                     # Frequency
    'TotalPurchaseAmount': 'sum'                              # Monetary val
}).reset_index()
```

In [9]:
```
# Rename columns
rfm.columns = ['CustomerID', 'Recency', 'Frequency', 'TotalPurchaseAmount']
```

In [10]:
```
# Select relevant features for segmentation
X = rfm[['TotalPurchaseAmount', 'Frequency', 'Recency']]
```

In [11]:
```
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X = rfm[['TotalPurchaseAmount', 'Frequency', 'Recency']]
```

In [12]:
```
# Feature scaling
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

In [13]:
```
# Determine the optimal number of clusters using the elbow method
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, init='k-means++', random_state=42)
    kmeans.fit(X_scaled)
    wcss.append(kmeans.inertia_)
```

```
C:\Users\Ritesh\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:141
2: FutureWarning: The default value of `n_init` will change from 10 to 'au
to' in 1.4. Set the value of `n_init` explicitly to suppress the warning
  super()._check_params_vs_input(X, default_n_init=10)
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```
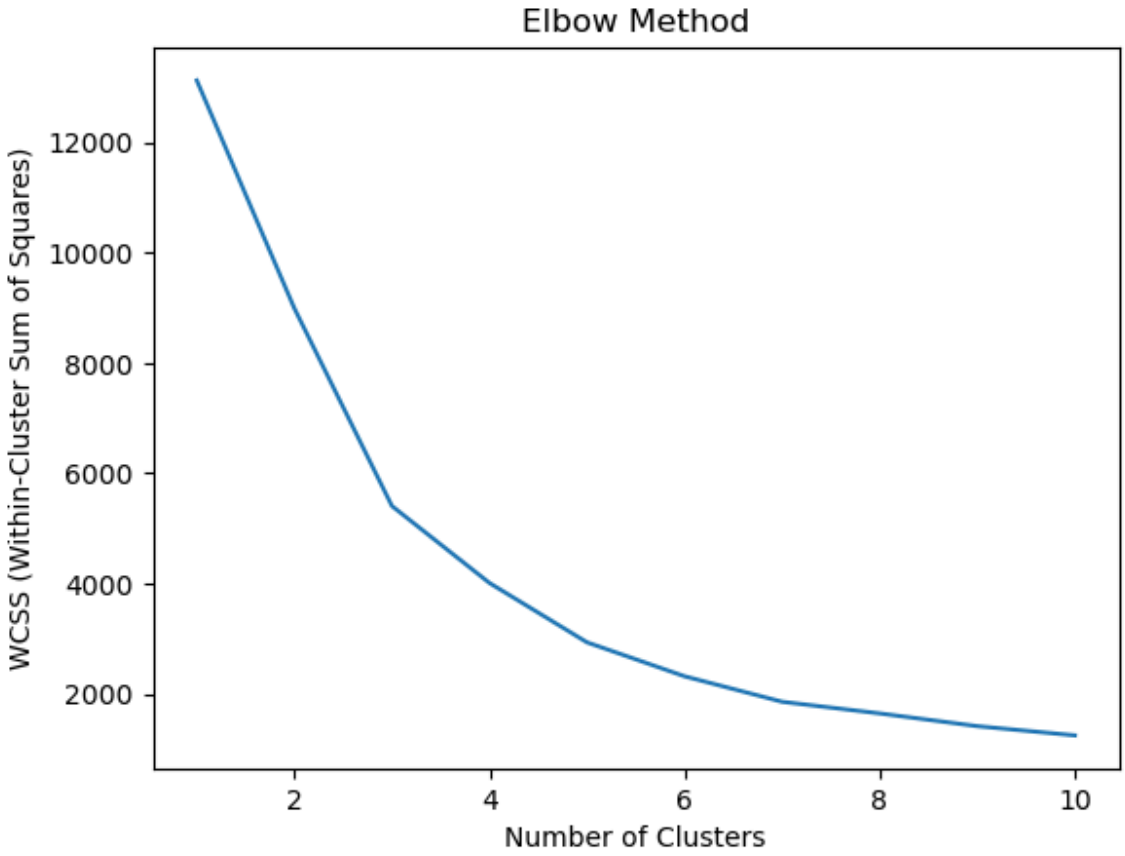

In [14]:
```
# Plot the elbow method to visualize the optimal number of clusters
plt.plot(range(1, 11), wcss)
plt.title('Elbow Method')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS (Within-Cluster Sum of Squares)')
plt.show()
```



In [15]:
```
# Based on the elbow method, choose the number of clusters
n_clusters = 3

# Apply K-means clustering
kmeans = KMeans(n_clusters=n_clusters, init='k-means++', random_state=42)
kmeans.fit(X_scaled)
labels = kmeans.labels_

# Add cluster labels to the RFM dataset
rfm['Cluster'] = labels
```

```
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  super()._check_params_vs_input(X, default_n_init=10)
```
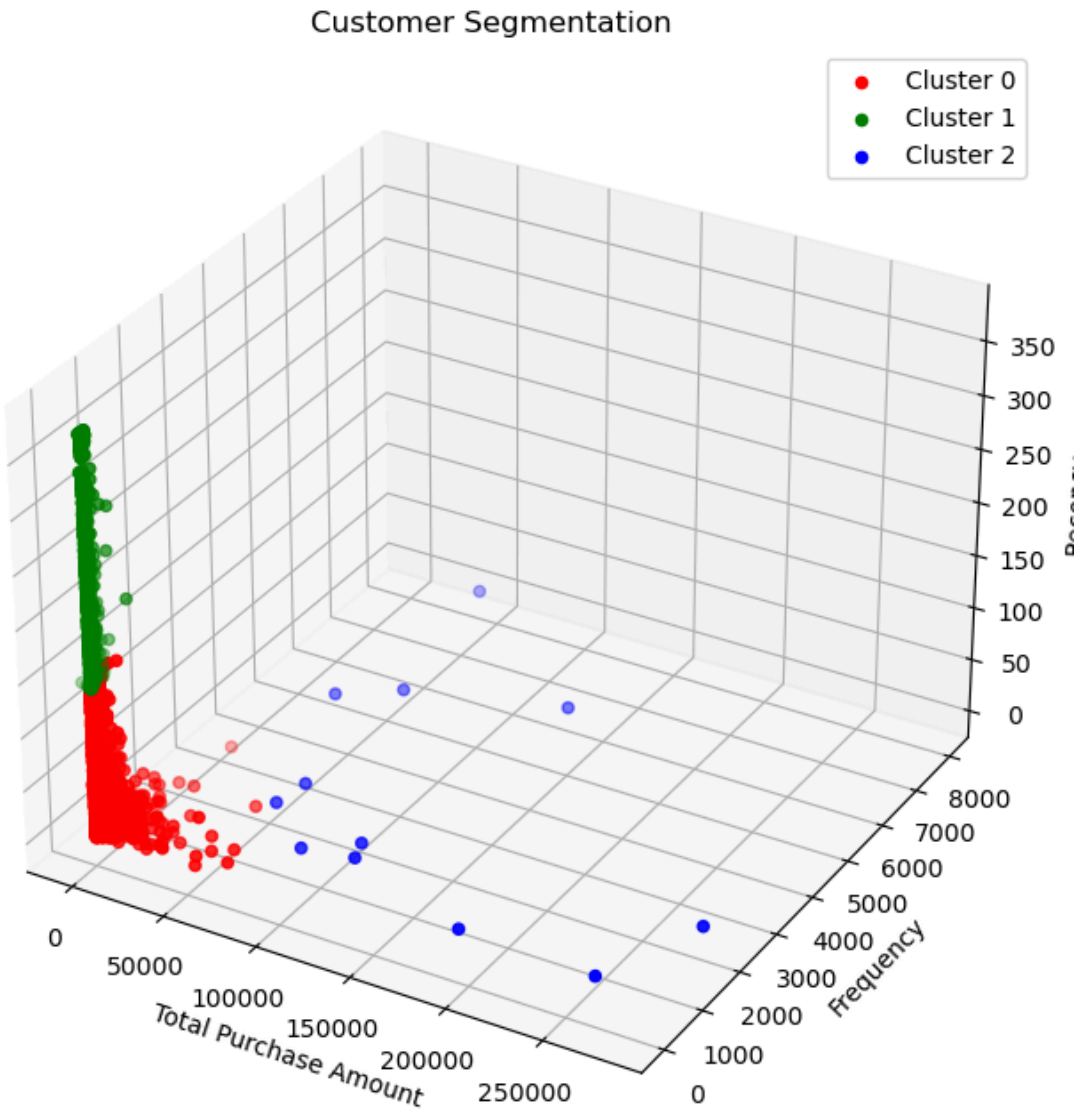

In [16]:
```
# Analyze segment characteristics
# Aggregate statistics for each cluster
segment_characteristics = rfm.groupby('Cluster').agg({
    'TotalPurchaseAmount': ['mean', 'median', 'min', 'max'],  # Purchase am
    'Frequency': ['mean', 'median', 'min', 'max'],             # Purchase f
    'Recency': ['mean', 'median', 'min', 'max'],               # Recency st
    'CustomerID': 'count'                                      # Number of c
}).reset_index()
```

In [17]:
```
# Print segment characteristics
print("Segment Characteristics:")
print(segment_characteristics)
```

```
Segment Characteristics:
  Cluster TotalPurchaseAmount                                      Frequenc
y  \
                          mean      median       min        max          mea
n
0       0         1950.597005     901.715  -1165.30   65892.08   104.87469
4
1       1          464.197911     297.330  -4287.63   21535.90    27.71076
6
2       2       118713.023333  100754.760  29072.10  279489.02  2845.58333
3

                        Recency                  CustomerID
   median  min   max        mean median  min  max      count
0    57.0    1  2782   40.254289   29.0    1  156       3264
1    18.0    1   312  247.244526  241.5  140  374       1096
2  1971.0  351  7983    5.000000    2.5    1   24         12
```

In [18]:
```
# Visualize the clusters in 3D (for demonstration purposes)
from mpl_toolkits.mplot3d import Axes3D

fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection='3d')

colors = ['r', 'g', 'b']
for i in range(n_clusters):
    cluster_data = rfm[rfm['Cluster'] == i]
    ax.scatter(cluster_data['TotalPurchaseAmount'], cluster_data['Frequency

ax.set_xlabel('Total Purchase Amount')
ax.set_ylabel('Frequency')
ax.set_zlabel('Recency')
ax.set_title('Customer Segmentation')
ax.legend()
plt.show()
```



So, the 3D scatter plot shows the segmentation of customers into three clusters based on their purchasing behavior: Total Purchase Amount, Frequency, and Recency. Cluster 0 (red) includes customers with low purchase amounts and high frequency. Cluster 1 (green)

represents customers with low purchase amounts and moderate frequency. Cluster 2 (blue)