In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```
df = pd.read_csv("superstore.csv", encoding='iso-8859-1')
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 51290 entries, 0 to 51289
Data columns (total 24 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   Row ID          51290 non-null  int64  
 1   Order ID        51290 non-null  object 
 2   Order Date      51290 non-null  object 
 3   Ship Date       51290 non-null  object 
 4   Ship Mode       51290 non-null  object 
 5   Customer ID     51290 non-null  object 
 6   Customer Name   51290 non-null  object 
 7   Segment         51290 non-null  object 
 8   City            51290 non-null  object 
 9   State           51290 non-null  object 
 10  Country         51290 non-null  object 
 11  Postal Code     9994 non-null   float64
 12  Market          51290 non-null  object 
 13  Region          51290 non-null  object 
 14  Product ID      51290 non-null  object 
 15  Category        51290 non-null  object 
 16  Sub-Category    51290 non-null  object 
 17  Product Name    51290 non-null  object 
 18  Sales           51290 non-null  float64
 19  Quantity        51290 non-null  int64  
 20  Discount        51290 non-null  float64
 21  Profit          51290 non-null  float64
 22  Shipping Cost   51290 non-null  float64
 23  Order Priority  51290 non-null  object 
dtypes: float64(5), int64(2), object(17)
memory usage: 9.4+ MB
```

In [3]:

```
df = df.drop('Postal Code', axis=1)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 51290 entries, 0 to 51289
Data columns (total 23 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   Row ID          51290 non-null  int64  
 1   Order ID        51290 non-null  object 
 2   Order Date      51290 non-null  object 
 3   Ship Date       51290 non-null  object 
 4   Ship Mode       51290 non-null  object 
 5   Customer ID     51290 non-null  object 
 6   Customer Name   51290 non-null  object 
 7   Segment         51290 non-null  object 
 8   City            51290 non-null  object 
 9   State           51290 non-null  object 
 10  Country         51290 non-null  object 
 11  Market          51290 non-null  object 
 12  Region          51290 non-null  object 
 13  Product ID      51290 non-null  object 
 14  Category        51290 non-null  object 
 15  Sub-Category    51290 non-null  object 
 16  Product Name    51290 non-null  object 
 17  Sales           51290 non-null  float64
 18  Quantity        51290 non-null  int64  
 19  Discount        51290 non-null  float64
 20  Profit          51290 non-null  float64
 21  Shipping Cost   51290 non-null  float64
 22  Order Priority  51290 non-null  object 
dtypes: float64(4), int64(2), object(17)
memory usage: 9.0+ MB
```

In [5]:

```
df['Order Date'] = pd.to_datetime(df['Order Date'])
df['Ship Date'] = pd.to_datetime(df['Ship Date'])
```

In [6]:

```
df.dtypes
```

Out[6]:

```
Row ID                     int64
Order ID                  object
Order Date        datetime64[ns]
Ship Date         datetime64[ns]
Ship Mode                 object
Customer ID               object
Customer Name             object
Segment                   object
City                      object
State                     object
Country                   object
Market                    object
Region                    object
Product ID                object
Category                  object
Sub-Category              object
Product Name              object
Sales                    float64
Quantity                   int64
Discount                 float64
Profit                   float64
Shipping Cost            float64
Order Priority            object
dtype: object
```

In [7]:

```
df.isnull().sum()
```

Out[7]:

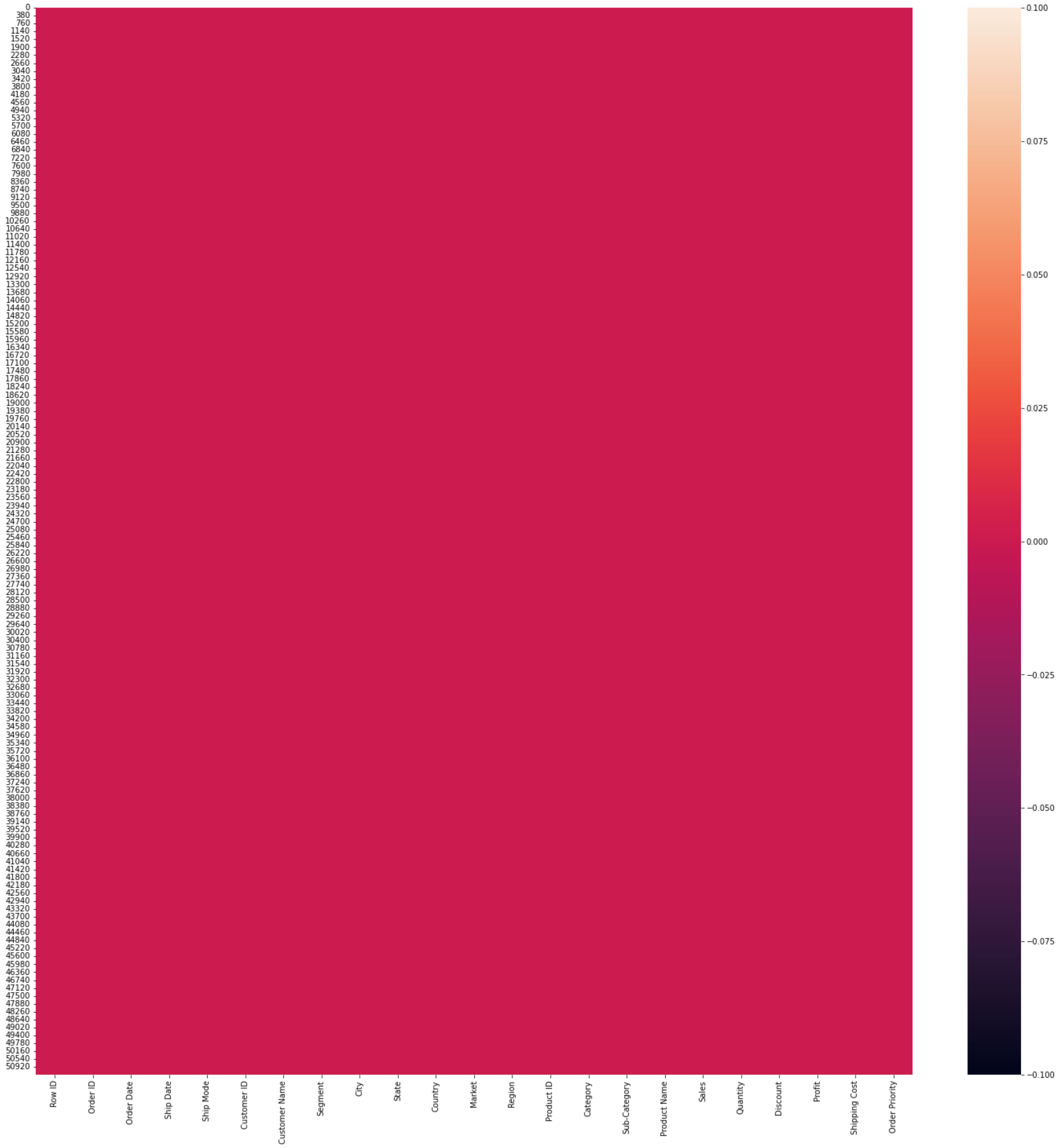
```
Row ID            0
Order ID          0
Order Date        0
Ship Date         0
Ship Mode         0
Customer ID       0
Customer Name     0
Segment           0
City              0
State             0
Country           0
Market            0
Region            0
Product ID        0
Category          0
Sub-Category      0
Product Name      0
Sales             0
Quantity          0
Discount          0
Profit            0
Shipping Cost     0
Order Priority    0
dtype: int64
```

In [8]:

```
plt.figure(figsize = (25, 25))
sns.heatmap(df.isnull())
```

Out[8]:

```
<AxesSubplot:>
```



In [9]:
```
df.select_dtypes(include=['int64', 'float64']).columns
```

Out[9]:
```
Index(['Row ID', 'Sales', 'Quantity', 'Discount', 'Profit', 'Shipping Cost'], dtype
='object')
```

In [10]:
```
df.select_dtypes(include=['object']).columns
```

Out[10]:
```
Index(['Order ID', 'Ship Mode', 'Customer ID', 'Customer Name', 'Segment',
       'City', 'State', 'Country', 'Market', 'Region', 'Product ID',
       'Category', 'Sub-Category', 'Product Name', 'Order Priority'],
      dtype='object')
```

In [11]:
```
df.select_dtypes(include=['datetime64[ns]']).columns
```

Out[11]:
```
Index(['Order Date', 'Ship Date'], dtype='object')
```

Basic Exploratory data analysis

What are the total sales and profits for the store for each year in the datasets?

In [12]:

```
# What are the total sales and profits for the store for each year in the datasets?

# create new columns (year)
df['year'] = df['Order Date'].dt.year
#df.head()
#Calculate the total sales for each year?
sales_by_year = df.groupby('year')['Sales'].sum()
#sales_by_year
#calculate the total shipping cost of the year?
shipping_cost_year = df.groupby('year')['Shipping Cost'].sum()
#shipping_cost_year

# calculate the total profits for each year?
profits_by_year = sales_by_year - shipping_cost_year
profits_by_year
```

Out[12]:

```
year
2011    2.015180e+06
2012    2.393947e+06
2013    3.041196e+06
2014    3.839358e+06
dtype: float64
```

What are the top-selling products in terms of revenue and quantity sold?

In [13]:

```
# What are the top-selling products in terms of revenue and quantity sold?
product_sales = df.groupby('Product Name').agg({'Sales': 'sum',
                                               'Quantity': 'sum'})

#product_sales.sort_values(by='Sales', ascending=False).head(10)
product_sales.sort_values(by='Quantity', ascending=False).head(10)
```

Out[13]:

Product Name	Sales	Quantity
Staples	7008.2000	876
Cardinal Index Tab, Clear	1922.8302	337
Eldon File Cart, Single Width	34387.7287	321
Rogers File Cart, Single Width	29466.3053	262
Sanford Pencil Sharpener, Water Color	5581.9741	259
Stockwell Paper Clips, Assorted Sizes	2395.4378	253
Avery Index Tab, Clear	1312.9488	252
Ibico Index Tab, Clear	1807.1811	251
Smead File Cart, Single Width	25397.1708	250
Stanley Pencil Sharpener, Water Color	5537.2290	242

What are the top product categories in terms of revenue and quantity sold?

In [14]:

```
#What are the top product categories in terms of revenue and quantity sold?
category_sales = df.groupby('Category').agg({'Sales': 'sum',
                                               'Quantity': 'sum'})
#category_sales.sort_values(by='Sales', ascending=False).head(10)
category_sales.sort_values(by='Quantity', ascending=False).head(10)
```

Out[14]:

Category	Sales	Quantity
Office Supplies	3.787070e+06	108182
Technology	4.744557e+06	35176
Furniture	4.110874e+06	34954

what is the average order value and how does it vary by product category?

In [15]:

```
# what is the average order value and how does it vary by product category?
order_revenue = df.groupby('Order ID')['Sales'].sum()
avg_order_value = order_revenue.mean()

# calculated the avg order value by product category
category_avg_order_value = df.groupby('Category')['Sales'].mean()

print("Average Order Value: ${:.2f}".format(avg_order_value))
print("\nAverage Order Value by Product Category: ")
print(category_avg_order_value)
```

```
Average Order Value: $504.99

Average Order Value by Product Category:
Category
Furniture          416.248905
Office Supplies    121.097120
Technology         467.858939
Name: Sales, dtype: float64
```

Who are the top customers in terms of total spending and number of orders?

In [16]:

```
#Who are the top customers in terms of total spending and number of orders?

customer_spending = df.groupby("Customer Name")["Sales"].sum()
top_customers_by_spending = customer_spending.sort_values(ascending=False).head(3)
customer_orders = df.groupby("Customer Name")["Order ID"].nunique()
top_customers_by_orders = customer_orders.sort_values(ascending=False).head(3)

print("Top 3 Customers by total spending:")
print(top_customers_by_spending)
print("\nTop 3 Customers by Number of Orders:")
print(top_customers_by_orders)
```

```
Top 3 Customers by total spending:
Customer Name
Tom Ashbrook    40488.07080
Tamara Chand    37457.33300
Greg Tran       35550.95428
Name: Sales, dtype: float64

Top 3 Customers by Number of Orders:
Customer Name
Frank Olsen      47
Anna Andreadi    47
Michael Paige    47
Name: Order ID, dtype: int64
```

How does sales performance vary across different regions or states?

In [17]:

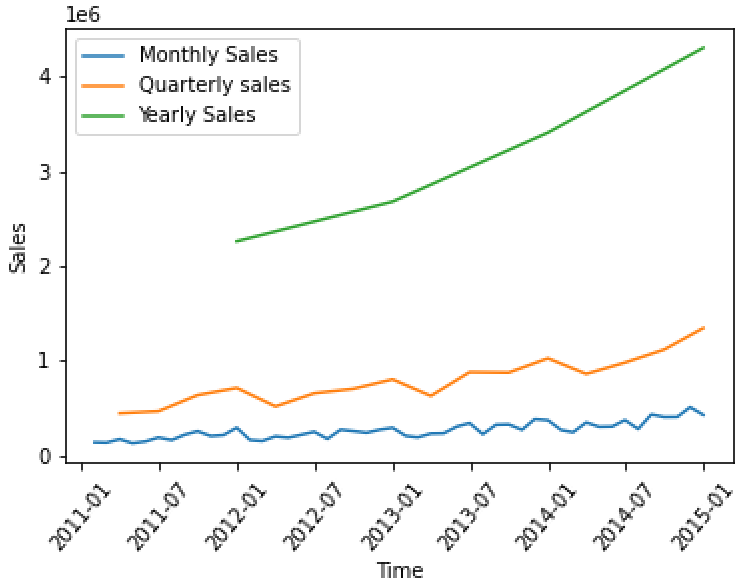
```
#How does sales performance vary across different regions or states?
region_sales = df.groupby("Region")["Sales"].sum()
state_sales = df.groupby('State')['Sales'].sum()

top_region_sales = region_sales.sort_values(ascending=False)
top_state_sales = state_sales.sort_values(ascending=False).head(10)

print("Total sales by region:")
print(top_region_sales)
print("\nTotal sales by states:")
print(top_state_sales)
```

```
Total sales by region:
Region
Central           2.822303e+06
South             1.600907e+06
North             1.248166e+06
Oceania           1.100185e+06
Southeast Asia    8.844232e+05
North Asia        8.483098e+05
EMEA              8.061613e+05
Africa            7.837732e+05
Central Asia      7.528266e+05
West              7.254578e+05
East              6.787812e+05
Caribbean         3.242809e+05
Canada            6.692817e+04
Name: Sales, dtype: float64

Total sales by states:
State
England                     485170.9710
California                  457687.6315
Ile-de-France               317822.5440
New York                    310876.2710
New South Wales             270487.1040
Queensland                  238312.7340
North Rhine-Westphalia      216451.8510
Texas                       170188.0458
San Salvador                153639.3970
National Capital            152175.3555
Name: Sales, dtype: float64
```

How do sales trends vary across different time periods (e.g., months, quarters, years)?

In [18]:

```
#How do sales trends vary across different time periods (e.g., months, quarters, years
monthly_sales = df.groupby(pd.Grouper(key='Order Date', freq='M'))['Sales'].sum()
quarterly_sales = df.groupby(pd.Grouper(key='Order Date', freq='Q'))['Sales'].sum()
yearly_sales = df.groupby(pd.Grouper(key='Order Date', freq='Y'))['Sales'].sum()

#plot the sales trends over time
plt.plot(monthly_sales, label='Monthly Sales')
plt.plot(quarterly_sales, label = 'Quarterly sales')
plt.plot(yearly_sales, label = "Yearly Sales")
plt.xticks(rotation = 50)
plt.xlabel('Time')
plt.ylabel("Sales")
plt.legend()
plt.show()
```



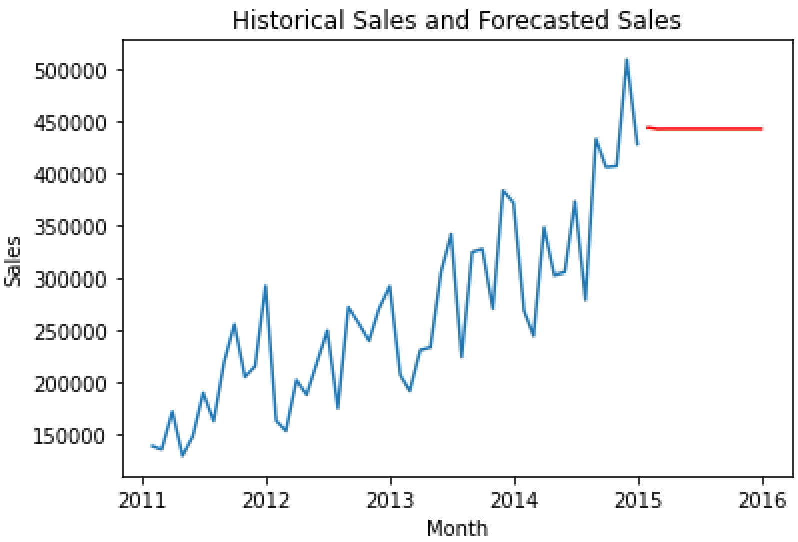
Can we use the data to forecast future sales and identify potential growth opportunities for the business?

In [20]:

```
from statsmodels.tsa.arima.model import ARIMA
```

In [21]:

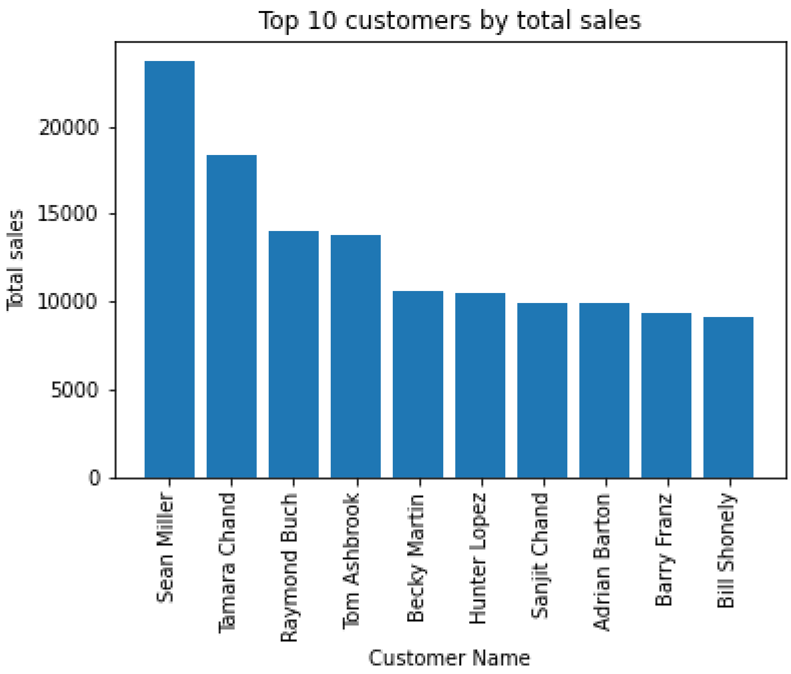
```
# Create a new DataFrame for sales data by month
monthly_sales = df.groupby(pd.Grouper(key='Order Date', freq='M')).sum()

# Fit an ARIMA model to the monthly sales data
model = ARIMA(monthly_sales['Sales'], order=(1, 1, 1))
model_fit = model.fit()

# Generate forecasted sales data for the next 12 months
forecast = model_fit.forecast(steps=12)

# Plot the historical sales data and forecasted sales data
plt.plot(monthly_sales.index, monthly_sales['Sales'])
plt.plot(forecast.index, forecast, color='red')
plt.title('Historical Sales and Forecasted Sales')
plt.xlabel('Month')
plt.ylabel('Sales')

plt.show()
```



Data visualization

In [22]:

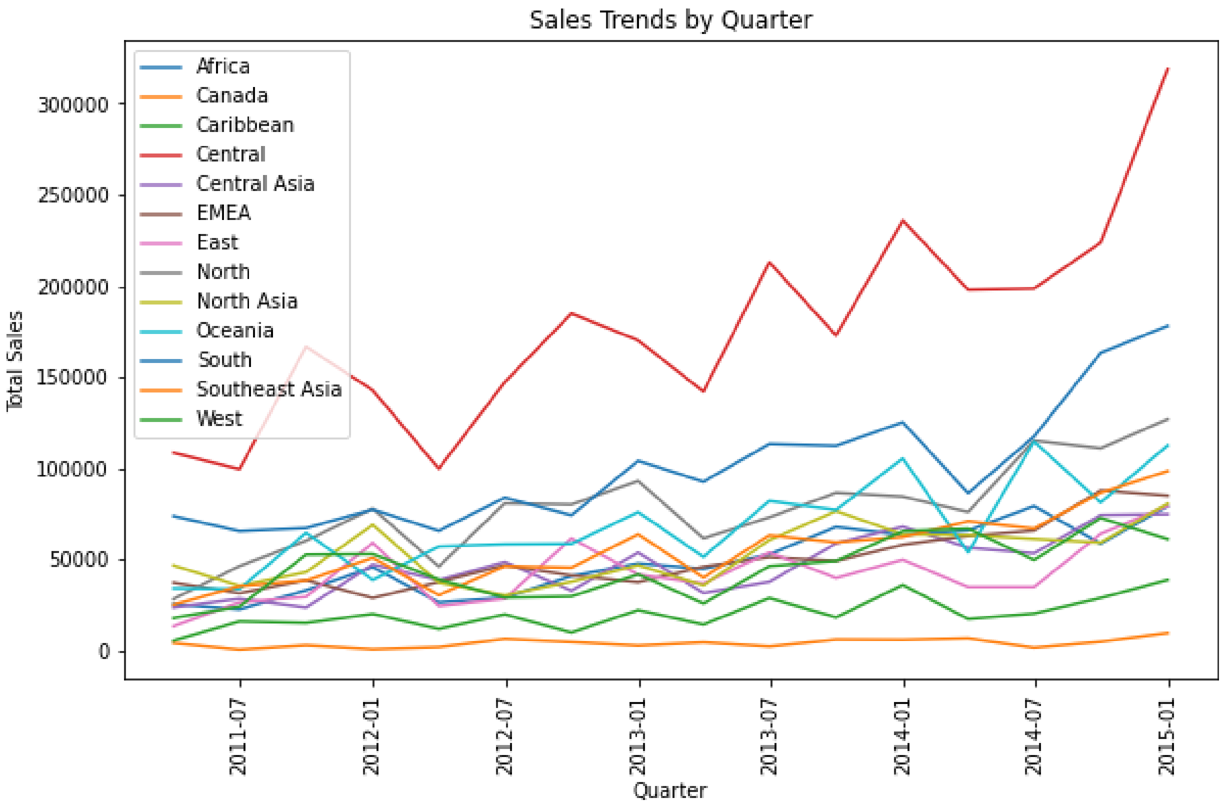
```
# Top customers by sales

# group the data by customers name and location and calculated total sales

customer_sales = df.groupby(['Customer Name', 'Segment', 'City', 'State']).agg({
                                                            'Sales': 'sum'
                                                                         }).reset_inde
#print(customer_sales)
# sort results by sales

customer_sales = customer_sales.sort_values(by = 'Sales', ascending = False)
#print(customer_sales)

# Creating bar chart showing top 10 customers by total sales

top_10 = customer_sales.head(10)
plt.bar(top_10['Customer Name'], top_10['Sales'])
plt.xticks(rotation=90) # for x axis 90 degeree
plt.xlabel("Customer Name")
plt.ylabel("Total sales")
plt.title("Top 10 customers by total sales")
plt.show()

# Display the order history for the top 10 customers

top_10_history = df[df['Customer Name'].isin(top_10['Customer Name'])]
print(top_10_history[['Customer Name', 'Order Date', 'Region', 'Category', 'Sales']])
```



```
      Customer Name Order Date        Region         Category    Sales
336    Becky Martin 2011-01-12         South  Office Supplies    57.12
339    Becky Martin 2011-01-12         South  Office Supplies    38.68
393    Hunter Lopez 2011-02-04  Central Asia       Technology  1278.00
397    Hunter Lopez 2011-02-04  Central Asia       Technology  3195.00
404    Hunter Lopez 2011-02-04  Central Asia  Office Supplies   149.58
...             ...        ...           ...              ...      ...
51237  Bill Shonely 2014-12-31  Central Asia  Office Supplies   258.12
51245  Bill Shonely 2014-12-31  Central Asia       Technology   276.60
51269  Bill Shonely 2014-12-31  Central Asia        Furniture   364.59
51271  Bill Shonely 2014-12-31  Central Asia  Office Supplies    72.00
51276  Bill Shonely 2014-12-31  Central Asia  Office Supplies    39.42

[703 rows x 5 columns]
```

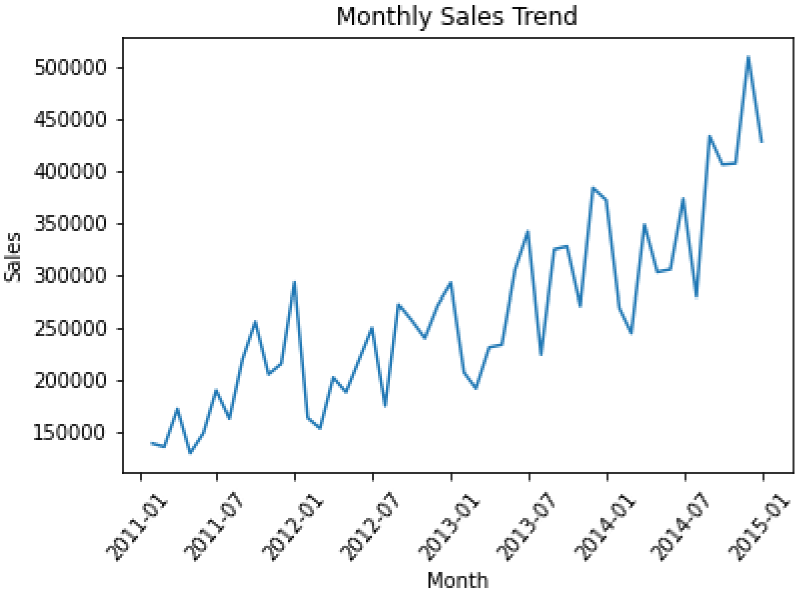
In [30]:

```python
# Group the data by quarter and region or category
sales_by_quarter = df.groupby([pd.Grouper(key='Order Date', freq='Q'), 'Region'])['Sa
# Or, we can group the data by quarter and category
# sales_by_quarter = data.groupby([pd.Grouper(key='Order Date', freq='Q'), 'Category'

# Plot the line chart
fig, ax = plt.subplots(figsize=(10, 6))
for region in sales_by_quarter['Region'].unique():
    ax.plot(sales_by_quarter[sales_by_quarter['Region']==region]['Order Date'],
            sales_by_quarter[sales_by_quarter['Region']==region]['Sales'],
            label=region)
plt.xticks(rotation=90)
ax.set_xlabel('Quarter')
ax.set_ylabel('Total Sales')
ax.set_title('Sales Trends by Quarter')
ax.legend()
plt.show()
```



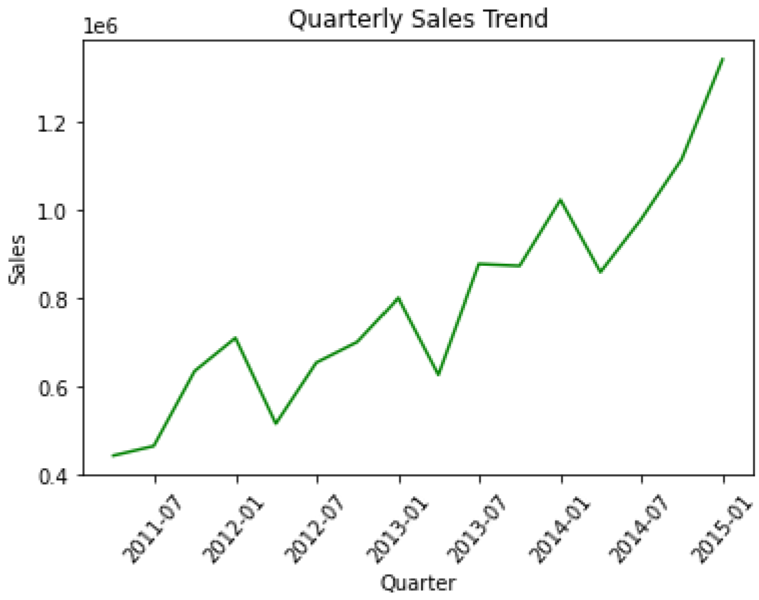
In [23]:

```
# Get monthly sales data
monthly_sales = df.groupby(pd.Grouper(key='Order Date', freq='M')).agg({'Sales': 'sum'

# Plot monthly sales trend
plt.plot(monthly_sales.index, monthly_sales['Sales'])
plt.xticks(rotation=50)
plt.title("Monthly Sales Trend")
plt.xlabel("Month")
plt.ylabel("Sales")
plt.show()
```



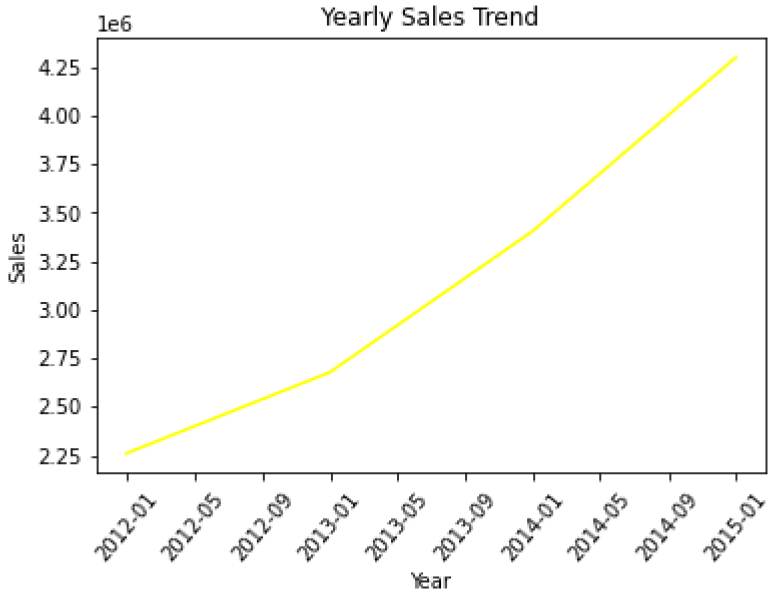
In [24]:

```
#quaterly sales trend
quarterly_sales = df.groupby(pd.Grouper(key='Order Date', freq='Q')).agg({'Sales': 'su
# Plot quarterly sales trend
plt.plot(quarterly_sales.index, quarterly_sales['Sales'], color = 'green')
plt.xticks(rotation=50)
plt.title("Quarterly Sales Trend")
plt.xlabel("Quarter")
plt.ylabel("Sales")
plt.show()
```



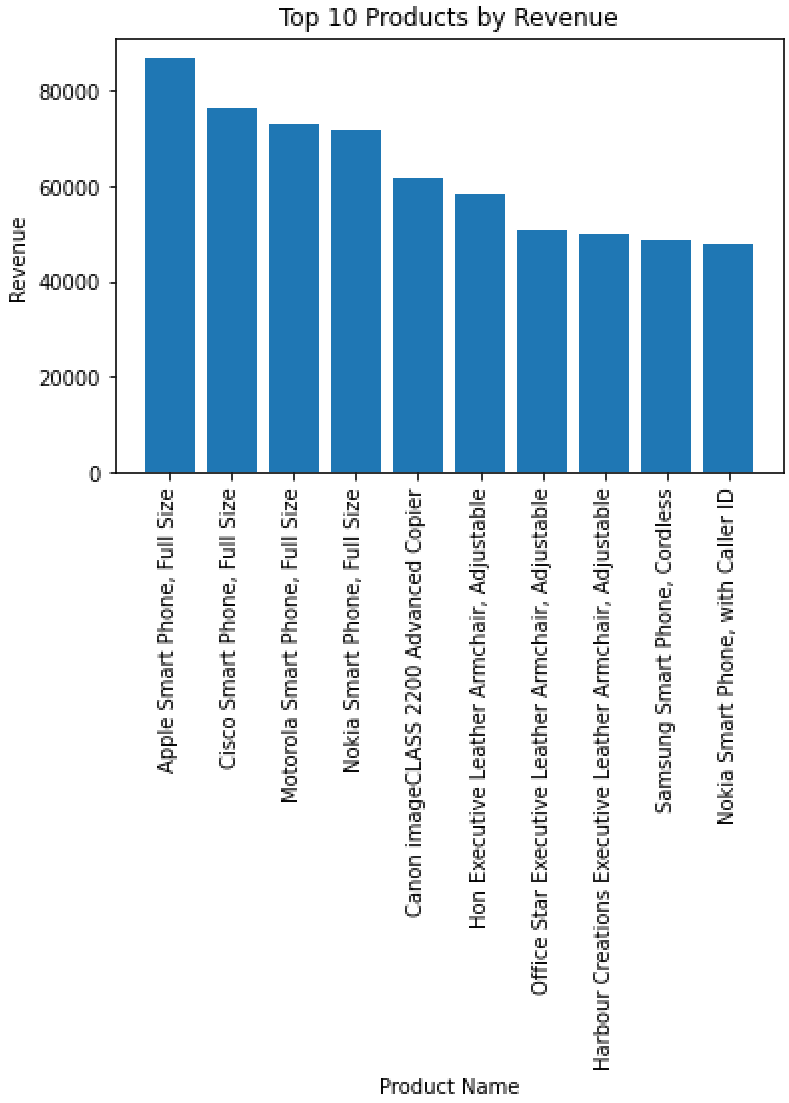
In [25]:

```
# yearly sales treand
yearly_sales = df.groupby(pd.Grouper(key='Order Date', freq='Y')).agg({'Sales':'sum'})
# Plot yearly sales trend
plt.plot(yearly_sales.index, yearly_sales['Sales'], color = 'yellow')
plt.xticks(rotation=50)
plt.title("Yearly Sales Trend")
plt.xlabel("Year")
plt.ylabel("Sales")
plt.show()
```



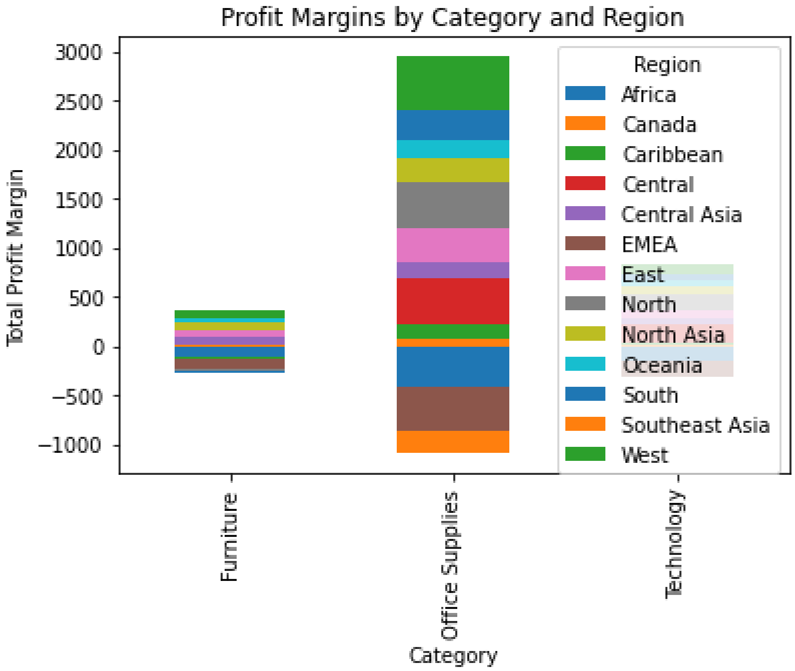
In [26]:

```
# Get top 10 products by revenue
top_products = df.groupby(['Product Name'])['Sales'].sum().reset_index().sort_values('
# Plot top 10 products by revenue
plt.bar(top_products['Product Name'], top_products['Sales'])
plt.xticks(rotation=90)
plt.title("Top 10 Products by Revenue")
plt.xlabel("Product Name")
plt.ylabel("Revenue")
plt.show()
```



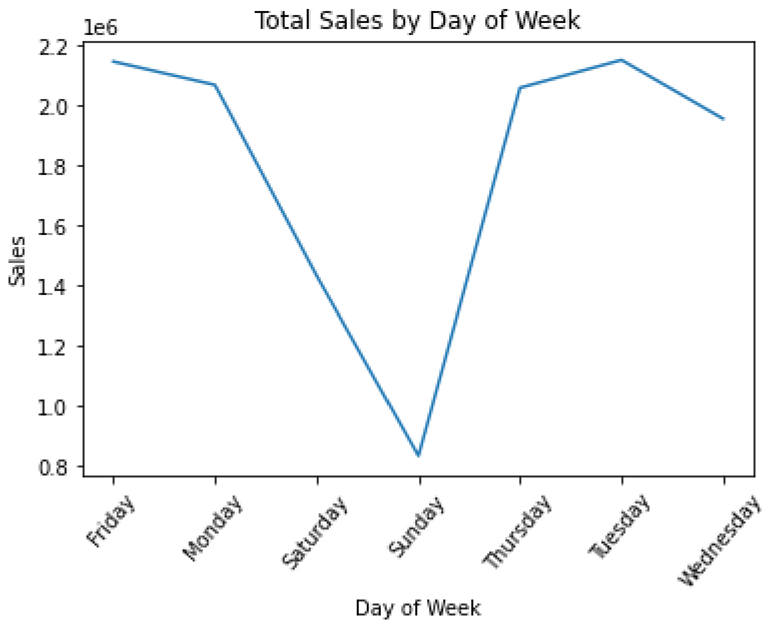
In [27]:
```
# Calculate profit margin for each sale
df["Profit Margin"] = (df["Profit"] / df["Sales"]).round(2)

# Group the data by category and region and sum the profit margins
profit_margin_df = df.groupby(["Category", "Region"])["Profit Margin"].sum().reset_in

# Pivot the data to create a table with columns for each region
profit_margin_pivot = profit_margin_df.pivot(index="Category", columns="Region", value

# Create a stacked bar chart
plt.figure(figsize = (25, 25))
profit_margin_pivot.plot(kind="bar", stacked=True)
plt.title("Profit Margins by Category and Region")
plt.xlabel("Category")
plt.ylabel("Total Profit Margin")
plt.show()
```

```
<Figure size 1800x1800 with 0 Axes>
```



In [28]:

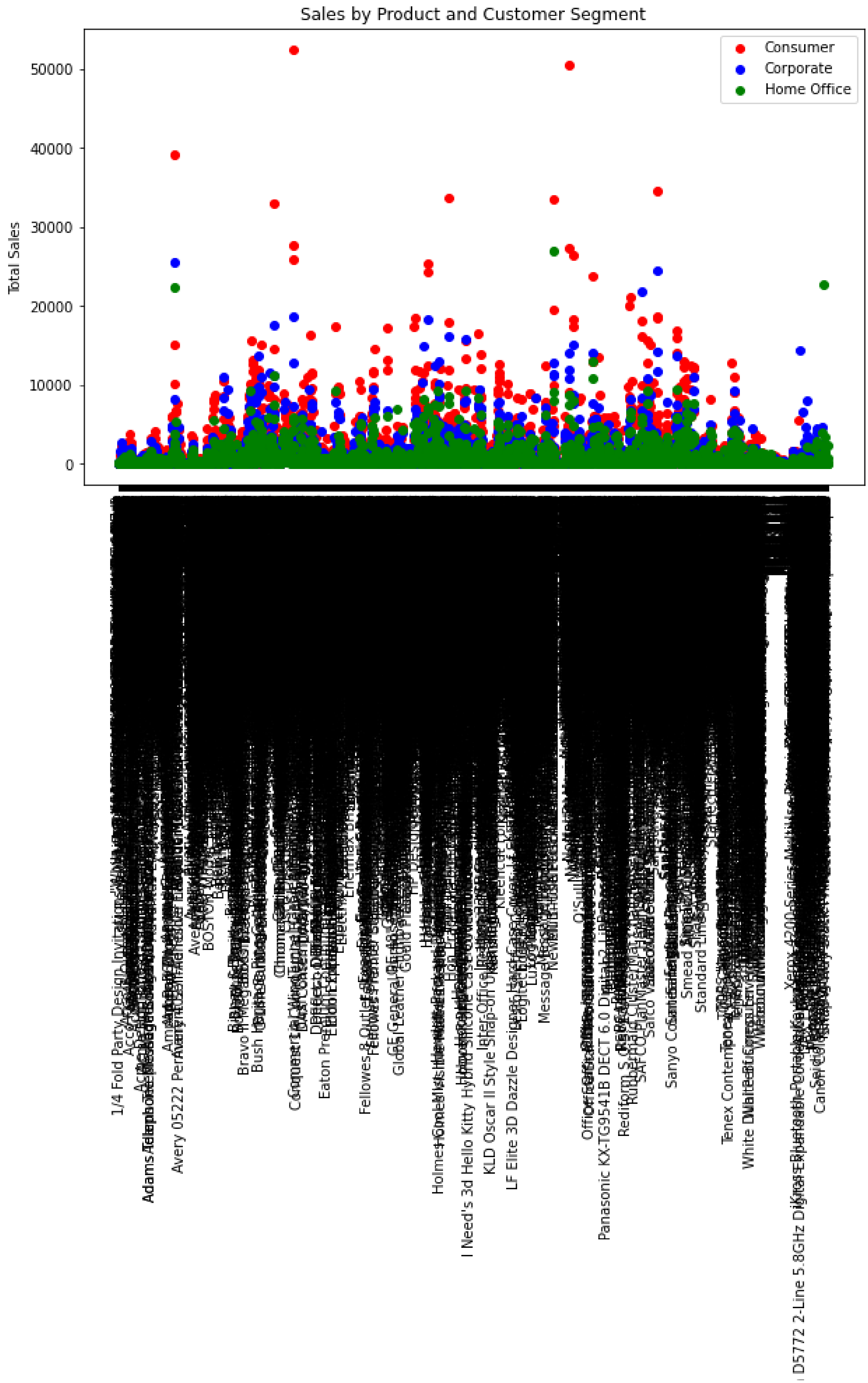
```
# Step 4: Add a new column 'Day of Week' to the dataframe
df['Day of Week'] = df['Order Date'].dt.day_name()
# Step 5: Group the dataframe by 'Day of Week', and aggregate the 'Sales' column
sales_by_day = df.groupby('Day of Week')['Sales'].sum()

# Step 6: Filter the data by category or region, if desired
# Example:
# sales_by_day = df[df['Category'] == 'Office Supplies'].groupby('Day of Week')['Sales

# Step 7: Create a line chart using matplotlib
plt.plot(sales_by_day.index, sales_by_day.values)
plt.xticks(rotation = 50)
plt.title('Total Sales by Day of Week')
plt.xlabel('Day of Week')
plt.ylabel('Sales')
plt.show()
```



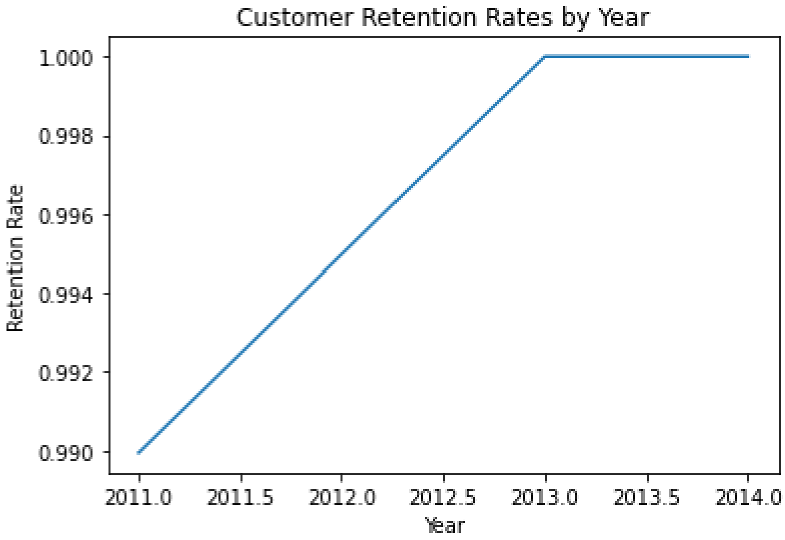
In [55]:

```
 #Aggregate the data by product and customer segment
grouped = df.groupby(['Product Name', 'Segment'], as_index=False)['Sales'].sum()

# Create a scatter plot
fig, ax = plt.subplots(figsize=(10, 6))
colors = {'Consumer': 'red', 'Corporate': 'blue', 'Home Office': 'green'}
for segment, color in colors.items():
    x = grouped[grouped['Segment'] == segment]['Product Name']
    y = grouped[grouped['Segment'] == segment]['Sales']
    ax.scatter(x, y, color=color, label=segment)
ax.legend()
ax.set_xlabel('Product Name')
ax.set_ylabel('Total Sales')
ax.set_title('Sales by Product and Customer Segment')
plt.xticks(rotation=90)
plt.show()
```

```
C:\Users\ASUS\AppData\Local\Programs\Python\Python310\lib\site-packages\IPython\core
\pylabtools.py:151: UserWarning: Glyph 148 (\x94) missing from current font.
  fig.canvas.print_figure(bytes_io, **kw)
C:\Users\ASUS\AppData\Local\Programs\Python\Python310\lib\site-packages\IPython\core
\pylabtools.py:151: UserWarning: Glyph 147 (\x93) missing from current font.
  fig.canvas.print_figure(bytes_io, **kw)
```


Sales by Product and Customer Segment
Total Sales
0
10000
20000
30000
40000
50000
Consumer
Corporate
Home Office
1/4 Fold Party Design Invitation
Avery 05222 Permanent
Bravo
Bush
Eaton Premium
Fellowes 8 Outlet
Global Leather
I Need's 3d Hello Kitty Hybrid Silicone Case
KLD Oscar II Style Snap-on
LF Elite 3D Dazzle Designer Hard Case Cover
Message
Panasonic KX-TG9541B DECT 6.0 Digital 2-Line
Sanyo
Smead
Standard
Tenex Contemporary
White Dual
Xerox 4200 Series MultiUse
D5772 2-Line 5.8GHz Digital

In [29]:
```
# convert the order date to a datetime object
df['Order Date'] = pd.to_datetime(df['Order Date'])

# group the data by year and customer name
grouped = df.groupby([df['Order Date'].dt.year, 'Customer Name'])

# calculate the number of orders and number of repeat customers
orders = grouped.size()
repeat_customers = (orders > 1).groupby(level=0).sum()

# calculate the retention rate
retention_rate = repeat_customers / orders.groupby(level=0).size()

# plot the retention rate over time
retention_rate.plot()
plt.xlabel('Year')
plt.ylabel('Retention Rate')
plt.title('Customer Retention Rates by Year')
plt.show()
```



Statistical measurement to better understand data

In [30]:
```
# mean
mean_sales = df['Sales'].mean()
#median
median_sales = df['Sales'].median()
#mode
mode_sales = df['Sales'].mode()[0]

print("MeanSales: ${:.2f}".format(mean_sales))
print("MedianSales: ${:.2f}".format(median_sales))
print("ModeSales: ${:.2f}".format(mode_sales))
```

```
MeanSales: $246.49
MedianSales: $85.05
ModeSales: $12.96
```

In [31]:

```python
# Range of sales
sales_range = df['Sales'].max()-df['Sales'].min()
print("Sales range: ${:.2f}".format(sales_range))
```

```
Sales range: $22638.04
```

In [32]:

```python
total_sales = df['Sales'].sum()
total_profit = df['Profit'].sum()
print("Total Sales: ${:.2f}".format(total_sales))
print("Total Profit: ${:.2f}".format(total_profit))
```

```
Total Sales: $12642501.91
Total Profit: $1467457.29
```

In [33]:

```python
order_counts = df['Region'].value_counts()
print("Total order: ", order_counts)
```

```
Total order:  Central           11117
South             6645
EMEA              5029
North             4785
Africa            4587
Oceania           3487
West              3203
Southeast Asia    3129
East              2848
North Asia        2338
Central Asia      2048
Caribbean         1690
Canada             384
Name: Region, dtype: int64
```

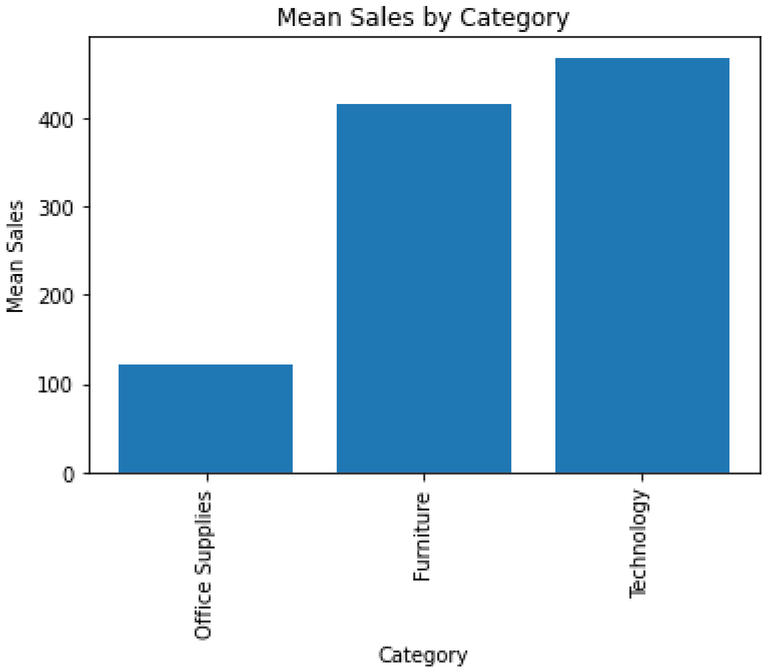
In [34]:

```python
sales_profit_corr = df['Sales'].corr(df['Profit'])
print(sales_profit_corr)
```

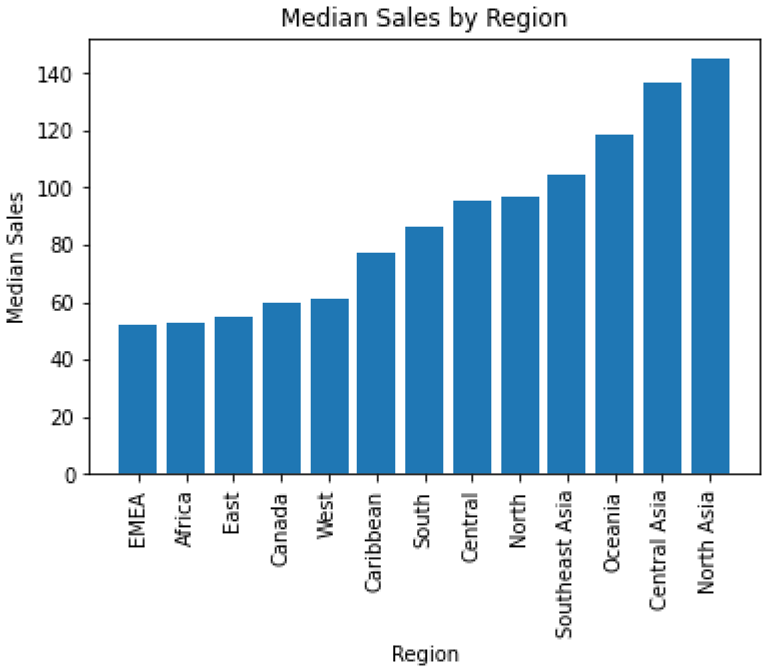
```
0.4849181126194441
```

In [35]:

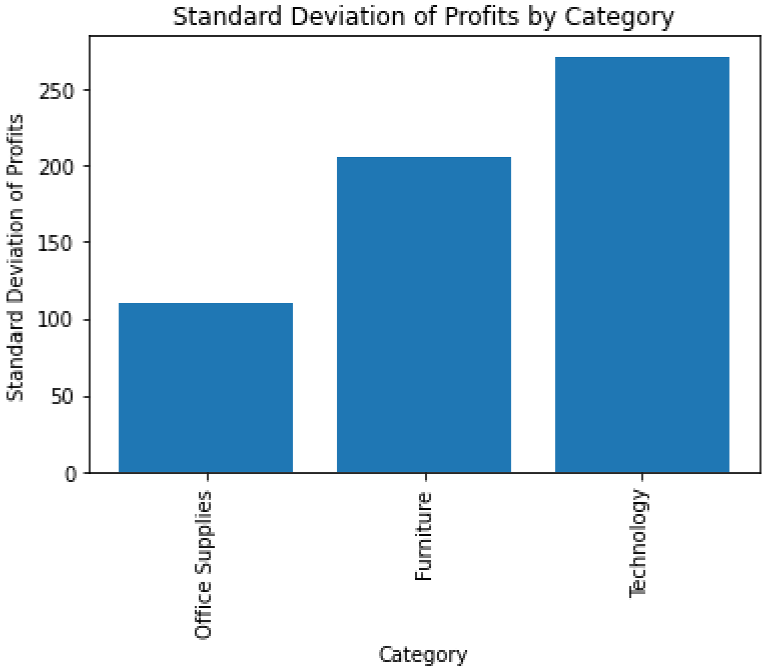
```python
mean_sales_by_category = df.groupby('Category')['Sales'].mean().sort_values()

plt.bar(mean_sales_by_category.index, mean_sales_by_category.values)
plt.xticks(rotation=90)
plt.xlabel('Category')
plt.ylabel('Mean Sales')
plt.title('Mean Sales by Category')
plt.show()
```



In [36]:
```
median_sales_by_region = df.groupby('Region')['Sales'].median().sort_values()

plt.bar(median_sales_by_region.index, median_sales_by_region.values)
plt.xticks(rotation=90)
plt.xlabel('Region')
plt.ylabel('Median Sales')
plt.title('Median Sales by Region')
plt.show()
```

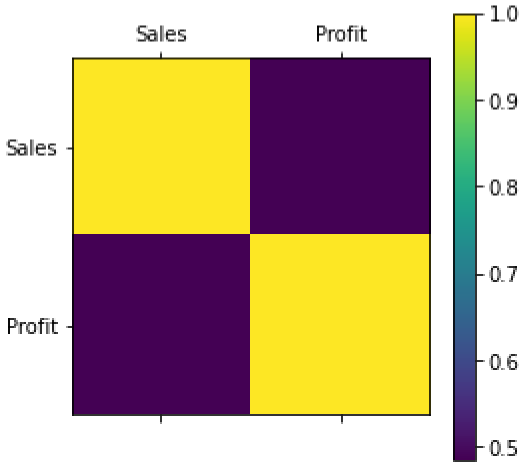


In [37]:
```
std_profits_by_category = df.groupby('Category')['Profit'].std().sort_values()

plt.bar(std_profits_by_category.index, std_profits_by_category.values)
plt.xticks(rotation=90)
plt.xlabel('Category')
plt.ylabel('Standard Deviation of Profits')
plt.title('Standard Deviation of Profits by Category')
plt.show()
```



In [38]:

```
sales_and_profits = df[['Sales', 'Profit']]
corr = sales_and_profits.corr()

plt.matshow(corr)
plt.xticks(range(len(sales_and_profits.columns)), sales_and_profits.columns)
plt.yticks(range(len(sales_and_profits.columns)), sales_and_profits.columns)
plt.colorbar()
plt.show()
```

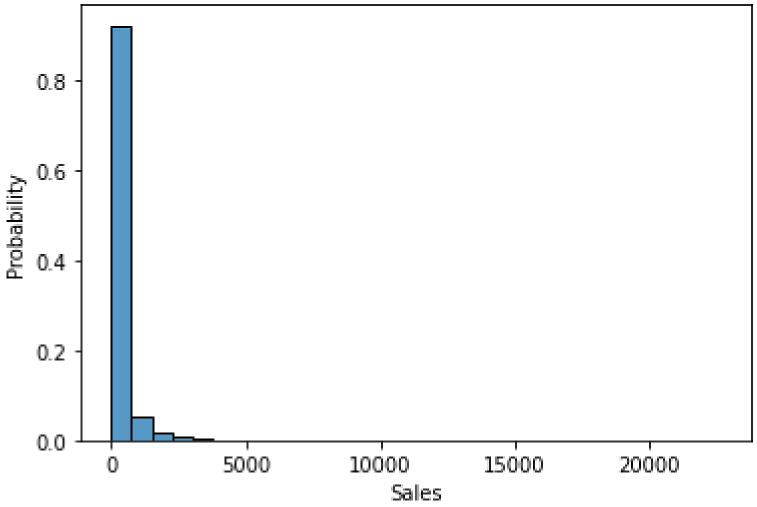


In [39]:

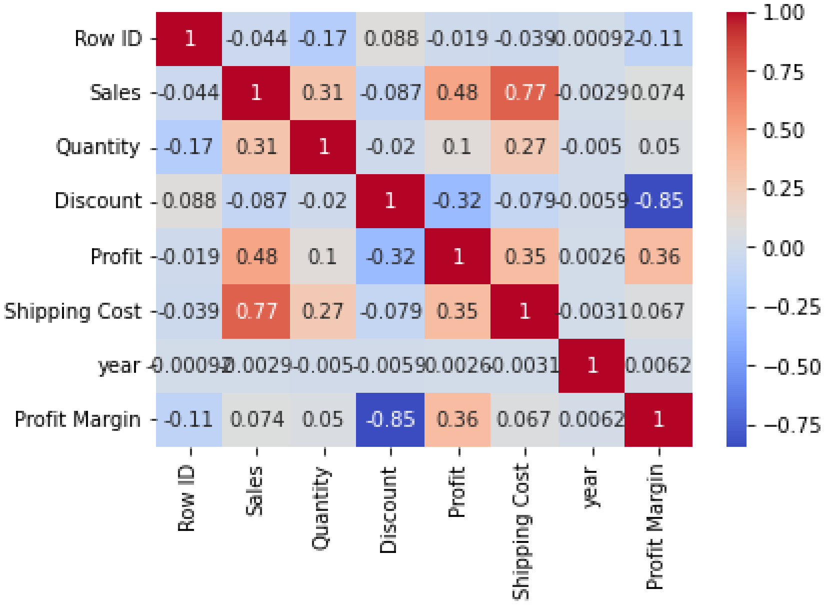
```
# Calculate the probability distribution of Sales
sales_prob = df['Sales'].value_counts(normalize=True)

# Plot the probability distribution using a histogram
sns.histplot(df, x="Sales", stat="probability", bins=30)
```

Out[39]:

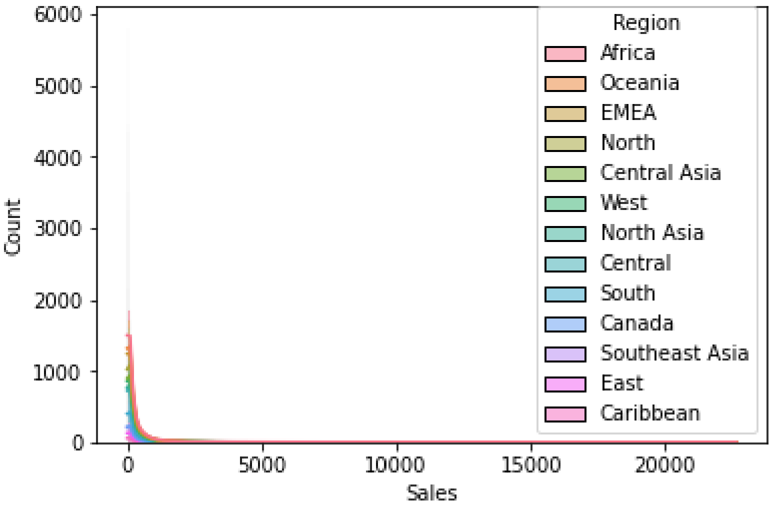
```
<AxesSubplot:xlabel='Sales', ylabel='Probability'>
```



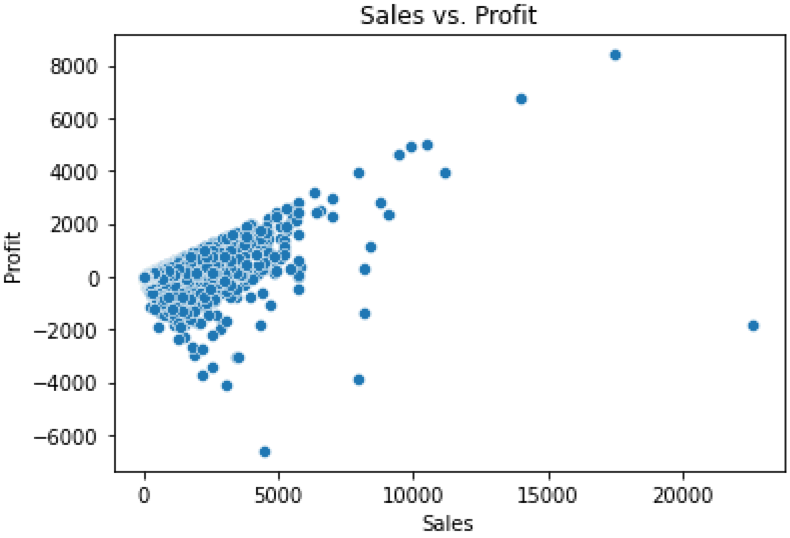
```
In [40]: # Calculate the correlation matrix
         corr_matrix = df.corr()

         # Visualize the correlation matrix as a heatmap
         sns.heatmap(corr_matrix, annot=True, cmap='coolwarm')

Out[40]: <AxesSubplot:>
```



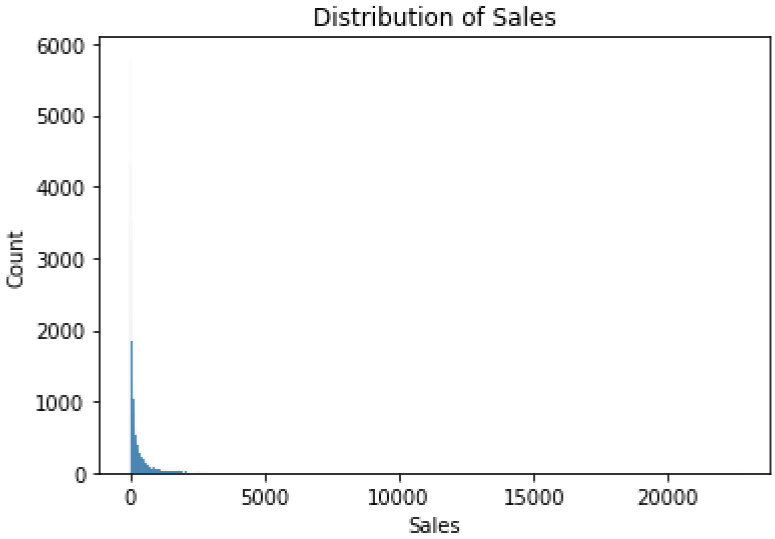
```
In [41]: # Use Seaborn to create a histogram of sales by region
         sns.histplot(data=df, x='Sales', hue='Region', kde=True, multiple='stack')

Out[41]: <AxesSubplot:xlabel='Sales', ylabel='Count'>
```



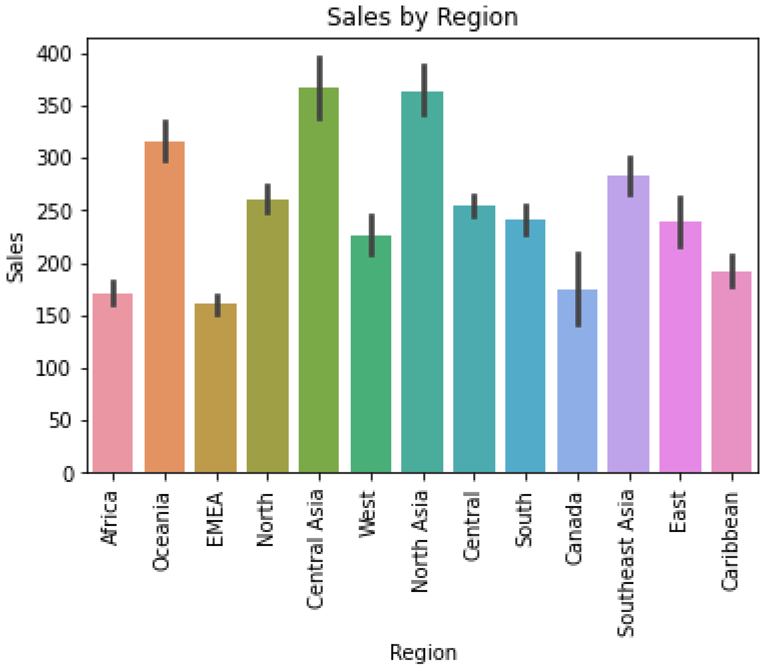
In [42]:
```
sns.scatterplot(x='Sales', y='Profit', data=df)
plt.title('Sales vs. Profit')
plt.show()
```



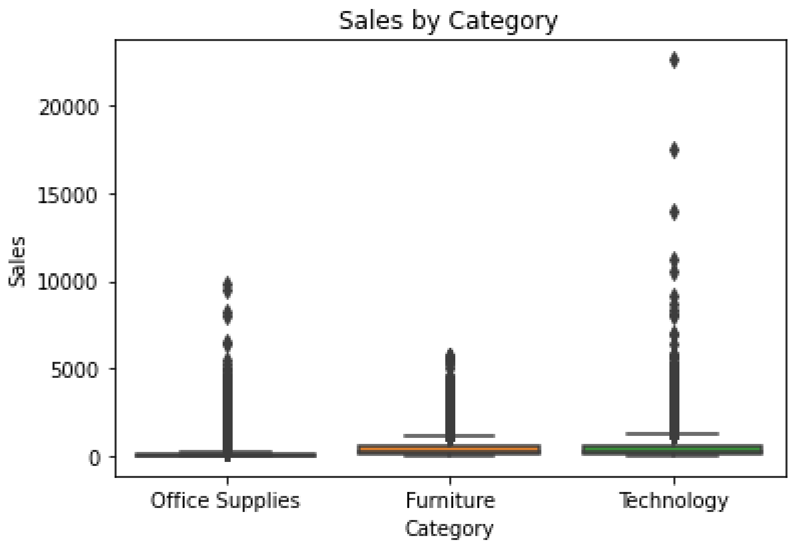
In [78]:
```
sns.histplot(x='Sales', data=df)
plt.title('Distribution of Sales')
plt.show()
```



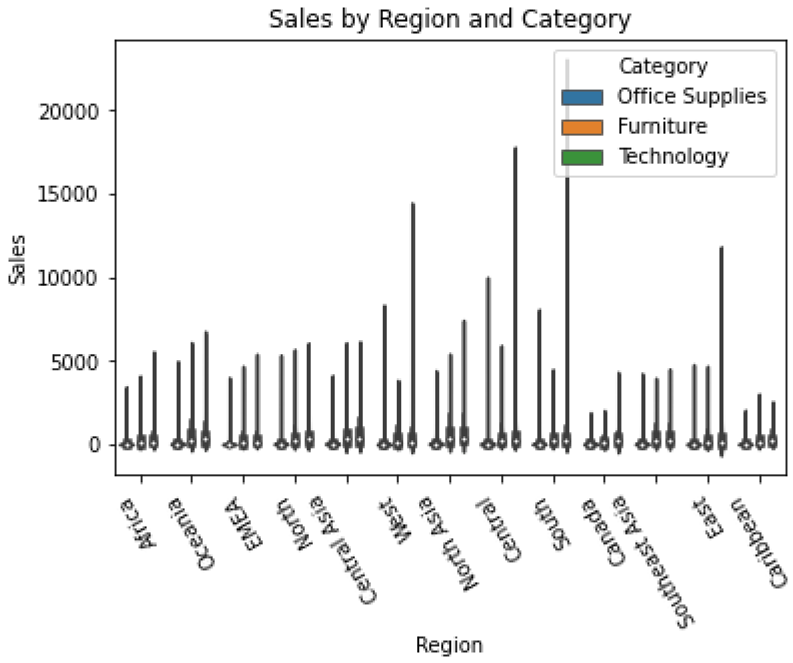
In [43]:
```
sns.barplot(x='Region', y='Sales', data=df)
plt.xticks(rotation = 90)
plt.title('Sales by Region')
plt.show()
```



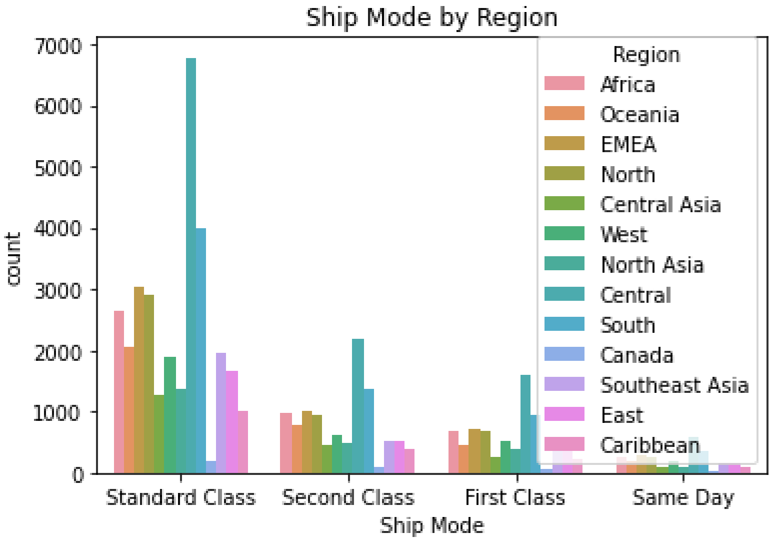
In [82]:
```
sns.boxplot(x='Category', y='Sales', data=df)
plt.title('Sales by Category')
plt.show()
```



In [85]:
```
sns.violinplot(x='Region', y='Sales', hue='Category', data=df)
plt.xticks(rotation = 120)
plt.title('Sales by Region and Category')
plt.show()
```

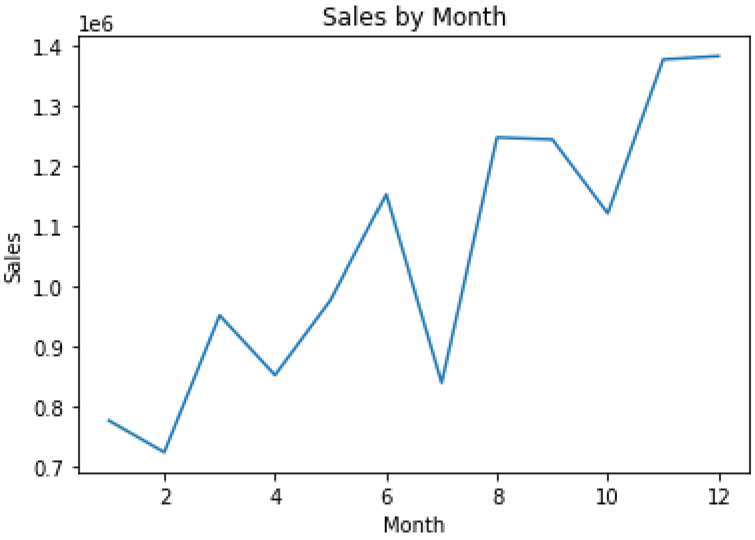


In [86]:
```
sns.countplot(x='Ship Mode', hue='Region', data=df)
plt.title('Ship Mode by Region')
plt.show()
```



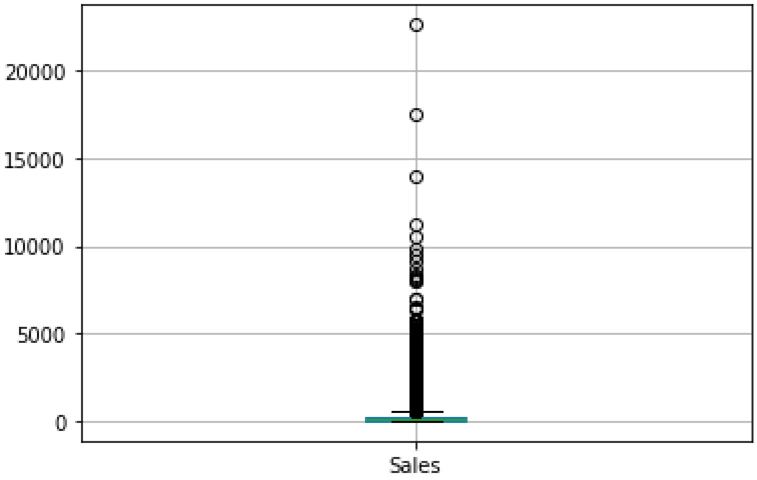
In [87]:

```
df['Month'] = pd.to_datetime(df['Order Date']).dt.month
sales_by_month = df.groupby('Month')['Sales'].sum().reset_index()
sns.lineplot(x='Month', y='Sales', data=sales_by_month)
plt.title('Sales by Month')
plt.show()
```



In [44]:

```
# Identify outliers using box plot
df.boxplot(column=['Sales'])

# Calculate upper and lower bounds
q1 = df['Sales'].quantile(0.25)
q3 = df['Sales'].quantile(0.75)
iqr = q3 - q1
upper_bound = q3 + 1.5 * iqr
lower_bound = q1 - 1.5 * iqr

# Remove outliers
df = df[(df['Sales'] > lower_bound) & (df['Sales'] < upper_bound)]
```



In [45]:
```
from sklearn.preprocessing import LabelEncoder
```

In [46]:
```
# Label encode the Category column
le = LabelEncoder()
df['Category'] = le.fit_transform(df['Category'])

# One-hot encode the Region column
df = pd.get_dummies(df, columns=['Region'])
```

```
C:\Users\ASUS\AppData\Local\Temp\ipykernel_9848\1845053093.py:3: SettingWithCopyWarni
ng:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/us
er_guide/indexing.html#returning-a-view-versus-a-copy
  df['Category'] = le.fit_transform(df['Category'])
```

In [48]:
```
from sklearn.preprocessing import StandardScaler
```

In [49]:
```
from sklearn.preprocessing import MinMaxScaler
```

In [50]:
```
# Select the numerical columns to be scaled
numerical_columns = ['Sales', 'Quantity', 'Discount']

# Scale the numerical columns using MinMaxScaler
scaler = MinMaxScaler()
df[numerical_columns] = scaler.fit_transform(df[numerical_columns])

# View the scaled dataframe
print(df.head())
```

```
   Row ID         Order ID Order Date  Ship Date       Ship Mode Customer ID  \
0   42433     AG-2011-2040 2011-01-01 2011-06-01  Standard Class    TB-11280   
1   22253    IN-2011-47883 2011-01-01 2011-08-01  Standard Class    JH-15985   
2   48883     HU-2011-1220 2011-01-01 2011-05-01    Second Class      AT-735   
3   11731  IT-2011-3647632 2011-01-01 2011-05-01    Second Class    EM-14140   
4   22255    IN-2011-47883 2011-01-01 2011-08-01  Standard Class    JH-15985   

     Customer Name      Segment         City            State  ...  \
0  Toby Braunhardt     Consumer  Constantine      Constantine  ...   
1      Joseph Holt     Consumer  Wagga Wagga  New South Wales  ...   
2    Annie Thurman     Consumer     Budapest         Budapest  ...   
3     Eugene Moren  Home Office    Stockholm        Stockholm  ...   
4      Joseph Holt     Consumer  Wagga Wagga  New South Wales  ...   

  Region_Central Region_Central Asia Region_EMEA  Region_East Region_North  \
0              0                   0           0            0            0   
1              0                   0           0            0            0   
2              0                   0           1            0            0   
3              0                   0           0            0            1   
4              0                   0           0            0            0   

  Region_North Asia  Region_Oceania  Region_South  Region_Southeast Asia  \
0                 0               0             0                      0   
1                 0               1             0                      0   
2                 0               0             0                      0   
3                 0               0             0                      0   
4                 0               1             0                      0   

   Region_West  
0            0  
1            0  
2            0  
3            0  
4            0  

[5 rows x 38 columns]
```

In [51]:

```
# Create a new feature "profit" by subtracting the cost from the sale price
df['profit'] = df['Sales'] - df['Profit']

# Display the updated dataset
print(df.head())
```

```
   Row ID         Order ID Order Date  Ship Date       Ship Mode Customer ID  \
0   42433     AG-2011-2040 2011-01-01 2011-06-01  Standard Class    TB-11280   
1   22253    IN-2011-47883 2011-01-01 2011-08-01  Standard Class    JH-15985   
2   48883     HU-2011-1220 2011-01-01 2011-05-01    Second Class      AT-735   
3   11731  IT-2011-3647632 2011-01-01 2011-05-01    Second Class    EM-14140   
4   22255    IN-2011-47883 2011-01-01 2011-08-01  Standard Class    JH-15985   

     Customer Name      Segment         City            State  ...  \
0  Toby Braunhardt     Consumer  Constantine      Constantine  ...   
1      Joseph Holt     Consumer  Wagga Wagga  New South Wales  ...   
2    Annie Thurman     Consumer     Budapest         Budapest  ...   
3     Eugene Moren  Home Office    Stockholm        Stockholm  ...   
4      Joseph Holt     Consumer  Wagga Wagga  New South Wales  ...   

  Region_Central Asia Region_EMEA Region_East  Region_North Region_North Asia  \
0                   0           0           0             0                 0   
1                   0           0           0             0                 0   
2                   0           1           0             0                 0   
3                   0           0           0             1                 0   
4                   0           0           0             0                 0   

  Region_Oceania  Region_South  Region_Southeast Asia  Region_West      profit  
0              0             0                      0            0 -105.437957  
1              1             0                      0            0  -35.829578  
2              0             0                      0            0  -29.526952  
3              0             0                      0            0   26.131462  
4              1             0                      0            0  -37.575104  

[5 rows x 39 columns]
```

In [52]:

```
from sklearn.model_selection import train_test_split

X = df.drop('Sales', axis=1)  # Features
y = df['Sales']  # Target variable

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=
```

In [ ]: