Project - 5 (DATASET: Online Retail) :

The transactions made by a UKbased, registered, non-store online retailer between December 1, 2010,and December 9,2011, are all included in the transnational datasetknown as online retail. The company primarily offersone-of-a-kindgifts for every occasion. Thecompany has a large number ofwholesalers as clients.CompanyObjectiveUsing the global online retaildataset, we willdesign a clustering model and select the ideal groupofclients for the business to target.

In [1]:

```
#IMPORTING NECESSARY LIBRARIES
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```
#Reading the data set
df=pd.read_csv(r"C:\Users\mural\Downloads\online retail.csv")
df
```

Out[2]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	01-12-2010 08:26	2.55	17850.0
1	536365	71053	WHITE METAL LANTERN	6	01-12-2010 08:26	3.39	17850.0
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	01-12-2010 08:26	2.75	17850.0
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	01-12-2010 08:26	3.39	17850.0
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	01-12-2010 08:26	3.39	17850.0
...	...	...	...	...	...	...	...
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	09-12-2011 12:50	0.85	12680.0
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	09-12-2011 12:50	2.10	12680.0
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	09-12-2011 12:50	4.15	12680.0
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	09-12-2011 12:50	4.15	12680.0
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	09-12-2011 12:50	4.95	12680.0

541909 rows × 8 columns

DATA CLEANING AND PREPROCESSING

In [3]:

```
df.head()
```

Out[3]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	01-12-2010 08:26	2.55	17850.0	United Kingdom
1	536365	71053	WHITE METAL LANTERN	6	01-12-2010 08:26	3.39	17850.0	United Kingdom
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	01-12-2010 08:26	2.75	17850.0	United Kingdom
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	01-12-2010 08:26	3.39	17850.0	United Kingdom
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	01-12-2010 08:26	3.39	17850.0	United Kingdom

In [4]:

```
df.tail()
```

Out[4]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	09-12-2011 12:50	0.85	12680.0
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	09-12-2011 12:50	2.10	12680.0
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	09-12-2011 12:50	4.15	12680.0
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	09-12-2011 12:50	4.15	12680.0
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	09-12-2011 12:50	4.95	12680.0

In [5]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 541909 entries, 0 to 541908
Data columns (total 8 columns):
 #   Column       Non-Null Count   Dtype  
---  ------       --------------   -----  
 0   InvoiceNo    541909 non-null  object 
 1   StockCode    541909 non-null  object 
 2   Description  540455 non-null  object 
 3   Quantity     541909 non-null  int64  
 4   InvoiceDate  541909 non-null  object 
 5   UnitPrice    541909 non-null  float64
 6   CustomerID   406829 non-null  float64
 7   Country      541909 non-null  object 
dtypes: float64(2), int64(1), object(5)
memory usage: 33.1+ MB
```

In [6]:

```
df.describe()
```

Out[6]:

	Quantity	UnitPrice	CustomerID
count	541909.000000	541909.000000	406829.000000
mean	9.552250	4.611114	15287.690570
std	218.081158	96.759853	1713.600303
min	-80995.000000	-11062.060000	12346.000000
25%	1.000000	1.250000	13953.000000
50%	3.000000	2.080000	15152.000000
75%	10.000000	4.130000	16791.000000
max	80995.000000	38970.000000	18287.000000

In [7]:

```
# Checking for null values
df.isnull().sum()
```

Out[7]:

```
InvoiceNo          0
StockCode          0
Description     1454
Quantity           0
InvoiceDate        0
UnitPrice          0
CustomerID     135080
Country            0
dtype: int64
```

In [8]:

```
df.dropna(inplace=True)
```

In [11]:

```
df['InvoiceNo'].value_counts()
```

Out[11]:

```
InvoiceNo
576339    542
579196    533
580727    529
578270    442
573576    435
         ...
554155      1
570248      1
545414      1
545418      1
565192      1
Name: count, Length: 22190, dtype: int64
```

In [12]:

```
df['CustomerID'].value_counts()
```

Out[12]:

```
CustomerID
17841.0    7983
14911.0    5903
14096.0    5128
12748.0    4642
14606.0    2782
           ...
15070.0       1
15753.0       1
17065.0       1
16881.0       1
16995.0       1
Name: count, Length: 4372, dtype: int64
```

In [13]:

```
df['Quantity'].value_counts()
```

Out[13]:

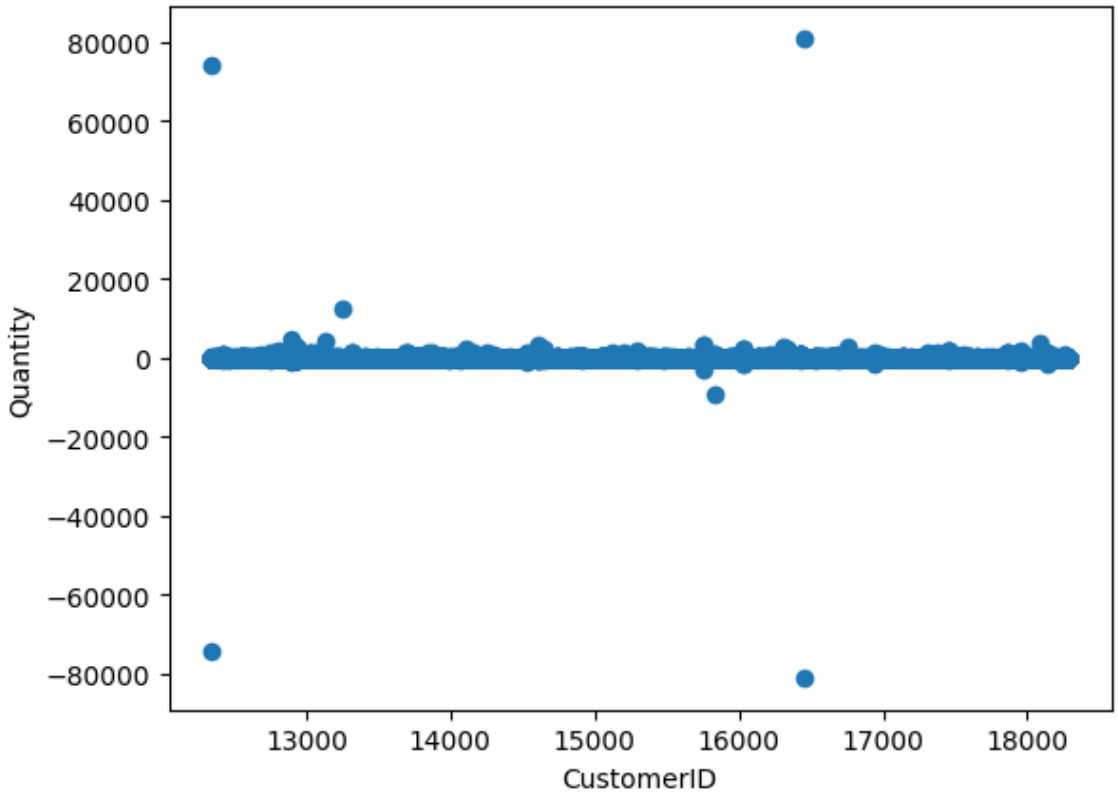
```
Quantity
 1        73314
 12       60033
 2        58003
 6        37688
 4        32183
          ...
 828          1
 560          1
-408          1
 512          1
-80995        1
Name: count, Length: 436, dtype: int64
```

In [14]:

```
plt.scatter(df["CustomerID"],df["Quantity"])
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[14]:

```
Text(0, 0.5, 'Quantity')
```



In [15]:

```
from sklearn.cluster import KMeans
km=KMeans()
km
```

Out[15]:

```
KMeans()
```

In [16]:

```
y_predicted=km.fit_predict(df[["CustomerID","Quantity"]])
y_predicted
```

```
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
```

Out[16]:

```
array([0, 0, 0, ..., 5, 5, 5])
```

In [17]:

```
df["cluster"]=y_predicted
df.head()
```

Out[17]:

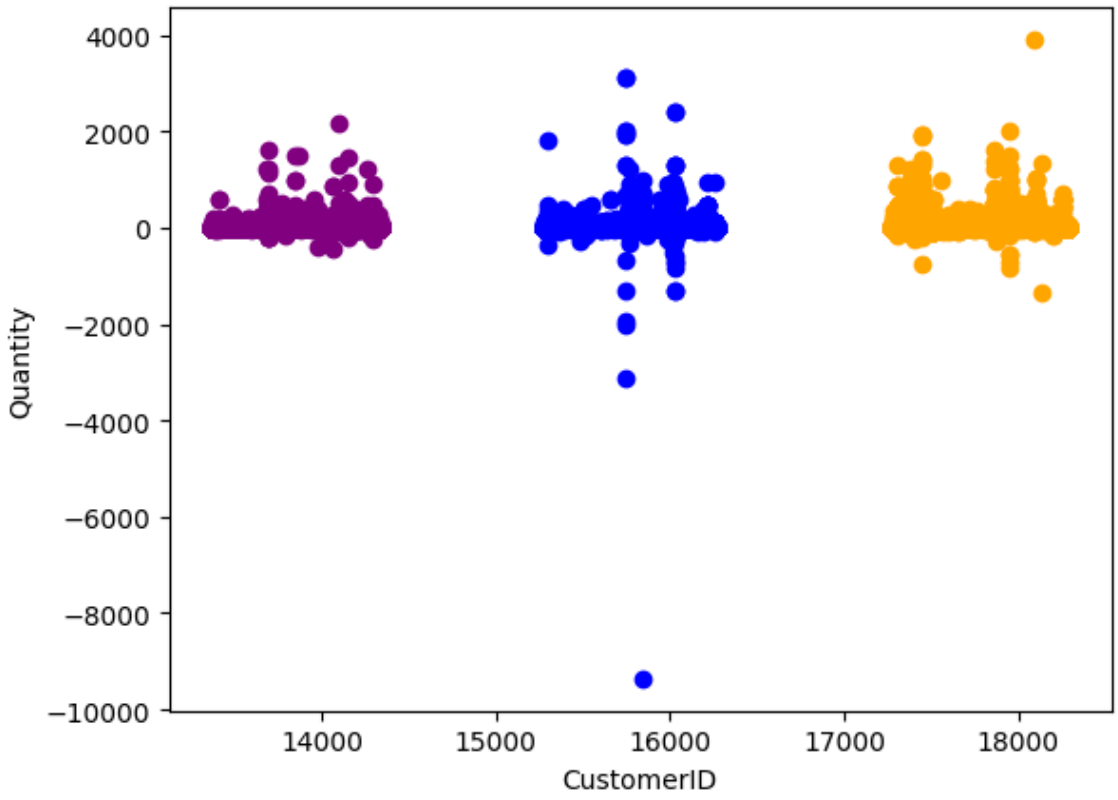
	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	01-12-2010 08:26	2.55	17850.0	United Kingdom
1	536365	71053	WHITE METAL LANTERN	6	01-12-2010 08:26	3.39	17850.0	United Kingdom
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	01-12-2010 08:26	2.75	17850.0	United Kingdom
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	01-12-2010 08:26	3.39	17850.0	United Kingdom
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	01-12-2010 08:26	3.39	17850.0	United Kingdom

In [19]:

```
df1=df[df.cluster==0]
df2=df[df.cluster==1]
df3=df[df.cluster==2]
plt.scatter(df1["CustomerID"],df1["Quantity"],color="orange")
plt.scatter(df2["CustomerID"],df2["Quantity"],color="purple")
plt.scatter(df3["CustomerID"],df3["Quantity"],color="blue")
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[19]:

```
Text(0, 0.5, 'Quantity')
```



In [20]:

```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler()
scaler.fit(df[["Quantity"]])
df["Quantity"]=scaler.transform(df[["Quantity"]])
df.head()
```

Out[20]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Countr
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	0.500037	01-12-2010 08:26	2.55	17850.0	Unite Kingdor
1	536365	71053	WHITE METAL LANTERN	0.500037	01-12-2010 08:26	3.39	17850.0	Unite Kingdor
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	0.500049	01-12-2010 08:26	2.75	17850.0	Unite Kingdor
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	0.500037	01-12-2010 08:26	3.39	17850.0	Unite Kingdor
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	0.500037	01-12-2010 08:26	3.39	17850.0	Unite Kingdor

In [21]:

```
scaler.fit(df[["CustomerID"]])
df["CustomerID"]=scaler.transform(df[["CustomerID"]])
df
```

Out[21]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	0.500037	01-12-2010 08:26	2.55	0.926443
1	536365	71053	WHITE METAL LANTERN	0.500037	01-12-2010 08:26	3.39	0.926443
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	0.500049	01-12-2010 08:26	2.75	0.926443
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	0.500037	01-12-2010 08:26	3.39	0.926443
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	0.500037	01-12-2010 08:26	3.39	0.926443
...	...	...	...	...	...	...	...
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	0.500074	09-12-2011 12:50	0.85	0.056219
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	0.500037	09-12-2011 12:50	2.10	0.056219
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	0.500025	09-12-2011 12:50	4.15	0.056219
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	0.500025	09-12-2011 12:50	4.15	0.056219
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	0.500019	09-12-2011 12:50	4.95	0.056219

406829 rows × 9 columns

K-MeansClustering

In [22]:

```
km=KMeans()
```

In [23]:

```
y_predicted=km.fit_predict(df[["CustomerID","Quantity"]])
y_predicted
```

```
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
```

Out[23]:

```
array([3, 3, 3, ..., 1, 1, 1])
```

In [24]:

```
df["New Cluster"]=y_predicted
df.head()
```

Out[24]:

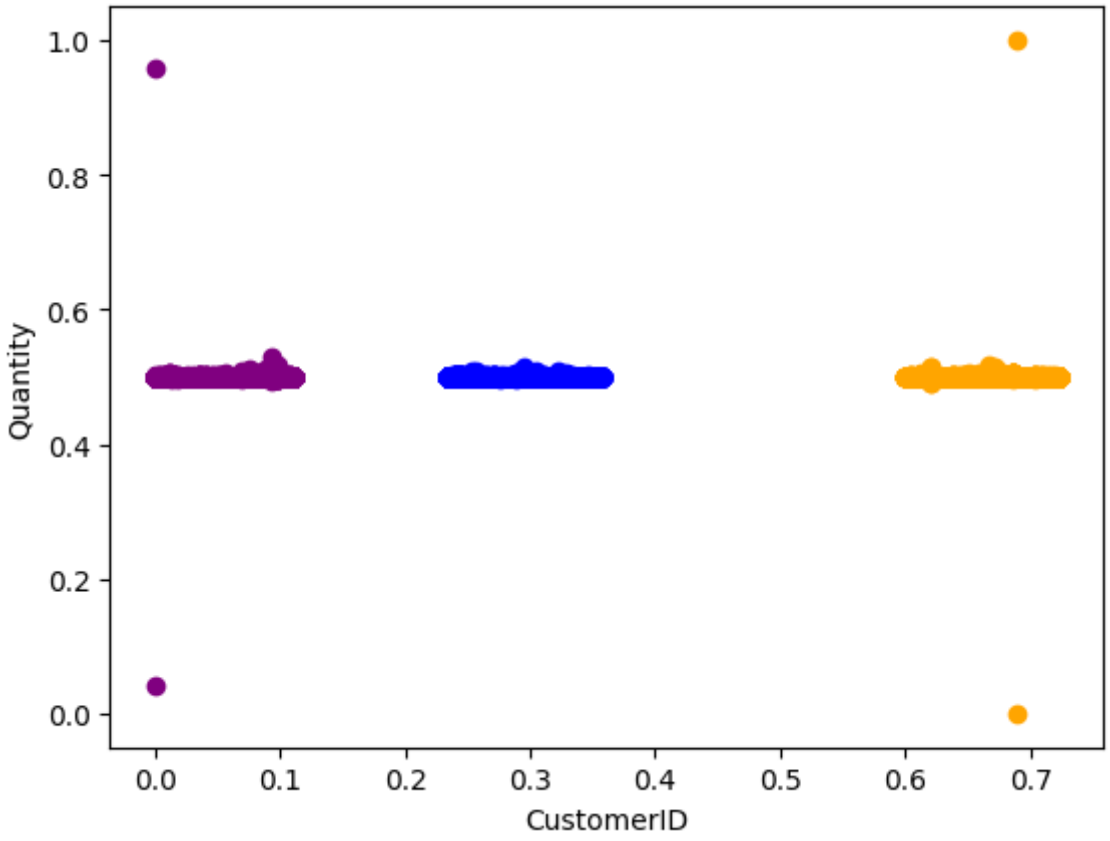
	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	0.500037	01-12-2010 08:26	2.55	0.926443	United Kingdom
1	536365	71053	WHITE METAL LANTERN	0.500037	01-12-2010 08:26	3.39	0.926443	United Kingdom
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	0.500049	01-12-2010 08:26	2.75	0.926443	United Kingdom
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	0.500037	01-12-2010 08:26	3.39	0.926443	United Kingdom
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	0.500037	01-12-2010 08:26	3.39	0.926443	United Kingdom

In [25]:

```
df1=df[df["New Cluster"]==0]
df2=df[df["New Cluster"]==1]
df3=df[df["New Cluster"]==2]
plt.scatter(df1["CustomerID"],df1["Quantity"],color="orange")
plt.scatter(df2["CustomerID"],df2["Quantity"],color="purple")
plt.scatter(df3["CustomerID"],df3["Quantity"],color="blue")
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[25]:

```
Text(0, 0.5, 'Quantity')
```



In [26]:

```
km.cluster_centers_
```

Out[26]:

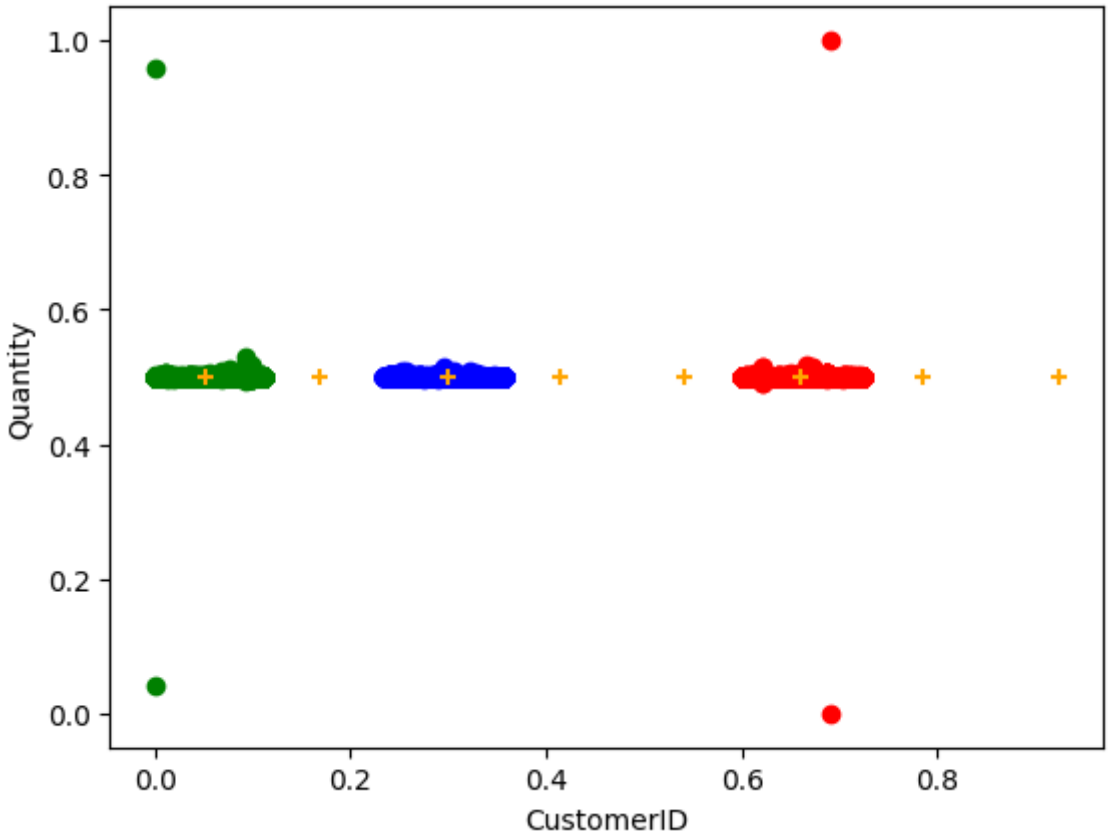
```
array([[0.66021756, 0.50007288],
       [0.05248778, 0.50009081],
       [0.3001765 , 0.50007519],
       [0.92346373, 0.50007492],
       [0.78566544, 0.50006577],
       [0.5402319 , 0.50006349],
       [0.16832212, 0.50008096],
       [0.41398774, 0.50007298]])
```

In [27]:

```
df1=df[df["New Cluster"]==0]
df2=df[df["New Cluster"]==1]
df3=df[df["New Cluster"]==2]
plt.scatter(df1["CustomerID"],df1["Quantity"],color="red")
plt.scatter(df2["CustomerID"],df2["Quantity"],color="green")
plt.scatter(df3["CustomerID"],df3["Quantity"],color="blue")
plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:,1],color="orange",marker="+")
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[27]:

```
Text(0, 0.5, 'Quantity')
```



In [28]:

```
k_rng=range(1,10)
sse=[]
```

In [29]:

```
for k in k_rng:
 km=KMeans(n_clusters=k)
 km.fit(df[["CustomerID","Quantity"]])
 sse.append(km.inertia_)
#km.inertia_ will give you the value of sum of square error
print(sse)
plt.plot(k_rng,sse)
plt.xlabel("K")
plt.ylabel("Sum of Squared Error")
```

```
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
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C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
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\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
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\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
C:\Users\mural\AppData\Local\Programs\Python\Python311\Lib\site-packages
\sklearn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_i
nit` will change from 10 to 'auto' in 1.4. Set the value of `n_init` expl
icitly to suppress the warning
  warnings.warn(
```
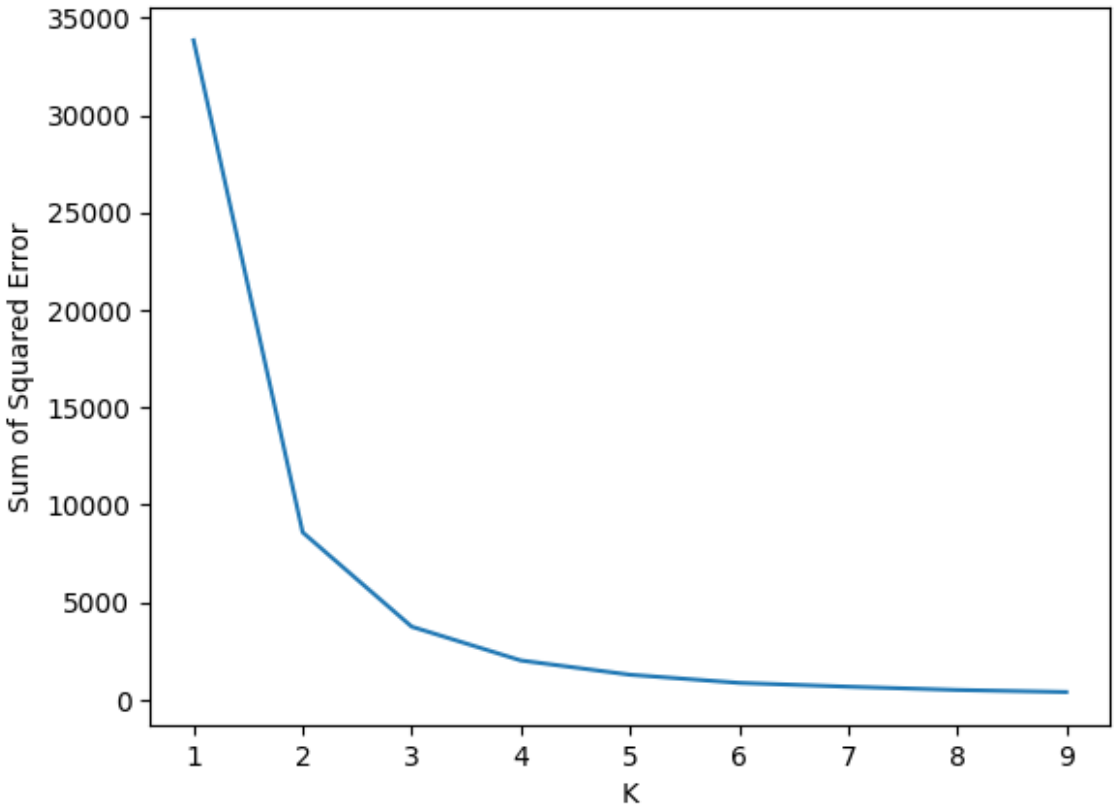

```
[33847.22708730174, 8593.16785431243, 3752.028137352341, 2018.32753197836
88, 1286.7654501526517, 868.9847602905056, 672.465994059463, 504.01120362
08818, 398.06892209931203]
```

Out[29]:

```
Text(0, 0.5, 'Sum of Squared Error')
```



For the given dataset we use K-means Clustering and done the groupingbased on the given data.In the above dataset we will take customer id andquantity based on that we make the clusters. When the K-value is low errorrate is more and the K-value is high error rate is very high. So,finally we canConclude the above dataset is bestfit for K-Means.

In [ ]: