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.

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

```python
In [2]: df=pd.read_csv(r"C:\Users\Sudheer\OneDrive\Documents\retail.csv")
        df
```

Out[2]:

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

541909 rows × 8 columns

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

In [5]: `df['InvoiceNo'].value_counts()`

Out[5]:
```
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 [6]: `df['CustomerID'].value_counts()`

Out[6]:
```
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 [7]: `df['Quantity'].value_counts()`

Out[7]:
```
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 [8]:
```python
plt.scatter(df["CustomerID"],df["Quantity"])
plt.xlabel("CustomerID")
plt.ylabel("Quantity")
```

Out[8]: Text(0, 0.5, 'Quantity')
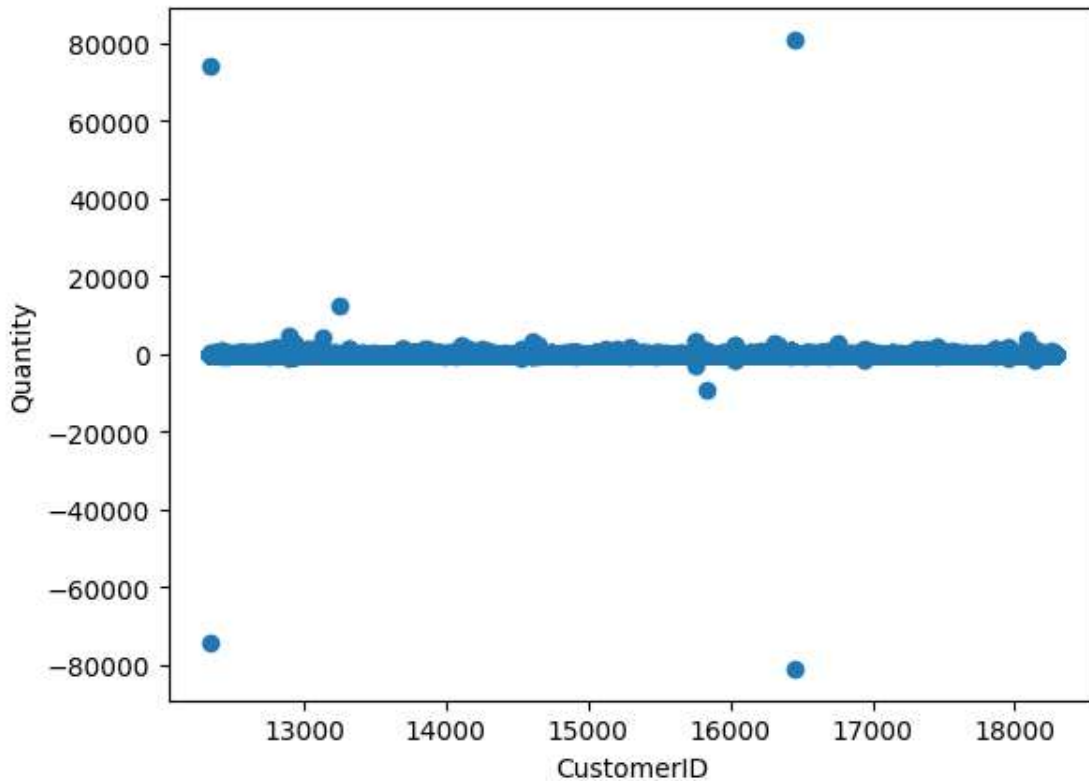
In [9]:
```python
df.info()
```

```
<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 [10]:
```python
df.isnull().sum()
```

Out[10]:
```
InvoiceNo            0
StockCode            0
Description       1454
Quantity             0
InvoiceDate          0
UnitPrice            0
CustomerID      135080
Country              0
dtype: int64
```

In [11]:
```python
df.fillna(method='ffill',inplace=True)
```

In [12]:
```python
df.isnull().sum()
```

Out[12]:
```
InvoiceNo       0
StockCode       0
Description     0
Quantity        0
InvoiceDate     0
UnitPrice       0
CustomerID      0
Country         0
dtype: int64
```

In [13]:
```python
from sklearn.cluster import KMeans
km=KMeans()
km
```

Out[13]:
```
▾ KMeans
KMeans()
```

In [14]:
```python
y_predicted=km.fit_predict(df[["CustomerID","Quantity"]])
y_predicted
```

```
C:\Users\Sudheer\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\clu
ster\_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[14]: array([3, 3, 3, ..., 4, 4, 4])

In [15]:
```python
df["cluster"]=y_predicted
df.head()
```
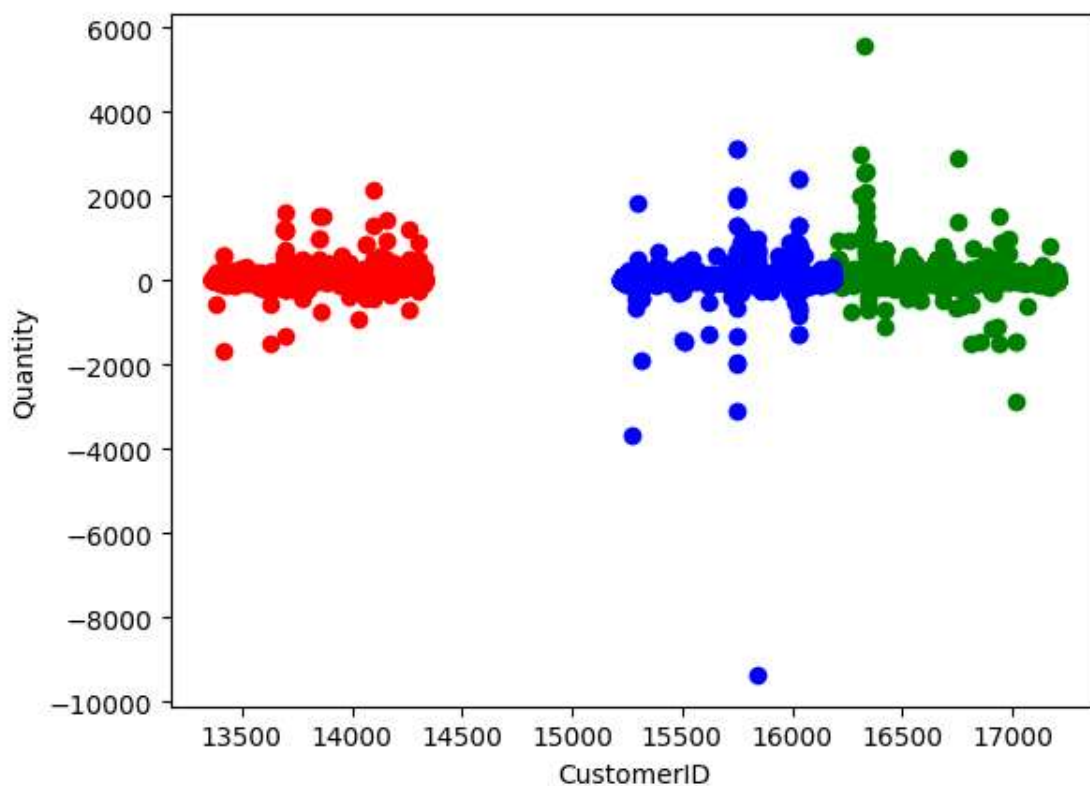
Out[15]:

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

In [16]:
```python
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[16]: Text(0, 0.5, 'Quantity')

In [17]:
```python
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler()
scaler.fit(df[["Quantity"]])
df["Quantity"]=scaler.transform(df[["Quantity"]])
df.head()
```

Out[17]:

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

In [18]:
```python
scaler.fit(df[["CustomerID"]])
df["CustomerID"]=scaler.transform(df[["CustomerID"]])
df.head()
```

Out[18]:

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

K-Means Clustering

In [19]:
```python
km=KMeans()
```

In [20]:
```python
y_predicted=km.fit_predict(df[["CustomerID","Quantity"]])
y_predicted
```

C:\Users\Sudheer\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\clu
ster_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[20]: array([0, 0, 0, ..., 2, 2, 2])

In [21]:
```python
df["New Cluster"]=y_predicted
df.head()
```

Out[21]:

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

In [22]:
```python
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[22]: Text(0, 0.5, 'Quantity')
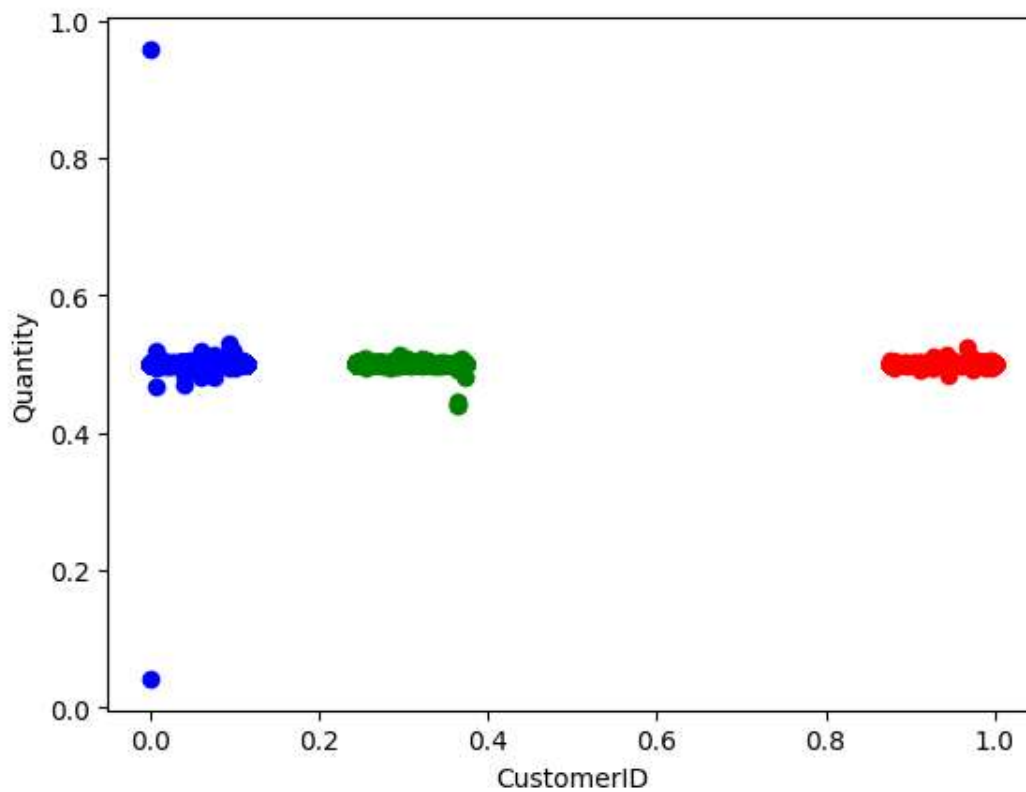
In [23]:
```python
km.cluster_centers_
```

Out[23]:
```
array([[0.93301334, 0.50005098],
       [0.31260094, 0.50005419],
       [0.05391016, 0.50006707],
       [0.70359664, 0.50005854],
       [0.17388674, 0.50006029],
       [0.43328342, 0.50006691],
       [0.81849089, 0.5000603 ],
       [0.5664571 , 0.50005219]])
```

In [24]:
```python
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[24]: Text(0, 0.5, 'Quantity')
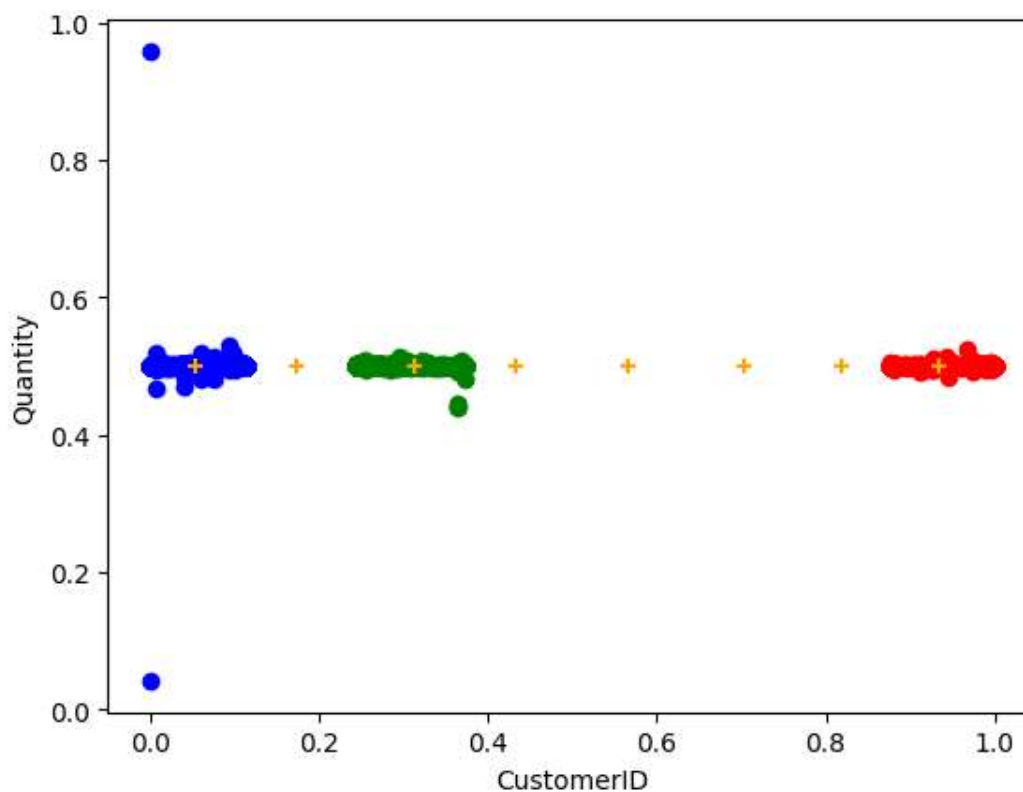
In [25]:
```python
k_rng=range(1,10)
sse=[]
```

In [26]:
```python
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\Sudheer\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\clu
ster_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(
C:\Users\Sudheer\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\clu
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  warnings.warn(
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ster_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(
C:\Users\Sudheer\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\clu
ster_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(
C:\Users\Sudheer\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\clu
ster_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(

[46374.84553398541, 11336.065820168738, 4921.706891841328, 2723.519105189502, 1695.040
5858458453, 1178.5923367697872, 902.5071226744774, 683.1748012251887, 528.466425727099
9]

Out[26]: Text(0, 0.5, 'Sum of Squared Error')
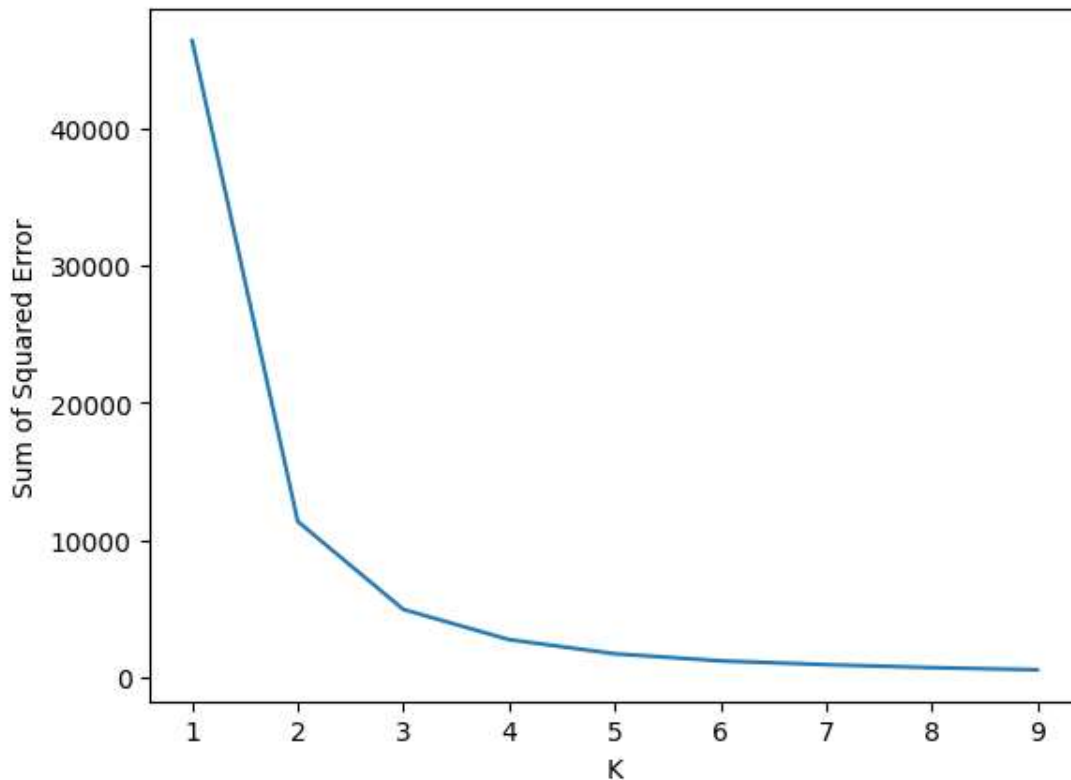
```
In [ ]:  for k in k_rng:
           km=KMeans(n_clusters=k)
           km.fit(df[["CustomerID","Quantity"]])
           sse.append(km.inertia_)
         #km.inertia_ will give you the value of sum of square error
         print(sse)
         plt.plot(k_rng,sse)
         plt.xlabel("K")
         plt.ylabel("Sum of Squared Error")
```

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 low error rate is more and the K-value is high error rate is very high. So,finally we can Conclude the above dataset is bestfit for K-Means.

```
In [ ]:
```