In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
data = pd.read_csv("C:/Users/Aditya Desai/Downloads/sales_data_sample.csv", enco
data.head()

# While utf-8 supports all languages according to pandas' documentation, utf-8 ha
```

Out[2]:

	ORDERNUMBER	QUANTITYORDERED	PRICEEACH	ORDERLINENUMBER	SALES	OR
0	10107	30	95.70	2	2871.00	2
1	10121	34	81.35	5	2765.90	
2	10134	41	94.74	2	3884.34	
3	10145	45	83.26	6	3746.70	8
4	10159	49	100.00	14	5205.27	10

5 rows × 25 columns

In [3]:
```
data.shape
```

Out[3]: (2823, 25)

In [4]:
```
# Number of NAN values per column in the dataset
data.isnull().sum
```

Out[4]:
```
<bound method DataFrame.sum of       ORDERNUMBER  QUANTITYORDERED  PRICEEACH  ORD
ERLINENUMBER  SALES  \
0           False            False      False            False  False
1           False            False      False            False  False
2           False            False      False            False  False
3           False            False      False            False  False
4           False            False      False            False  False
...           ...              ...        ...              ...    ...
2818        False            False      False            False  False
2819        False            False      False            False  False
2820        False            False      False            False  False
2821        False            False      False            False  False
2822        False            False      False            False  False

      ORDERDATE   STATUS   QTR_ID   MONTH_ID   YEAR_ID  ...  ADDRESSLINE1   \
0         False    False    False      False     False  ...          False
1         False    False    False      False     False  ...          False
2         False    False    False      False     False  ...          False
3         False    False    False      False     False  ...          False
4         False    False    False      False     False  ...          False
...         ...      ...      ...        ...       ...  ...            ...
2818      False    False    False      False     False  ...          False
2819      False    False    False      False     False  ...          False
2820      False    False    False      False     False  ...          False
2821      False    False    False      False     False  ...          False
2822      False    False    False      False     False  ...          False

      ADDRESSLINE2    CITY   STATE   POSTALCODE   COUNTRY   TERRITORY  \
0             True   False   False        False     False        True
1             True   False    True        False     False       False
2             True   False    True        False     False       False
3             True   False   False        False     False        True
4             True   False   False         True     False        True
...            ...     ...     ...          ...       ...         ...
2818          True   False    True        False     False       False
2819          True   False    True        False     False       False
2820          True   False    True        False     False       False
2821          True   False    True        False     False       False
2822          True   False   False        False     False        True

      CONTACTLASTNAME   CONTACTFIRSTNAME   DEALSIZE
0               False              False      False
1               False              False      False
2               False              False      False
3               False              False      False
4               False              False      False
...               ...                ...        ...
2818            False              False      False
2819            False              False      False
2820            False              False      False
2821            False              False      False
2822            False              False      False

[2823 rows x 25 columns]>
```

In [5]:
```
data.drop(["ORDERNUMBER", "PRICEEACH", "ORDERDATE", "PHONE", "ADDRESSLINE1", "ADD
```

In [6]:
```
data.head()
```

Out[6]:

	QUANTITYORDERED	ORDERLINENUMBER	SALES	STATUS	QTR_ID	MONTH_ID	YE
0	30	2	2871.00	Shipped	1	2	
1	34	5	2765.90	Shipped	2	5	
2	41	2	3884.34	Shipped	3	7	
3	45	6	3746.70	Shipped	3	8	
4	49	14	5205.27	Shipped	4	10	

In [7]:
```
data.isnull().sum()
```

Out[7]:
```
QUANTITYORDERED    0
ORDERLINENUMBER    0
SALES              0
STATUS             0
QTR_ID             0
MONTH_ID           0
YEAR_ID            0
PRODUCTLINE        0
MSRP               0
PRODUCTCODE        0
CUSTOMERNAME       0
COUNTRY            0
DEALSIZE           0
dtype: int64
```

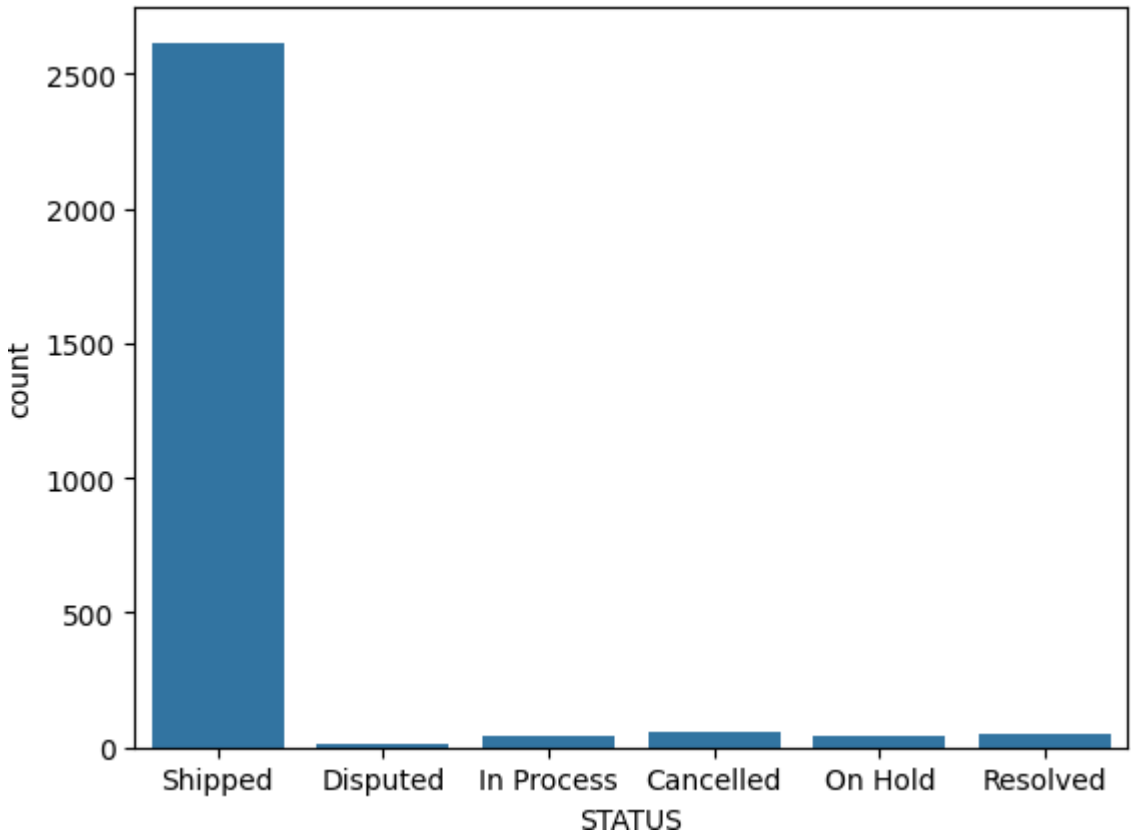
In [8]:
```
data.describe()
```

Out[8]:

	QUANTITYORDERED	ORDERLINENUMBER	SALES	QTR_ID	MONTH_I
count	2823.000000	2823.000000	2823.000000	2823.000000	2823.00000
mean	35.092809	6.466171	3553.889072	2.717676	7.09245
std	9.741443	4.225841	1841.865106	1.203878	3.65663
min	6.000000	1.000000	482.130000	1.000000	1.00000
25%	27.000000	3.000000	2203.430000	2.000000	4.00000
50%	35.000000	6.000000	3184.800000	3.000000	8.00000
75%	43.000000	9.000000	4508.000000	4.000000	11.00000
max	97.000000	18.000000	14082.800000	4.000000	12.00000

In [9]:
```
sns.countplot(data = data , x = 'STATUS')
```

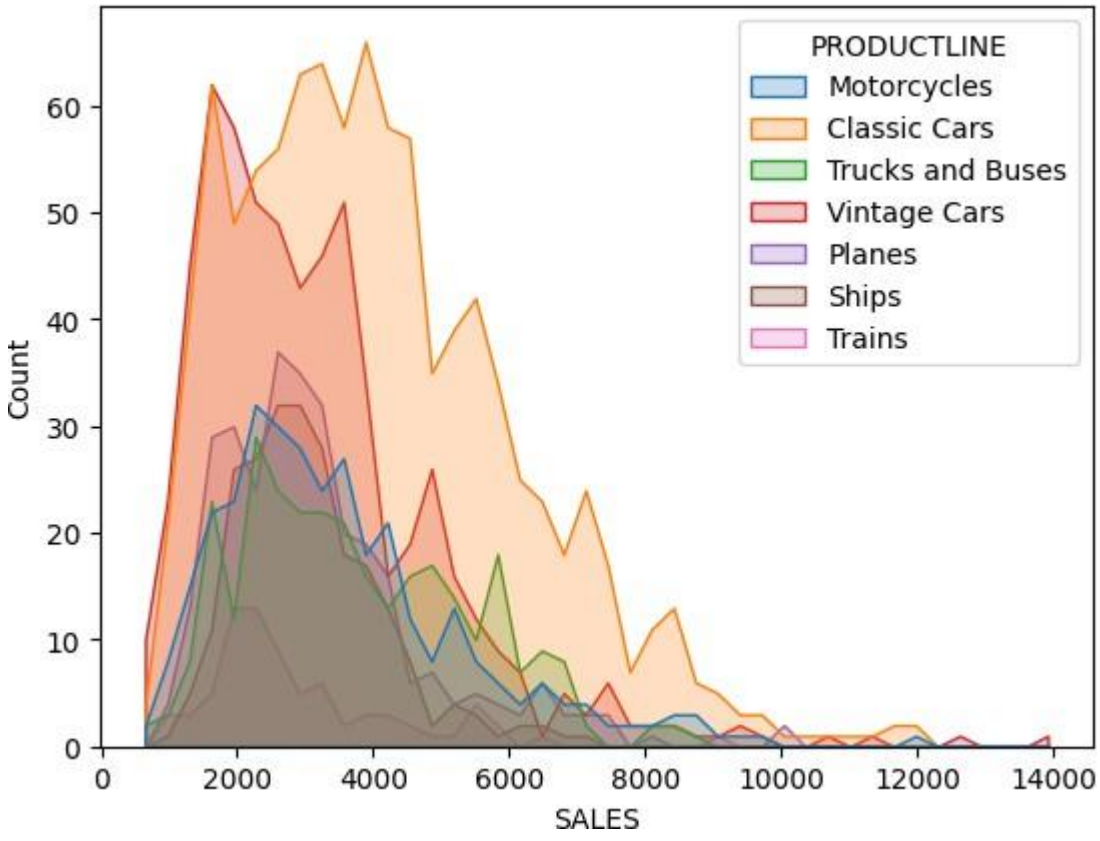
Out[9]:
```
<Axes: xlabel='STATUS', ylabel='count'>
```



In [10]:
```
import seaborn as sns
```

In [11]:
```
sns.histplot(x = 'SALES' , hue = 'PRODUCTLINE', data = data, element="poly")
```

Out[11]: <Axes: xlabel='SALES', ylabel='Count'>



In [12]:
```
data['PRODUCTLINE'].unique()
```

Out[12]:
```
array(['Motorcycles', 'Classic Cars', 'Trucks and Buses', 'Vintage Cars',
       'Planes', 'Ships', 'Trains'], dtype=object)
```

In [13]:
```
#checking the duplicated values
data.drop_duplicates(inplace=True)
```

In [14]:
```
data.info()
```

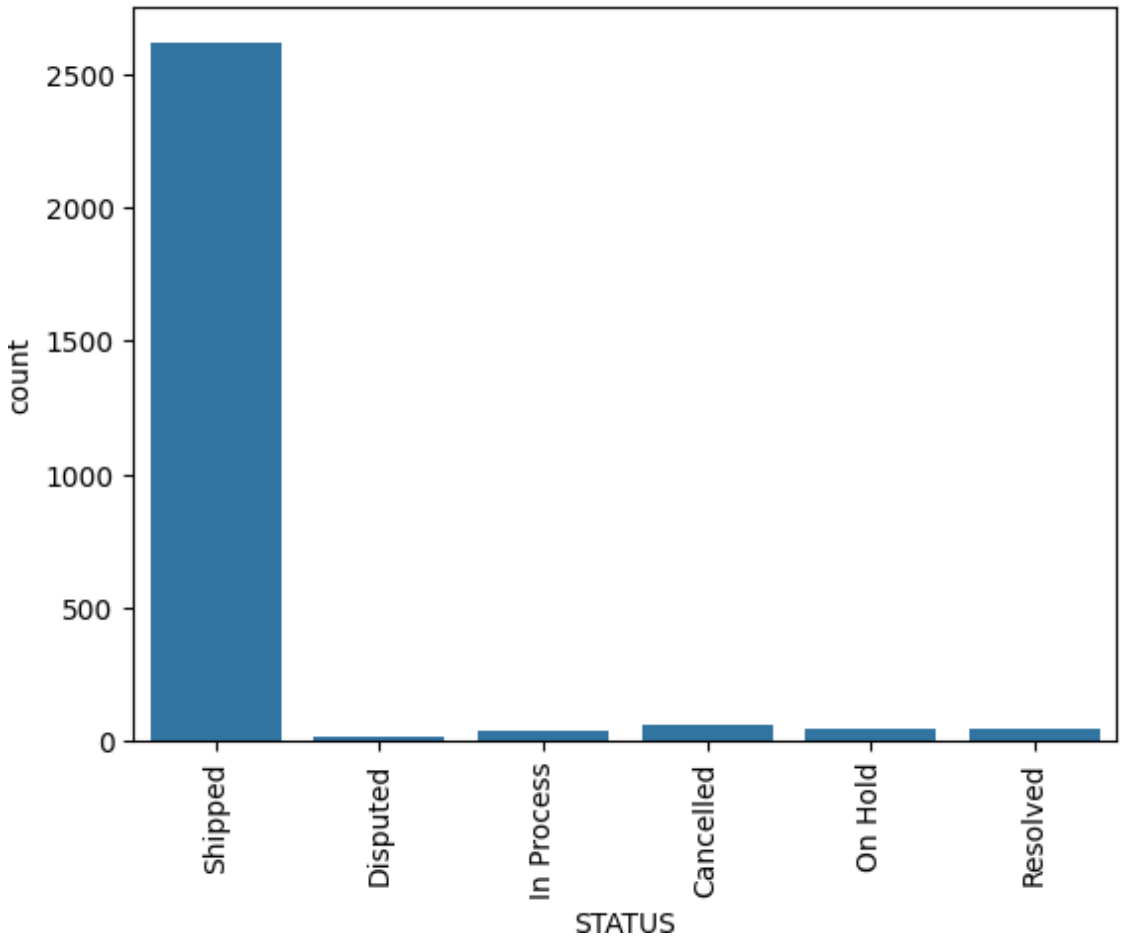
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2823 entries, 0 to 2822
Data columns (total 13 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   QUANTITYORDERED   2823 non-null   int64  
 1   ORDERLINENUMBER   2823 non-null   int64  
 2   SALES             2823 non-null   float64
 3   STATUS            2823 non-null   object 
 4   QTR_ID            2823 non-null   int64  
 5   MONTH_ID          2823 non-null   int64  
 6   YEAR_ID           2823 non-null   int64  
 7   PRODUCTLINE       2823 non-null   object 
 8   MSRP              2823 non-null   int64  
 9   PRODUCTCODE       2823 non-null   object 
 10  CUSTOMERNAME      2823 non-null   object 
 11  COUNTRY           2823 non-null   object 
 12  DEALSIZE          2823 non-null   object 
dtypes: float64(1), int64(6), object(6)
memory usage: 286.8+ KB
```

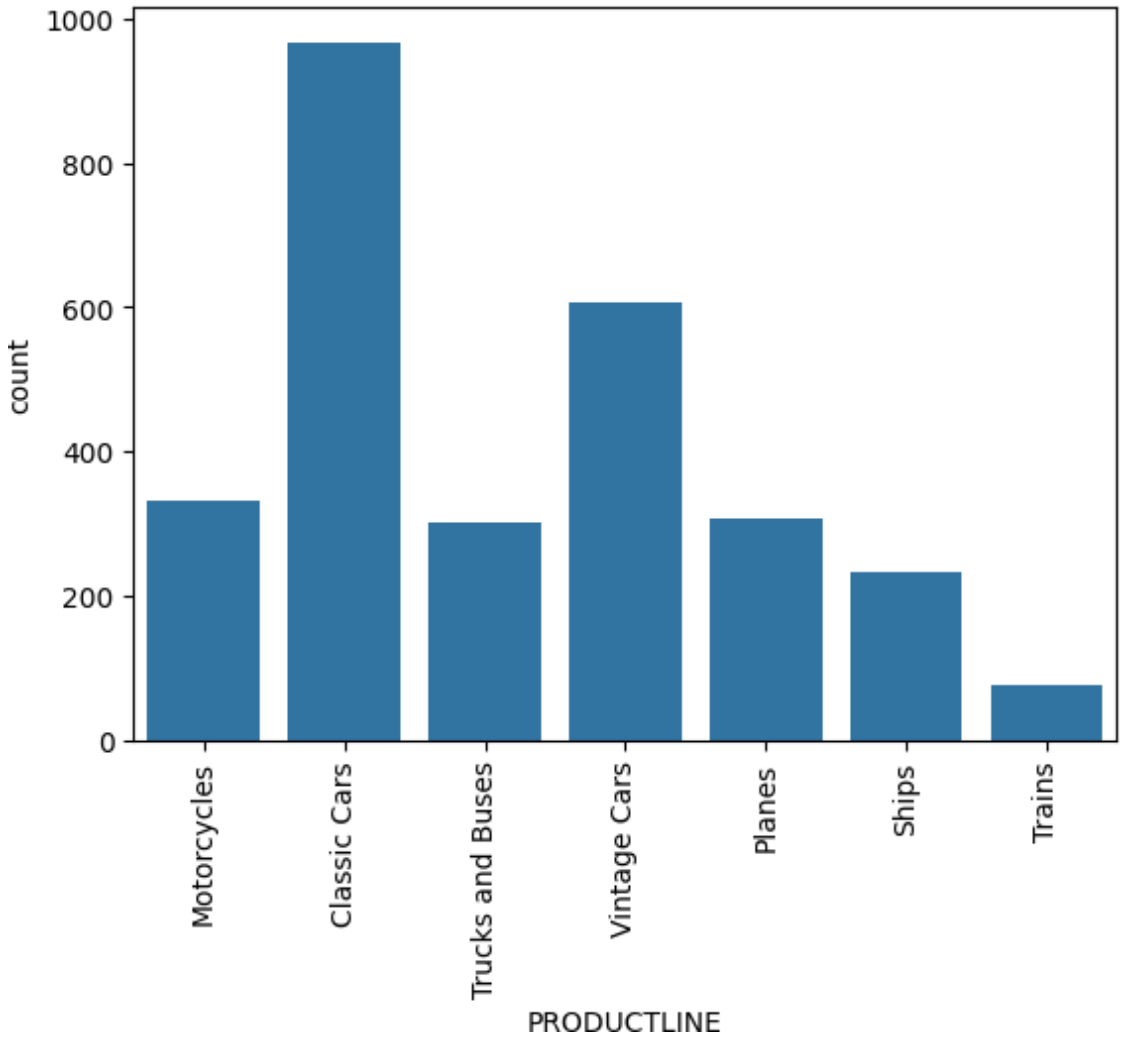
In [15]:
```
list_cat = data.select_dtypes(include=['object']).columns.tolist()
```

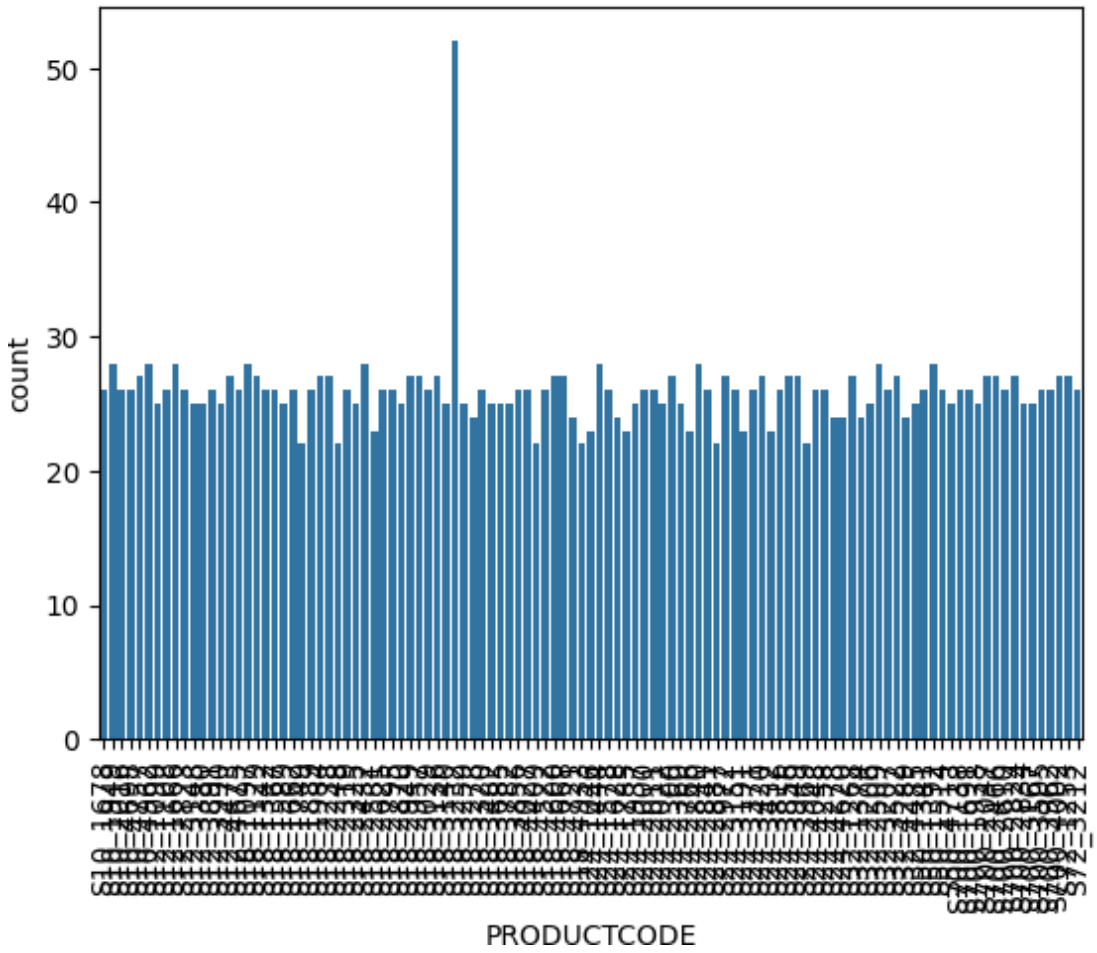
In [16]:
```
list_cat
```

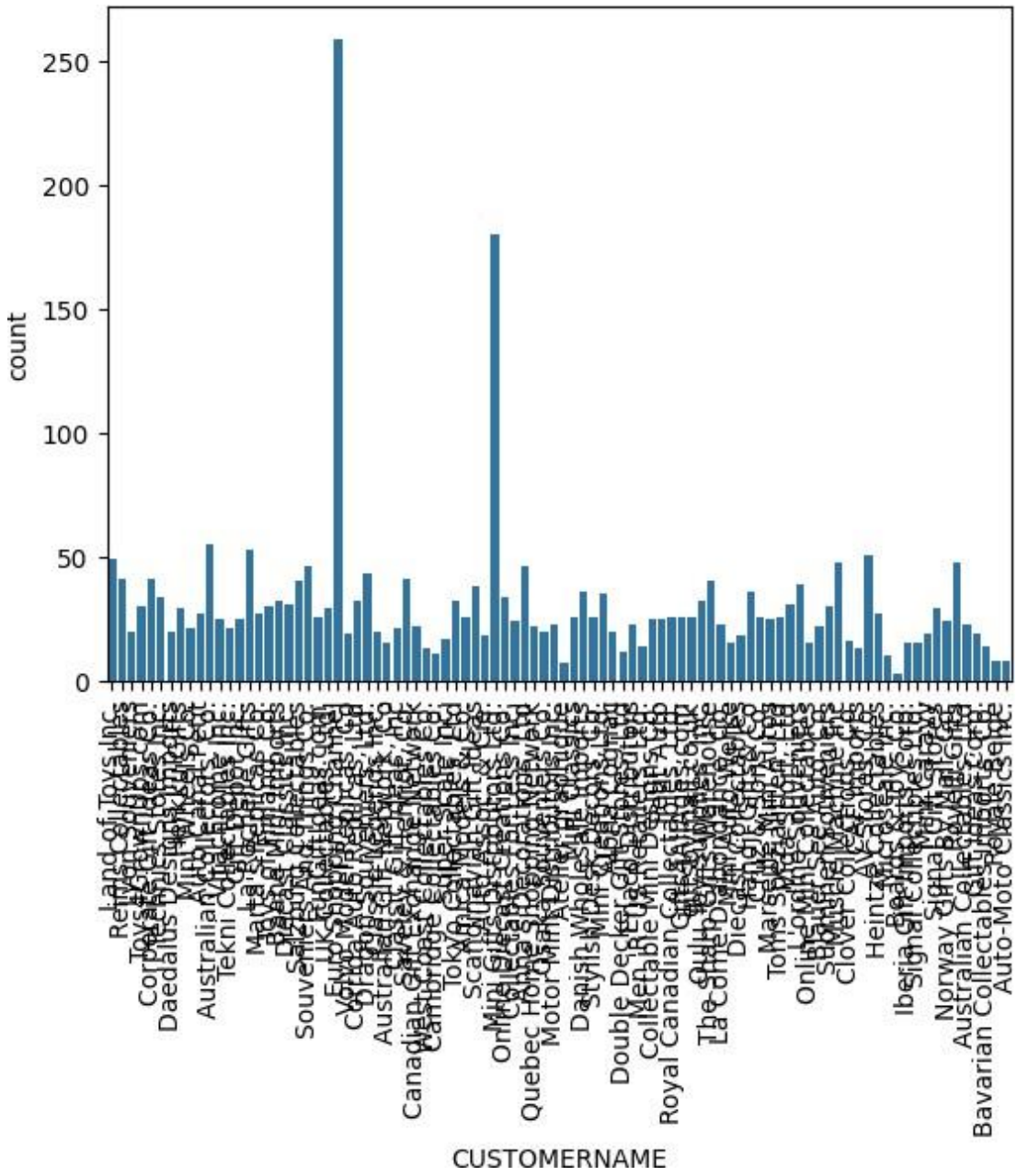
Out[16]:
```
['STATUS', 'PRODUCTLINE', 'PRODUCTCODE', 'CUSTOMERNAME', 'COUNTRY', 'DEALSIZE']
```

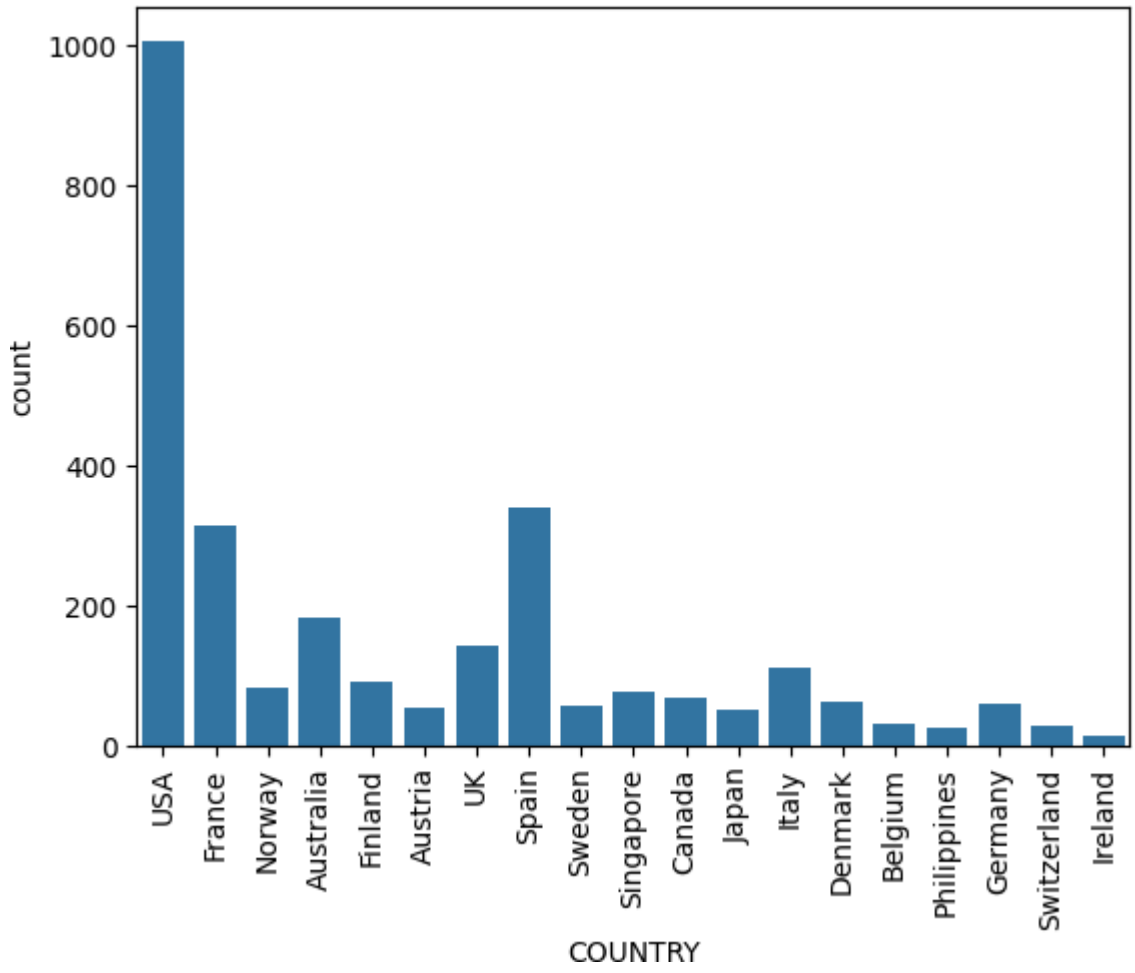
In [17]:
```
for i in list_cat:
  sns.countplot(data = data ,x = i)
  plt.xticks(rotation = 90)
  plt.show()
```

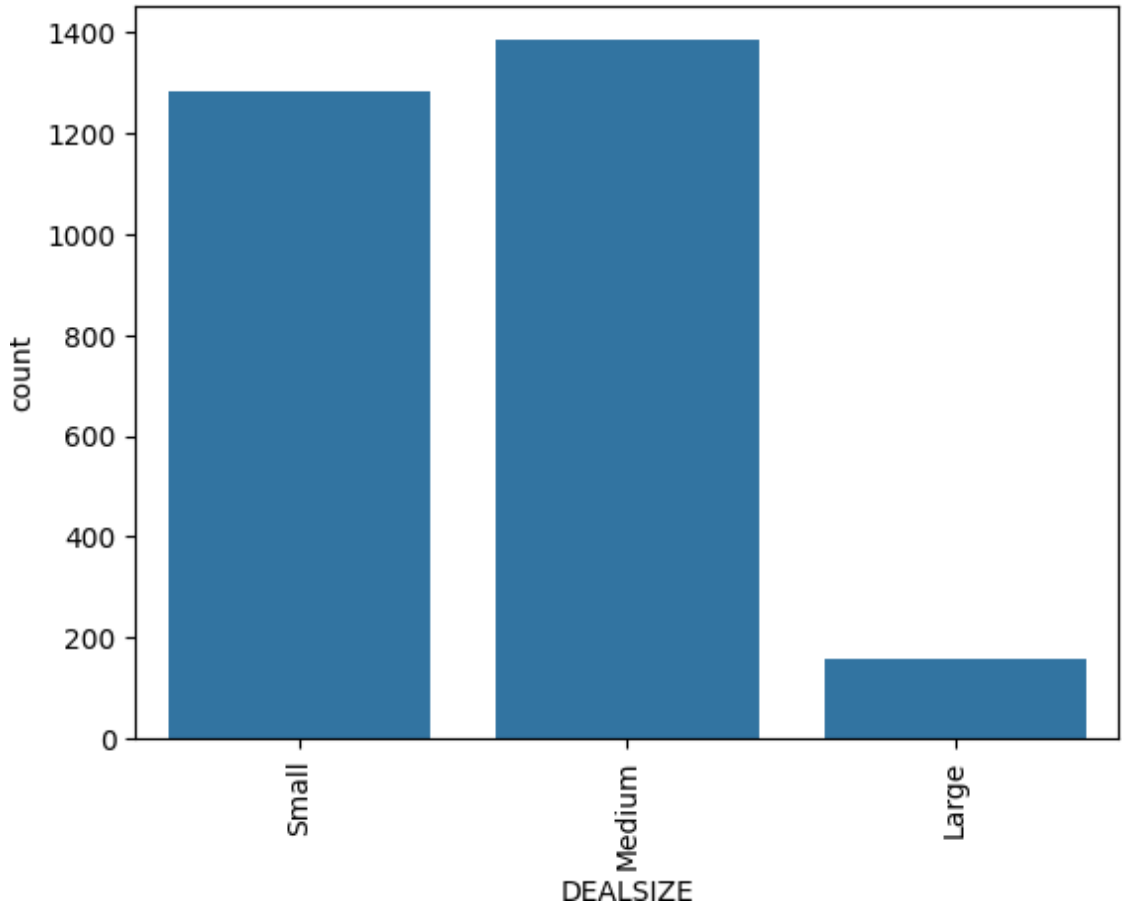

2500
2000
1500
1000
500
0
count
Shipped
Disputed
In Process
Cancelled
On Hold
Resolved
STATUS


1000
800
600
400
200
0
count
Motorcycles
Classic Cars
Trucks and Buses
Vintage Cars
Planes
Ships
Trains
PRODUCTLINE


50
40
30
20
10
0
count
PRODUCTCODE


250
200
150
100
50
0
count
CUSTOMERNAME


1000
800
600
400
200
0
count
USA
France
Norway
Australia
Finland
Austria
UK
Spain
Sweden
Singapore
Canada
Japan
Italy
Denmark
Belgium
Philippines
Germany
Switzerland
Ireland
COUNTRY


1400
1200
1000
800
600
400
200
0
count
Small
Medium
Large
DEALSIZE

In [18]:
```
#dealing with the catagorical features
from sklearn import preprocessing
le = preprocessing.LabelEncoder()

# Encode labels in column 'species'.
for i in list_cat:
  data[i]= le.fit_transform(data[i])
```

In [19]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2823 entries, 0 to 2822
Data columns (total 13 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   QUANTITYORDERED   2823 non-null   int64  
 1   ORDERLINENUMBER   2823 non-null   int64  
 2   SALES             2823 non-null   float64
 3   STATUS            2823 non-null   int32  
 4   QTR_ID            2823 non-null   int64  
 5   MONTH_ID          2823 non-null   int64  
 6   YEAR_ID           2823 non-null   int64  
 7   PRODUCTLINE       2823 non-null   int32  
 8   MSRP              2823 non-null   int64  
 9   PRODUCTCODE       2823 non-null   int32  
 10  CUSTOMERNAME      2823 non-null   int32  
 11  COUNTRY           2823 non-null   int32  
 12  DEALSIZE          2823 non-null   int32  
dtypes: float64(1), int32(6), int64(6)
memory usage: 220.7 KB
```

In [20]:
```
data['SALES'] = data['SALES'].astype(int)
```

In [21]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2823 entries, 0 to 2822
Data columns (total 13 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   QUANTITYORDERED   2823 non-null   int64
 1   ORDERLINENUMBER   2823 non-null   int64
 2   SALES             2823 non-null   int32
 3   STATUS            2823 non-null   int32
 4   QTR_ID            2823 non-null   int64
 5   MONTH_ID          2823 non-null   int64
 6   YEAR_ID           2823 non-null   int64
 7   PRODUCTLINE       2823 non-null   int32
 8   MSRP              2823 non-null   int64
 9   PRODUCTCODE       2823 non-null   int32
 10  CUSTOMERNAME      2823 non-null   int32
 11  COUNTRY           2823 non-null   int32
 12  DEALSIZE          2823 non-null   int32
dtypes: int32(7), int64(6)
memory usage: 209.6 KB
```

In [22]:
```
data.describe()
```

Out[22]:

	QUANTITYORDERED	ORDERLINENUMBER	SALES	STATUS	QTR_I
count	2823.000000	2823.000000	2823.000000	2823.000000	2823.00000
mean	35.092809	6.466171	3553.421537	4.782501	2.71767
std	9.741443	4.225841	1841.865754	0.879416	1.20387
min	6.000000	1.000000	482.000000	0.000000	1.00000
25%	27.000000	3.000000	2203.000000	5.000000	2.00000
50%	35.000000	6.000000	3184.000000	5.000000	3.00000
75%	43.000000	9.000000	4508.000000	5.000000	4.00000
max	97.000000	18.000000	14082.000000	5.000000	4.00000

In [23]:
```
## taget feature are Sales and productline
X = data[['SALES','PRODUCTCODE']]
```

In [24]:
```
data.columns
```

Out[24]:
```
Index(['QUANTITYORDERED', 'ORDERLINENUMBER', 'SALES', 'STATUS', 'QTR_ID',
       'MONTH_ID', 'YEAR_ID', 'PRODUCTLINE', 'MSRP', 'PRODUCTCODE',
       'CUSTOMERNAME', 'COUNTRY', 'DEALSIZE'],
      dtype='object')
```

In [25]:
```
## K Means implementation
```

In [26]:
```
from sklearn.cluster import KMeans
kmeans = KMeans(n_clusters=4, init='k-means++', random_state=0).fit(X)
```

In [27]:
```
kmeans.labels_
```

Out[27]:
```
array([2, 2, 2, ..., 3, 0, 2])
```

In [28]:
```
kmeans.inertia_
```

Out[28]:
```
1043164092.8545704
```

In [29]:
```
kmeans.n_iter_
```

Out[29]:
```
15
```

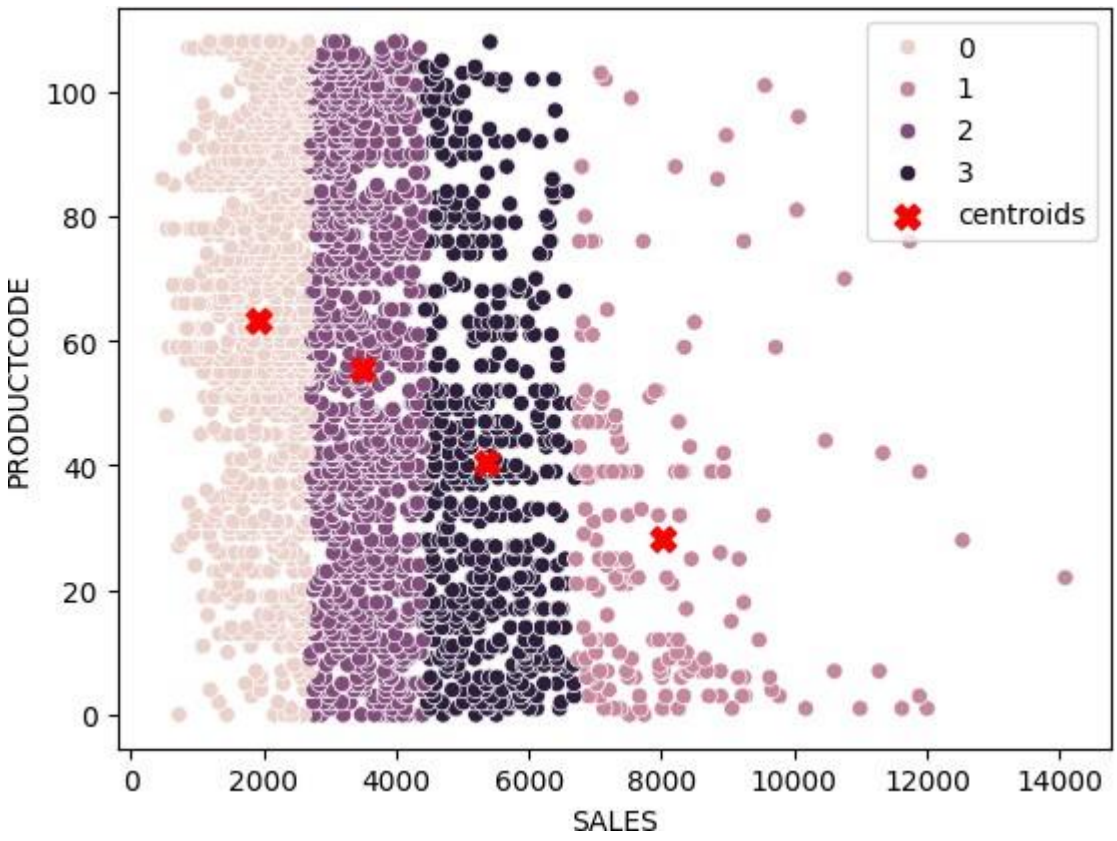
In [30]:
```
kmeans.cluster_centers_
```

Out[30]:
```
array([[1913.93425926,   63.19907407],
       [8023.78238342,   28.35751295],
       [3489.45517241,   55.50640394],
       [5371.72523364,   40.62616822]])
```

In [31]:
```
#getting the size of the clusters
from collections import Counter
Counter(kmeans.labels_)
```

Out[31]:
```
Counter({0: 1078, 2: 1015, 3: 537, 1: 193})
```

In [32]:
```
sns.scatterplot(data=X, x="SALES", y="PRODUCTCODE", hue=kmeans.labels_)
plt.scatter(kmeans.cluster_centers_[:,0],  kmeans.cluster_centers_[:,1],
            marker="X", c="r", s=80, label="centroids")
plt.legend()
plt.show()
```



In [ ]: