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

In [2]:

```
import pandas as pd
from matplotlib import pyplot as plt
%matplotlib inline
```

In [3]:

```
df=pd.read_csv(r"C:\Users\chinta pavani\Documents\OnlineRetail1.csv")
df
```

Out[3]:

	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

In [4]:

```
df.head()
```

Out[4]:

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

In [5]:

```
df.tail()
```

Out[5]:

	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 [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 [14]:
```
df.fillna(method='ffill',inplace=True)
```

In [15]:
```
df.isnull().sum()
```

Out[15]:
```
InvoiceNo      0
StockCode      0
Description    0
Quantity       0
InvoiceDate    0
UnitPrice      0
CustomerID     0
Country        0
dtype: int64
```

In [11]:
```
df['InvoiceNo'].value_counts()
```

Out[11]:
```
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 [10]:

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

Out[10]:

```
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 [12]:

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

Out[12]:

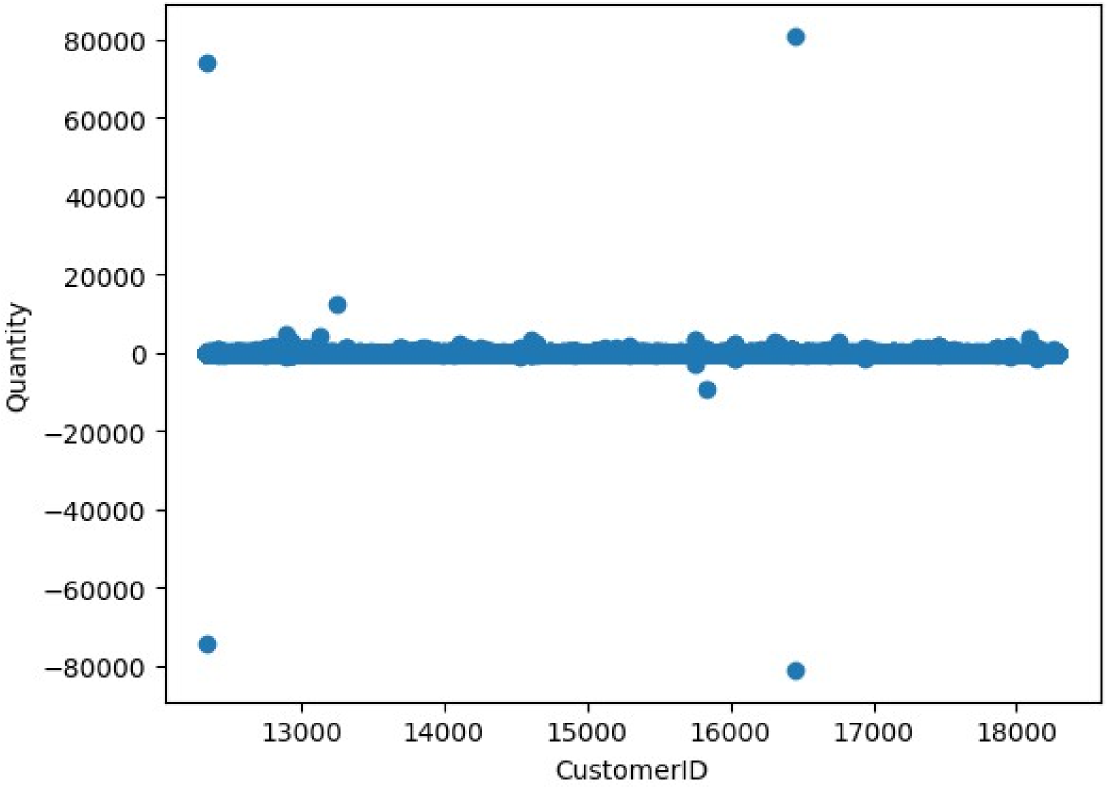
```
Quantity
 1        148227
 2         81829
 12        61063
 6         40868
 4         38484
           ...  
-472           1
-161           1
-1206          1
-272           1
-80995         1
Name: count, Length: 722, dtype: int64
```

In [13]:

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

Out[13]:

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



In [16]:

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

Out[16]:

```
▾ KMeans

KMeans()
```

In [17]:

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

```
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
```

Out[17]:

```
array([1, 1, 1, ..., 6, 6, 6])
```

In [18]:

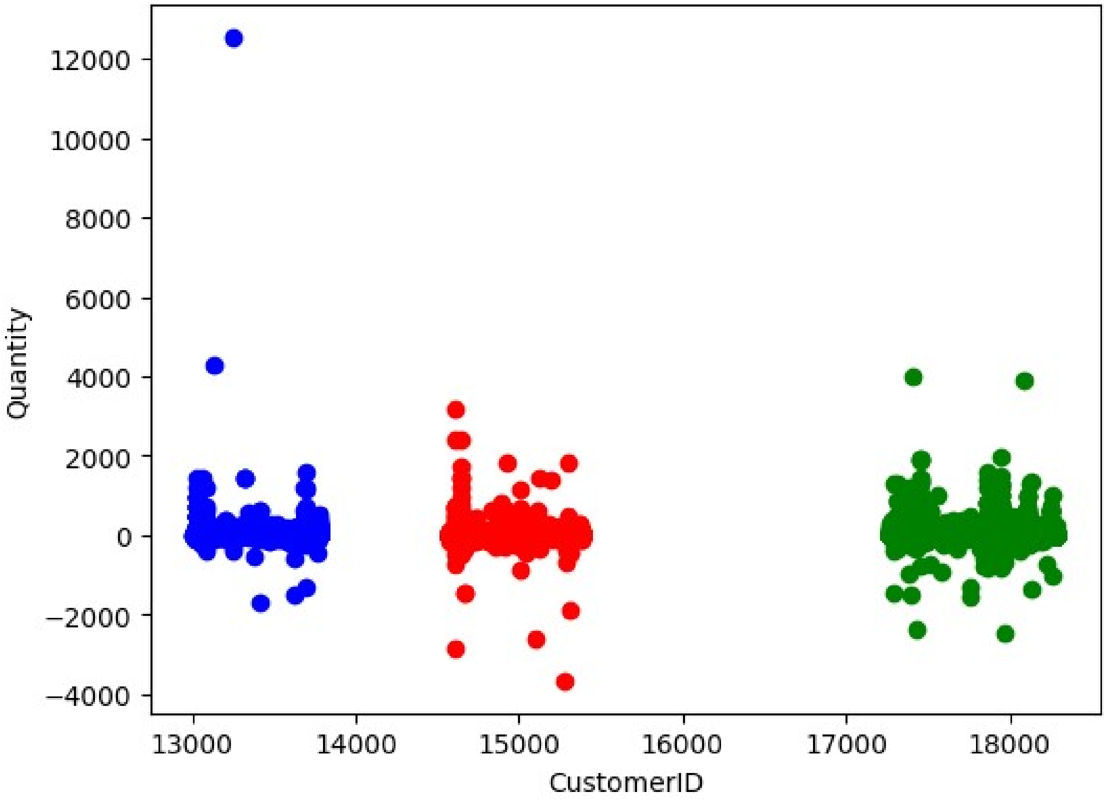
```
df["cluster"]=y_predicted
df.head()
```

Out[18]:

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

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

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

Out[21]:

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

K-MeansClustering

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

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

```
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
```

Out[23]:
```
array([3, 3, 3, ..., 6, 6, 6])
```

In [24]:

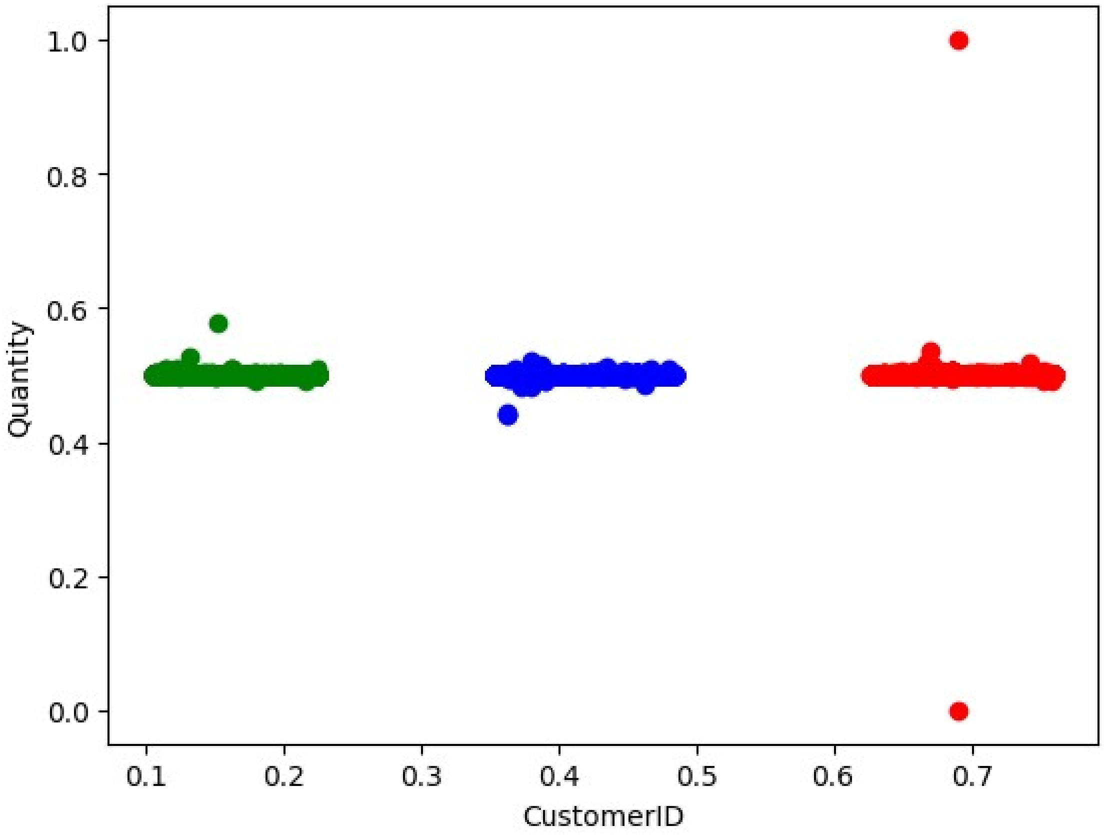
```
df["New Cluster"]=y_predicted
df.head()
```

Out[24]:

	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	0.926443	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	0.500037	01-12-2010 08:26	3.39	0.926443	Unite Kingdo
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	0.500049	01-12-2010 08:26	2.75	0.926443	Unite Kingdo
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	0.500037	01-12-2010 08:26	3.39	0.926443	Unite Kingdo
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	0.500037	01-12-2010 08:26	3.39	0.926443	Unite Kingdo

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')
```

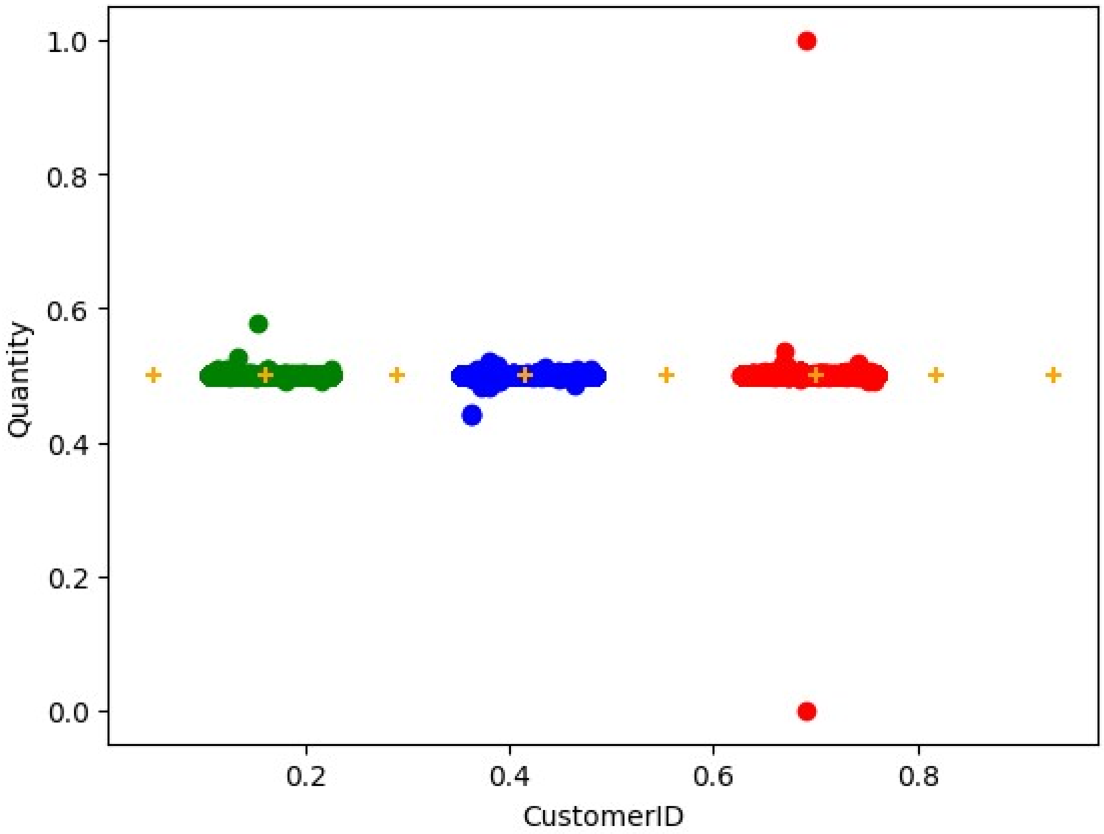


In [26]:

```
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="orang
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[26]:

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



In [27]:

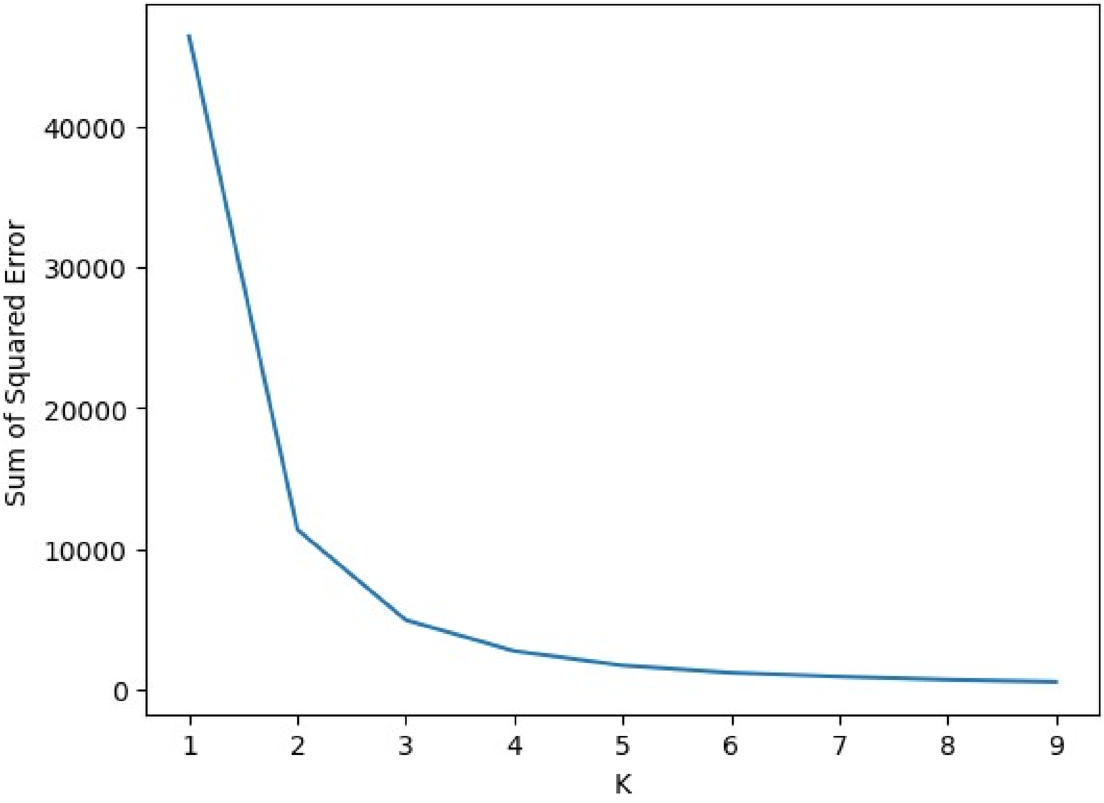
```
k_rng=range(1,10)
sse=[]
```

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 error
print(sse)
plt.plot(k_rng,sse)
plt.xlabel("K")
plt.ylabel("Sum of Squared Error")
```

```
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
C:\Users\chinta pavani\AppData\Local\Programs\Python\Python311\Lib\site-p
ackages\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_ini
t` explicitly to suppress the warning
  warnings.warn(
[46374.84553398485, 11336.065820168866, 4921.06838404593, 2723.5053916362
754, 1695.0392229312758, 1178.6080833990227, 902.5787504264805, 677.30465
06461086, 528.8251995247878]
```

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



CONCLUSION

For the given dataset we use K-means Clustering and done the grouping based on the given data.In the above dataset we will take customer id and quantity based on that we make the clusters. When the K-value is above dataset we will take customer id and quantity based on that we make the clusters dataset is bestfit for K-Means.

```
In [ ]:
```