Project - 5 (DATASET: Online Retail) Thetransactions made by a UK-based, registered,non-store online retailer between December 1,2010, and December 9,2011, are all included inthe transnational data set known as onlineretail. The company primarily offers one-ofa-kind gifts for every occasion. The companyhas a large number of wholesalers asclients.Company ObjectiveUsing the global online retail dataset, we will design a clusteringmodel and select the ideal group of clients forthe business to target.

In [1]:
```
import pandas as pd
from matplotlib import pyplot as plt
%matplotlib inline
```

In [3]:
```
df=pd.read_csv(r"C:\Users\manasa\Downloads\OnlineRetail1.csv")
df
```

Out[3]:

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

541909 rows × 8 columns

In [4]:
```
df.head()
```

Out[4]:

	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 [5]:
```
df.tail()
```

Out[5]:

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

In [6]:
```
df.shape
```

Out[6]: (541909, 8)

In [7]:
```
df.describe
```

Out[7]:
```
<bound method NDFrame.describe of        InvoiceNo StockCode
Description  Quantity
0         536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER         6  \
1         536365     71053                  WHITE METAL LANTERN         6
2         536365    84406B       CREAM CUPID HEARTS COAT HANGER         8
3         536365    84029G  KNITTED UNION FLAG HOT WATER BOTTLE         6
4         536365    84029E       RED WOOLLY HOTTIE WHITE HEART.         6
...          ...       ...                                  ...       ...
541904    581587     22613          PACK OF 20 SPACEBOY NAPKINS        12
541905    581587     22899         CHILDREN'S APRON DOLLY GIRL          6
541906    581587     23254        CHILDRENS CUTLERY DOLLY GIRL          4
541907    581587     23255      CHILDRENS CUTLERY CIRCUS PARADE         4
541908    581587     22138        BAKING SET 9 PIECE RETROSPOT          3

             InvoiceDate  UnitPrice  CustomerID         Country
0       01-12-2010 08:26       2.55     17850.0  United Kingdom
1       01-12-2010 08:26       3.39     17850.0  United Kingdom
2       01-12-2010 08:26       2.75     17850.0  United Kingdom
3       01-12-2010 08:26       3.39     17850.0  United Kingdom
4       01-12-2010 08:26       3.39     17850.0  United Kingdom
...                  ...        ...         ...             ...
541904  09-12-2011 12:50       0.85     12680.0          France
541905  09-12-2011 12:50       2.10     12680.0          France
541906  09-12-2011 12:50       4.15     12680.0          France
541907  09-12-2011 12:50       4.15     12680.0          France
541908  09-12-2011 12:50       4.95     12680.0          France

[541909 rows x 8 columns]>
```

In [8]:
```
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 [9]:
```
df.isnull().sum()
```

Out[9]:
```
InvoiceNo          0
StockCode          0
Description     1454
Quantity           0
InvoiceDate        0
UnitPrice          0
CustomerID     135080
Country            0
dtype: int64
```

In [10]:
```
df.fillna(method='ffill',inplace=True)
```

In [11]:
```
df.isnull().sum()
```

Out[11]:
```
InvoiceNo      0
StockCode      0
Description    0
Quantity       0
InvoiceDate    0
UnitPrice      0
CustomerID     0
Country        0
dtype: int64
```

In [12]:
```
df['InvoiceNo'].value_counts()
```

Out[12]:
```
InvoiceNo
573585     1114
581219      749
581492      731
580729      721
558475      705
           ...
554023        1
554022        1
554021        1
554020        1
C558901       1
Name: count, Length: 25900, dtype: int64
```

In [13]:
```
df['CustomerID'].value_counts()
```

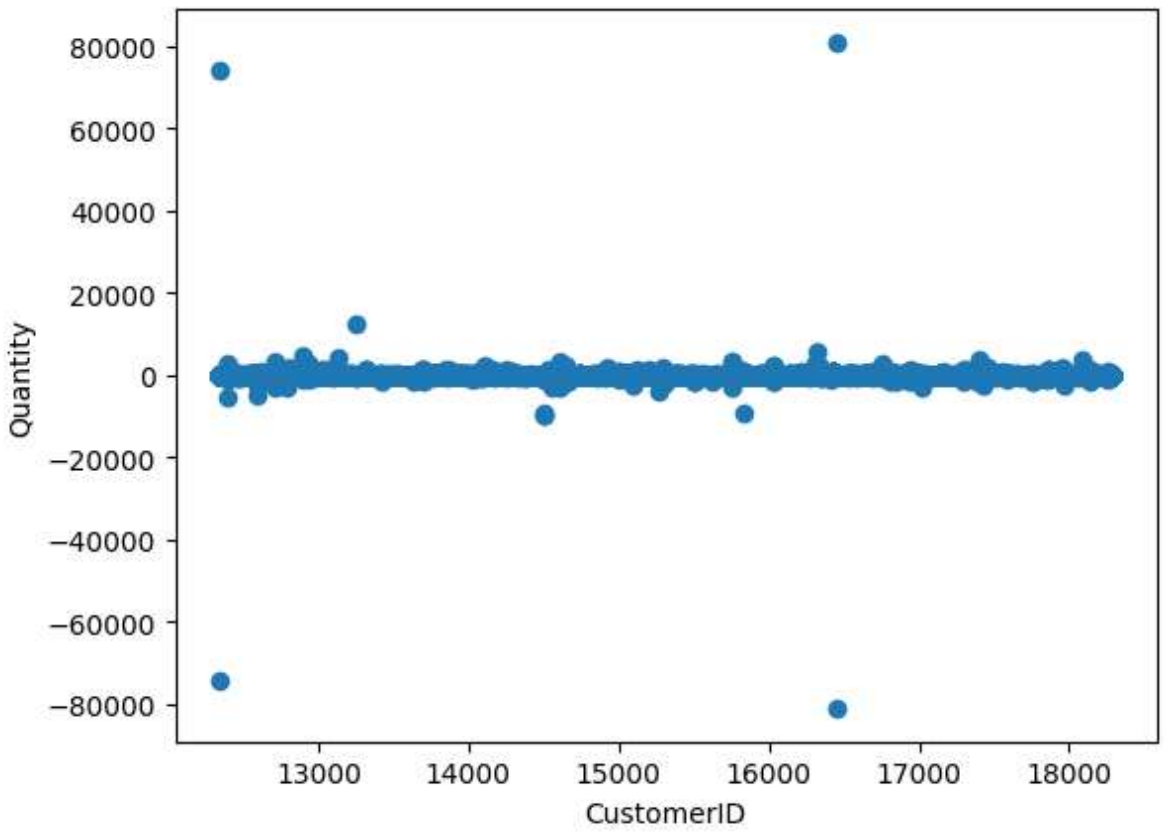
Out[13]:
```
CustomerID
17841.0    8644
14911.0    7648
12748.0    6134
14096.0    5412
14606.0    3952
           ...
15753.0       1
14424.0       1
15562.0       1
13302.0       1
17331.0       1
Name: count, Length: 4372, dtype: int64
```

In [14]:
```
df['Quantity'].value_counts()
```

Out[14]:
```
Quantity
 1        148227
 2         81829
 12        61063
 6         40868
 4         38484
           ...
-472           1
-161           1
-1206          1
-272           1
-80995         1
Name: count, Length: 722, dtype: int64
```

In [15]:
```
plt.scatter(df["CustomerID"],df["Quantity"])
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[15]:
```
Text(0, 0.5, 'Quantity')
```



In [16]:
```
from sklearn.cluster import KMeans
km=KMeans()
km
```

Out[16]:
```
KMeans()
```

In [17]:
```
y_predicted=km.fit_predict(df[["CustomerID","Quantity"]])
y_predicted
```

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

Out[17]:
```
array([4, 4, 4, ..., 2, 2, 2])
```

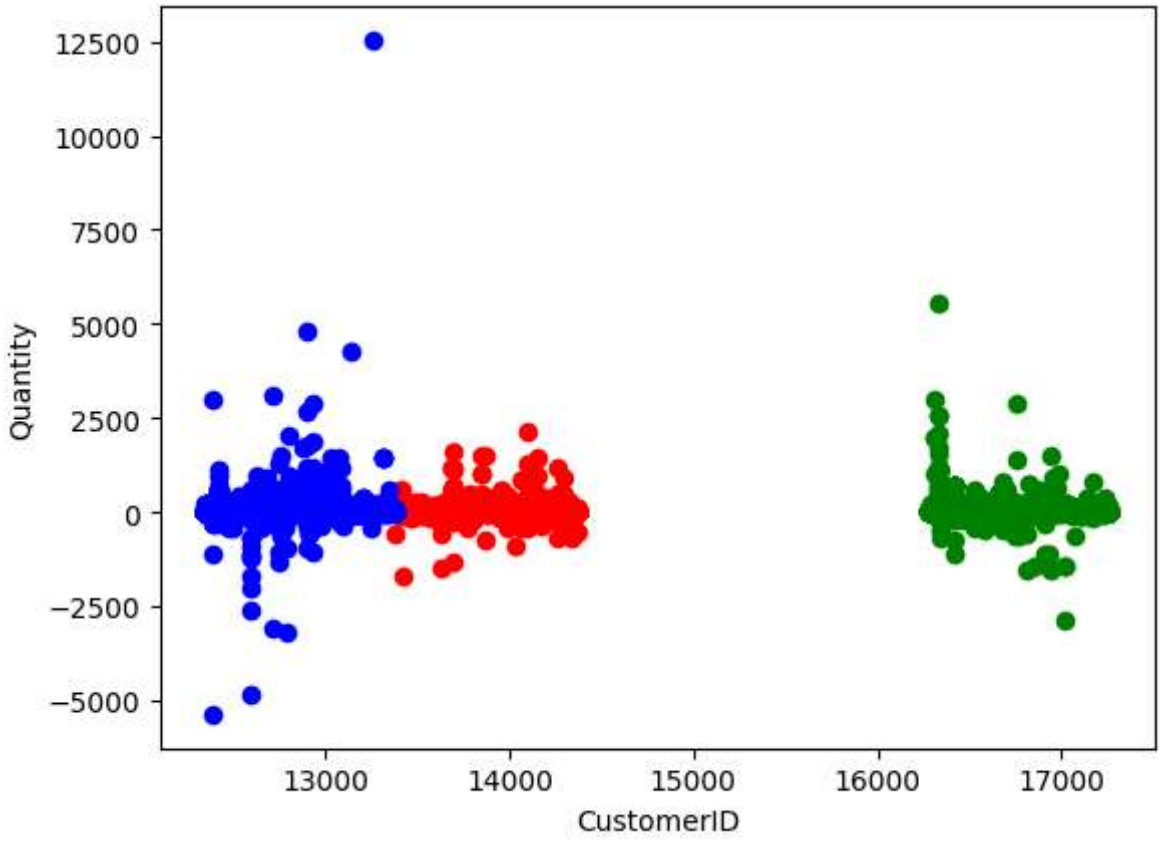
In [18]:
```
df["cluster"]=y_predicted
df.head()
```

Out[18]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country	cl
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="red")
plt.scatter(df2["CustomerID"],df2["Quantity"],color="green")
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	Country	c
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	0.500037	01-12-2010 08:26	2.55	17850.0	United Kingdom	
1	536365	71053	WHITE METAL LANTERN	0.500037	01-12-2010 08:26	3.39	17850.0	United Kingdom	
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	0.500049	01-12-2010 08:26	2.75	17850.0	United Kingdom	
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	0.500037	01-12-2010 08:26	3.39	17850.0	United Kingdom	
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	0.500037	01-12-2010 08:26	3.39	17850.0	United Kingdom	

In [21]:
```
scaler.fit(df[["CustomerID"]])
df["CustomerID"]=scaler.transform(df[["CustomerID"]])
df.head()
```

Out[21]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country	c
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	

K-MeansClustering

In [22]:
```
km=KMeans()
```

In [23]:
```
y_predicted=km.fit_predict(df[["CustomerID","Quantity"]])
y_predicted
```

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

Out[23]:
```
array([3, 3, 3, ..., 5, 5, 5])
```

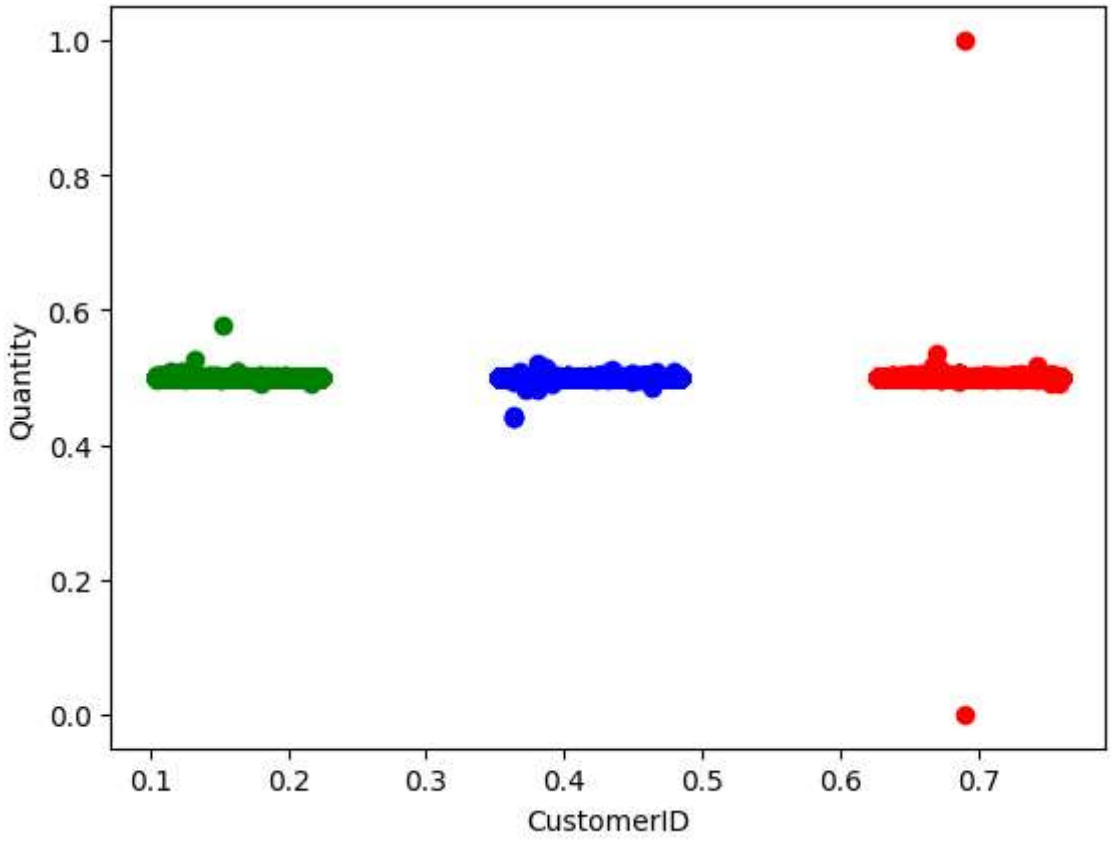
In [24]:
```
df["New Cluster"]=y_predicted
df.head()
```

Out[24]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country	c
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	

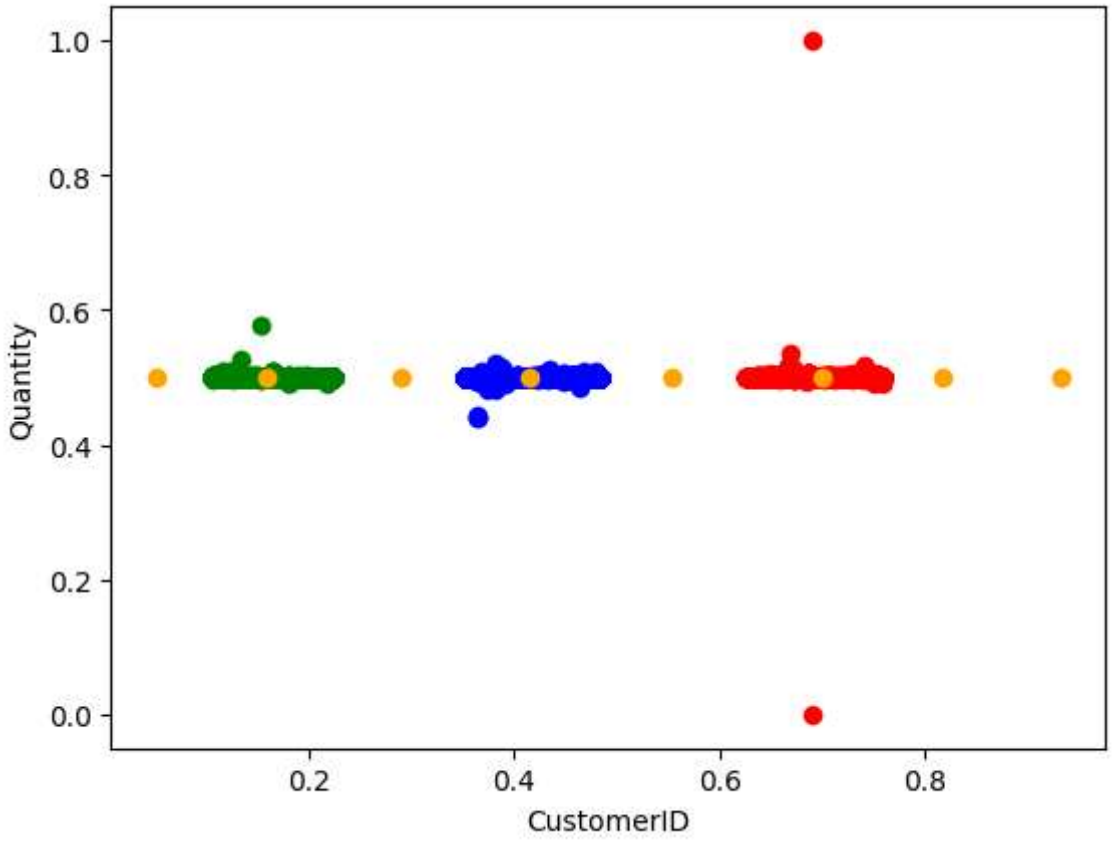
In [25]:
```
df1=df[df["New Cluster"]==0]
df2=df[df["New Cluster"]==1]
df3=df[df["New Cluster"]==2]
plt.scatter(df1["CustomerID"],df1["Quantity"],color="red")
plt.scatter(df2["CustomerID"],df2["Quantity"],color="green")
plt.scatter(df3["CustomerID"],df3["Quantity"],color="blue")
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[25]:
```
Text(0, 0.5, 'Quantity')
```



In [26]:
```
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")
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[26]:
```
Text(0, 0.5, 'Quantity')
```



In [27]:
```
k_rng=range(1,10)
sse=[]
```

In [28]:
```
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 errorprint(sse)
plt.plot(k_rng,sse)
plt.xlabel("K")
plt.ylabel("Sum of Squared Error")
```

```
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
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earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
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ppress the warning
  warnings.warn(
C:\Users\manasa\AppData\Local\Programs\Python\Python311\Lib\site-packages\skl
earn\cluster\_kmeans.py:870: FutureWarning: The default value of `n_init` wil
l change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to su
ppress the warning
  warnings.warn(
```
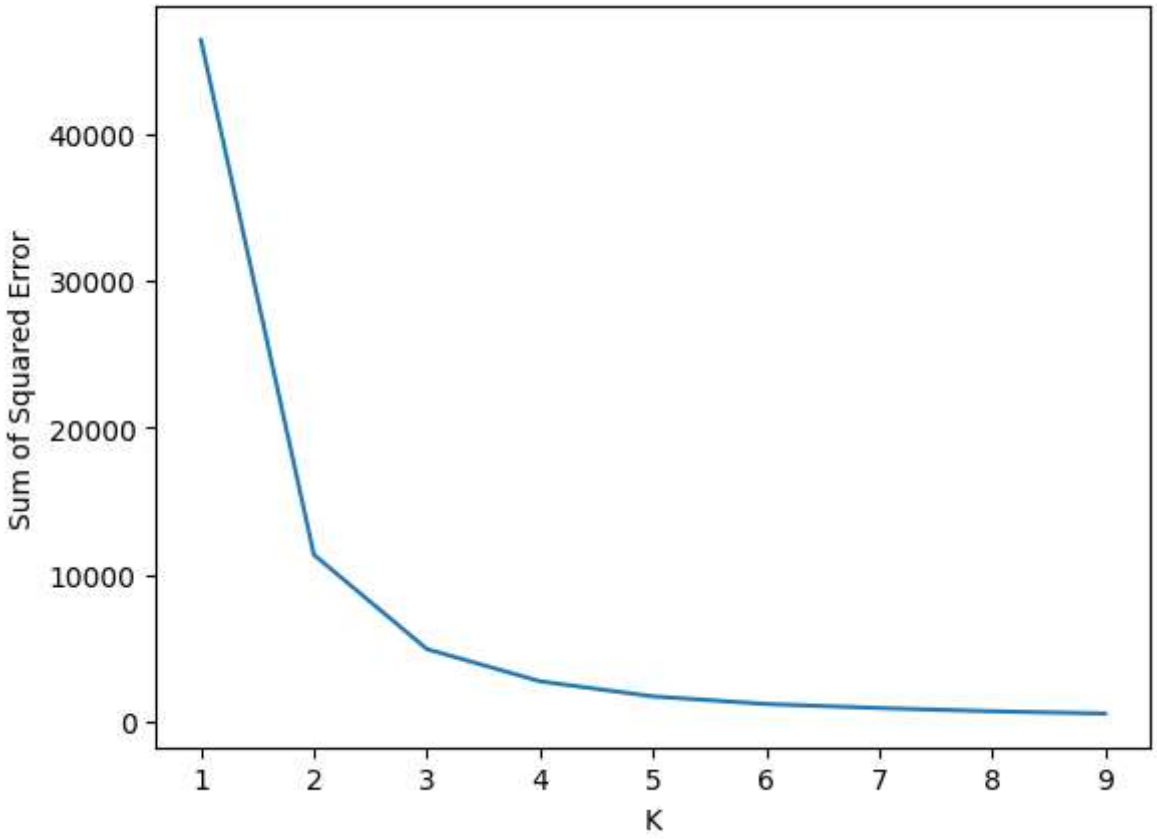

Out[28]:
```
Text(0, 0.5, 'Sum of Squared Error')
```



CONCLUSION

For the given dataset we use K-meansClustering and done the grouping based on thegiven data.In the above dataset we will takecustomer id and quantity based on that wemake the clusters. When the K-value is abovedataset we will take customer id and quantitybased on that we make the clusters dataset isbestfit for K-Means.

In [ ]: