Sales Data Analysis

In [ ]:
```
ontent/drivimport pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import plotly
sales_data = pd.read_excel(r"C:\Users\masir\Downloads\ECOMM DATA.xlsx") #re
```

Columns in our Dataset

In [ ]:
```
sales_data.columns
```

Out[82]:
```
Index(['Row ID', 'Order ID', 'Order Date', 'Ship Date', 'Ship Mode',
       'Customer ID', 'Customer Name', 'Segment', 'City', 'State', 'Countr
y',
       'Postal Code', 'Market', 'Region', 'Product ID', 'Category',
       'Sub-Category', 'Product Name', 'Sales', 'Quantity', 'Discount',
       'Profit', 'Shipping Cost', 'Order Priority'],
      dtype='object')
```

In [ ]:
```
sales_data.shape
```

Out[83]:
```
(51290, 24)
```

In [ ]:
```
sales_data
```

Out[84]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	City
0	32298	CA-2012-124891	2012-07-31	2012-07-31	Same Day	RH-19495	Rick Hansen	Consumer	New York City
1	26341	IN-2013-77878	2013-02-05	2013-02-07	Second Class	JR-16210	Justin Ritter	Corporate	Wollongong
2	25330	IN-2013-71249	2013-10-17	2013-10-18	First Class	CR-12730	Craig Reiter	Consumer	Brisbane
3	13524	ES-2013-1579342	2013-01-28	2013-01-30	First Class	KM-16375	Katherine Murray	Home Office	Berlin
4	47221	SG-2013-4320	2013-11-05	2013-11-06	Same Day	RH-9495	Rick Hansen	Consumer	Dakar
...	...	...	...	...	...	...	...	...	...
51285	29002	IN-2014-62366	2014-06-19	2014-06-19	Same Day	KE-16420	Katrina Edelman	Corporate	Kure
51286	35398	US-2014-102288	2014-06-20	2014-06-24	Standard Class	ZC-21910	Zuschuss Carroll	Consumer	Houston
51287	40470	US-2013-155768	2013-12-02	2013-12-02	Same Day	LB-16795	Laurel Beltran	Home Office	Oxnard
51288	9596	MX-2012-140767	2012-02-18	2012-02-22	Standard Class	RB-19795	Ross Baird	Home Office	Valinhos
51289	6147	MX-2012-134460	2012-05-22	2012-05-26	Second Class	MC-18100	Mick Crebagga	Consumer	Tipitapa

51290 rows × 24 columns

Information about Dataset

In [ ]:
```
sales_data.info() #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  datetime64[ns]
 3   Ship Date       51290 non-null  datetime64[ns]
 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: datetime64[ns](2), float64(5), int64(2), object(15)
memory usage: 9.4+ MB
```

In [ ]:
```
sales_data.describe() #all numerical data of dataset
```

Out[86]:

	Row ID	Order Date	Ship Date	Postal Code	Sales	
count	51290.00000	51290	51290	9994.000000	51290.000000	5129
mean	25645.50000	2013-05-11 21:26:49.155781120	2013-05-15 20:42:42.745174528	55190.379428	246.490581	
min	1.00000	2011-01-01 00:00:00	2011-01-03 00:00:00	1040.000000	0.444000	
25%	12823.25000	2012-06-19 00:00:00	2012-06-23 00:00:00	23223.000000	30.758625	
50%	25645.50000	2013-07-08 00:00:00	2013-07-12 00:00:00	56430.500000	85.053000	
75%	38467.75000	2014-05-22 00:00:00	2014-05-26 00:00:00	90008.000000	251.053200	
max	51290.00000	2014-12-31 00:00:00	2015-01-07 00:00:00	99301.000000	22638.480000	1
std	14806.29199	NaN	NaN	32063.693350	487.565361	

Checking any missing values in Dataset

In [ ]:
```
sales_data.isna().any() #postal code having some missing values
```

Out[87]:
```
Row ID           False
Order ID         False
Order Date       False
Ship Date        False
Ship Mode        False
Customer ID      False
Customer Name    False
Segment          False
City             False
State            False
Country          False
Postal Code       True
Market           False
Region           False
Product ID       False
Category         False
Sub-Category     False
Product Name     False
Sales            False
Quantity         False
Discount         False
Profit           False
Shipping Cost    False
Order Priority   False
dtype: bool
```

we have Postal Code column with 41296 missing values

In [ ]:
```
sales_data.isna().sum() #sum of missing values in postal code is 41296
```

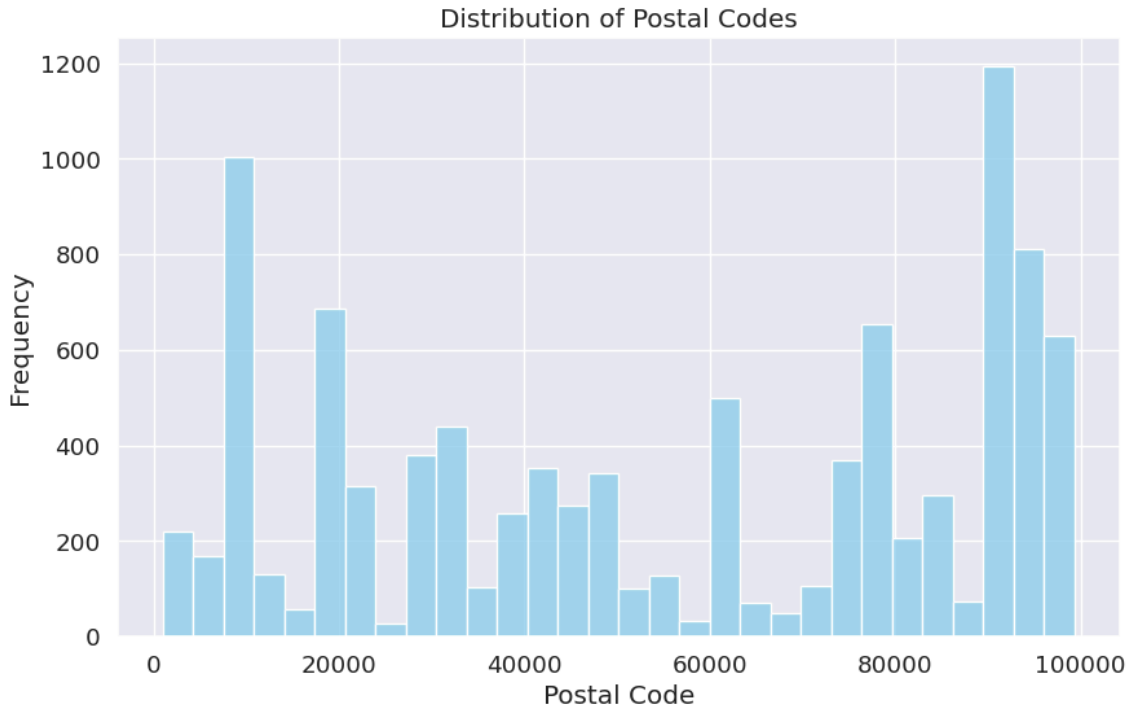
Out[88]:
```
Row ID               0
Order ID             0
Order Date           0
Ship Date            0
Ship Mode            0
Customer ID          0
Customer Name        0
Segment              0
City                 0
State                0
Country              0
Postal Code      41296
Market               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 [ ]:
```
postal_codes = sales_data['Postal Code']

# Attempt to convert the "Postal Code" column to numeric format
try:
    postal_codes_numeric = pd.to_numeric(postal_codes)
    print("Conversion to numeric format successful.")
except ValueError as e:
    print("Error encountered during conversion to numeric format:")
    print(e)
```

```
Conversion to numeric format successful.
```

In [ ]:
```
# Convert the values in the "Postal Code" column to numeric format
sales_data['Postal Code'] = pd.to_numeric(sales_data['Postal Code'])
```

In [ ]:
```
# Plot distribution of postal codes
plt.figure(figsize=(10, 6))
sns.histplot(postal_codes, bins=30, color='skyblue')
plt.xlabel('Postal Code')
plt.ylabel('Frequency')
plt.title('Distribution of Postal Codes')
plt.show()
```



In [ ]:
```
sales_data['Postal Code']
```

Out[95]:
```
0        10024.0
1            NaN
2            NaN
3            NaN
4            NaN
          ...
51285        NaN
51286    77095.0
51287    93030.0
51288        NaN
51289        NaN
Name: Postal Code, Length: 51290, dtype: float64
```

In [ ]:
```
# Fill missing values with the mode
mode_postal_code = sales_data['Postal Code'].mode()[0]
sales_data['Postal Code'].fillna(mode_postal_code, inplace=True)
```

In [ ]:
```
sales_data['Postal Code'].isna().sum() #cleaned the column
```

Out[99]:
```
0
```

Checking all columns in sales_Data

Row ID column

In [ ]:
```
sales_data['Row ID'] #row_id
```

Out[100]:
```
0        32298
1        26341
2        25330
3        13524
4        47221
         ...
51285    29002
51286    35398
51287    40470
51288     9596
51289     6147
Name: Row ID, Length: 51290, dtype: int64
```

In [ ]:
```
print(sales_data['Row ID'].unique())
print(sales_data['Row ID'].nunique())
```

```
[32298 26341 25330 ... 40470  9596  6147]
51290
```

Order_ID column

In [ ]:
```
sales_data['Order ID'].dtype
```

Out[13]:
```
dtype('O')
```

In [ ]:
```
sales_data['Order ID']
```

Out[23]:
```
0         CA-2012-124891
1          IN-2013-77878
2          IN-2013-71249
3        ES-2013-1579342
4           SG-2013-4320
              ...
51285      IN-2014-62366
51286     US-2014-102288
51287     US-2013-155768
51288     MX-2012-140767
51289     MX-2012-134460
Name: Order ID, Length: 51290, dtype: object
```

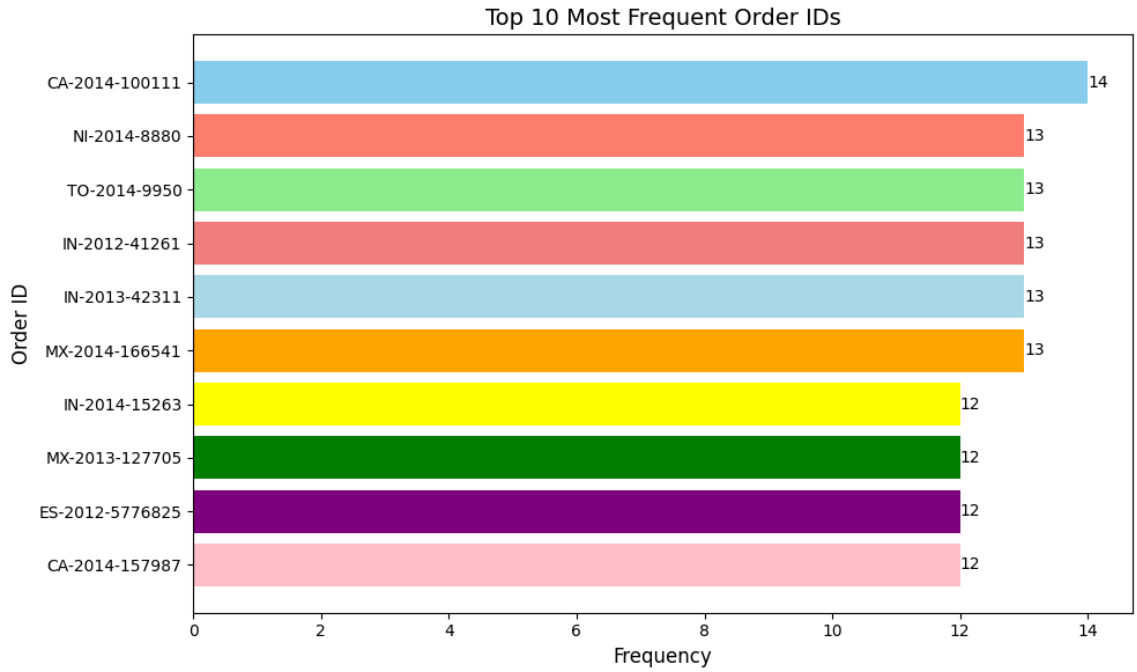
In [ ]:
```
print(sales_data['Order ID'].unique())
print(sales_data['Order ID'].nunique())
```

```
['CA-2012-124891' 'IN-2013-77878' 'IN-2013-71249' ... 'IN-2014-72327'
 'IN-2014-57662' 'MX-2012-134460']
25035
```

Order_ID Column - (Graphical Representation)

In [ ]:

```
# Get the unique values and their counts
unique_ids, counts = sales_data['Order ID'].value_counts().index, sales_dat

# Define colors for bars
colors = ['skyblue', 'salmon', 'lightgreen', 'lightcoral', 'lightblue',
          'orange', 'yellow', 'green', 'purple', 'pink']

# Plot the bar plot
plt.figure(figsize=(10, 6))
bars = plt.barh(unique_ids[:10], counts[:10], color=colors)

# Add labels and title
plt.xlabel('Frequency', fontsize=12)
plt.ylabel('Order ID', fontsize=12)
plt.title('Top 10 Most Frequent Order IDs', fontsize=14)

# Add frequency labels on each bar
for bar, count in zip(bars, counts[:10]):
    plt.text(bar.get_width(), bar.get_y() + bar.get_height() / 2, f'{count}
             va='center', ha='left', fontsize=10, color='black')

# Invert y-axis to display the highest frequency at the top
plt.gca().invert_yaxis()

# Show plot
plt.tight_layout()
plt.show()
```



Order Date Column

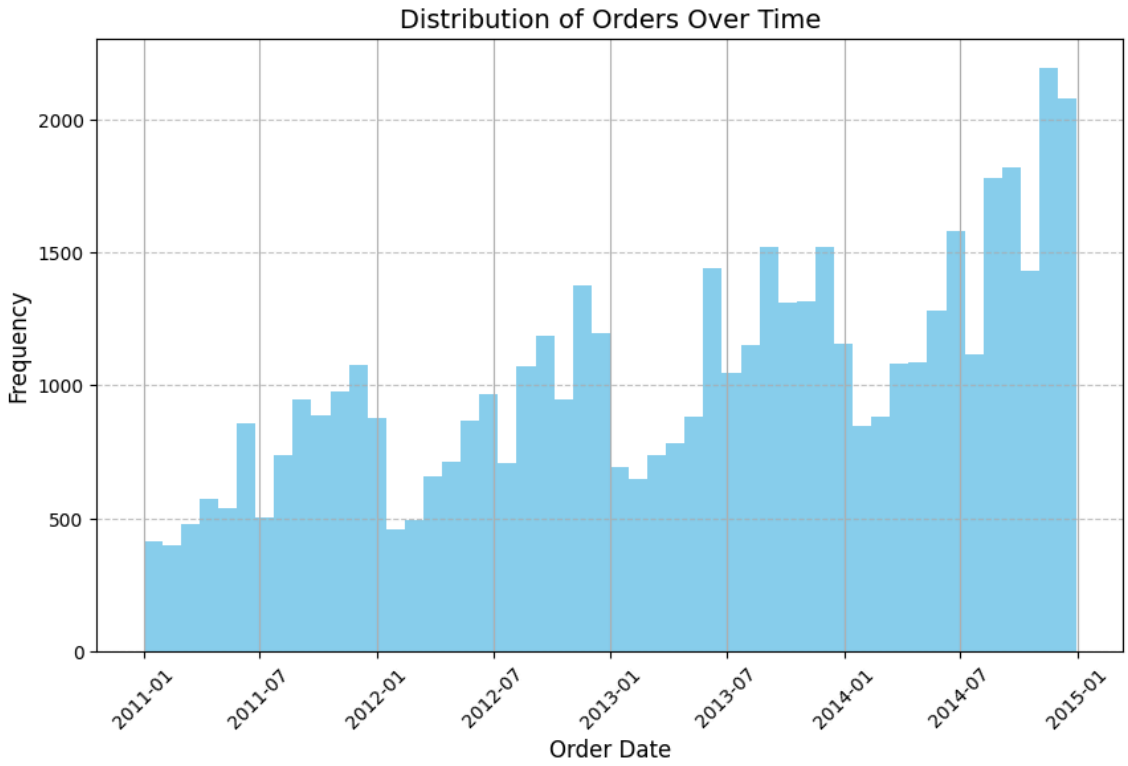
In [ ]:
```
sales_data['Order Date']
```

Out[16]:
```
0       2012-07-31
1       2013-02-05
2       2013-10-17
3       2013-01-28
4       2013-11-05
           ...
51285   2014-06-19
51286   2014-06-20
51287   2013-12-02
51288   2012-02-18
51289   2012-05-22
Name: Order Date, Length: 51290, dtype: datetime64[ns]
```

In [ ]:
```
print(sales_data['Order Date'].unique())
print(sales_data['Order Date'].nunique())
```

```
<DatetimeArray>
['2012-07-31 00:00:00', '2013-02-05 00:00:00', '2013-10-17 00:00:00',
 '2013-01-28 00:00:00', '2013-11-05 00:00:00', '2013-06-28 00:00:00',
 '2011-11-07 00:00:00', '2012-04-14 00:00:00', '2014-10-14 00:00:00',
 '2012-01-28 00:00:00',
 ...
 '2014-01-12 00:00:00', '2012-07-29 00:00:00', '2012-07-15 00:00:00',
 '2012-08-19 00:00:00', '2011-03-27 00:00:00', '2011-06-12 00:00:00',
 '2012-07-08 00:00:00', '2013-07-07 00:00:00', '2012-05-27 00:00:00',
 '2011-02-06 00:00:00']
Length: 1430, dtype: datetime64[ns]
1430
```

In [ ]:
```
# Plot the histogram of order dates
plt.figure(figsize=(10, 6))
sales_data['Order Date'].hist(bins=50, color='skyblue')
plt.xlabel('Order Date', fontsize=12)
plt.ylabel('Frequency', fontsize=12)
plt.title('Distribution of Orders Over Time', fontsize=14)
plt.xticks(rotation=45)  # Rotate x-axis labels for better readability
plt.grid(axis='y', linestyle='--', alpha=0.7)  # Add grid lines for better
plt.show()
```



Ship Date Column

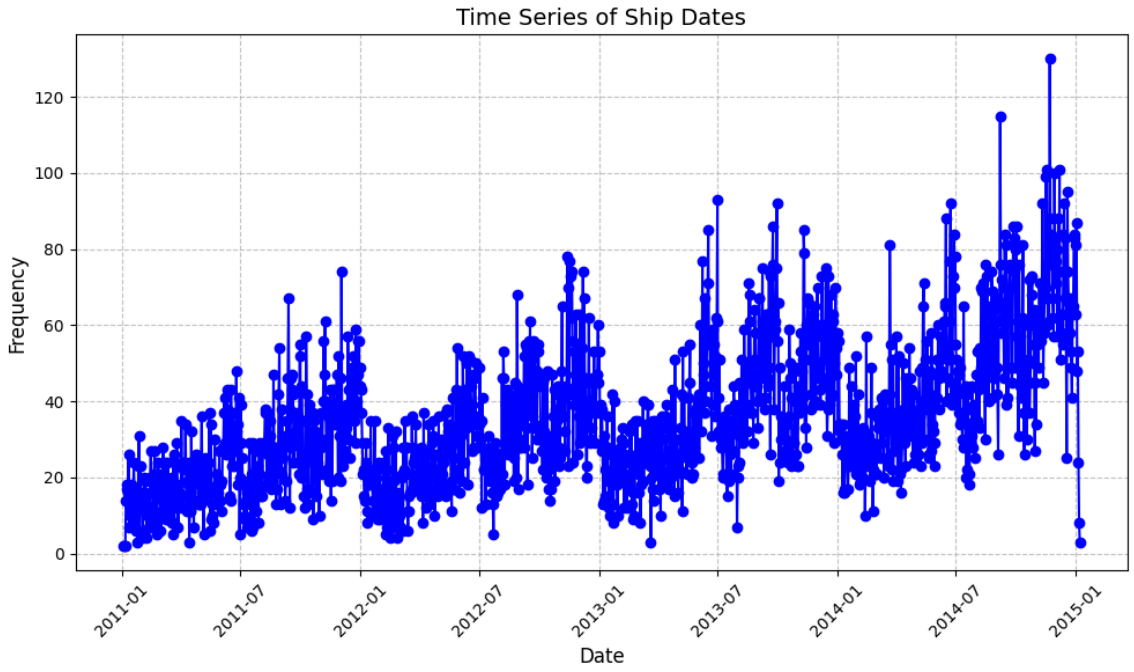
In [ ]:
```
sales_data['Ship Date']
```

Out[19]:
```
0       2012-07-31
1       2013-02-07
2       2013-10-18
3       2013-01-30
4       2013-11-06
           ...
51285   2014-06-19
51286   2014-06-24
51287   2013-12-02
51288   2012-02-22
51289   2012-05-26
Name: Ship Date, Length: 51290, dtype: datetime64[ns]
```

In [ ]:
```
print(sales_data['Ship Date'].unique())
print(sales_data['Ship Date'].nunique())
```

```
<DatetimeArray>
['2012-07-31 00:00:00', '2013-02-07 00:00:00', '2013-10-18 00:00:00',
 '2013-01-30 00:00:00', '2013-11-06 00:00:00', '2013-07-01 00:00:00',
 '2011-11-09 00:00:00', '2012-04-18 00:00:00', '2014-10-21 00:00:00',
 '2012-01-31 00:00:00',
 ...
 '2011-07-11 00:00:00', '2011-02-23 00:00:00', '2011-01-25 00:00:00',
 '2015-01-07 00:00:00', '2011-02-08 00:00:00', '2012-01-24 00:00:00',
 '2012-02-15 00:00:00', '2012-07-23 00:00:00', '2012-04-08 00:00:00',
 '2011-01-05 00:00:00']
Length: 1464, dtype: datetime64[ns]
1464
```

In [ ]:
```
# Plot the time series of ship dates as a line plot
plt.figure(figsize=(10, 6))
plt.plot(sales_data['Ship Date'].value_counts().sort_index(), marker='o', c
plt.xlabel('Date', fontsize=12)
plt.ylabel('Frequency', fontsize=12)
plt.title('Time Series of Ship Dates', fontsize=14)
plt.grid(True, linestyle='--', alpha=0.7)  # Add grid lines for better visu
plt.xticks(rotation=45)  # Rotate x-axis labels for better readability
plt.tight_layout()
plt.show()
```



Ship Mode column

In [ ]:
```
sales_data['Ship Mode']
```

Out[22]:
```
0             Same Day
1          Second Class
2           First Class
3           First Class
4             Same Day
              ...
51285         Same Day
51286    Standard Class
51287         Same Day
51288    Standard Class
51289      Second Class
Name: Ship Mode, Length: 51290, dtype: object
```

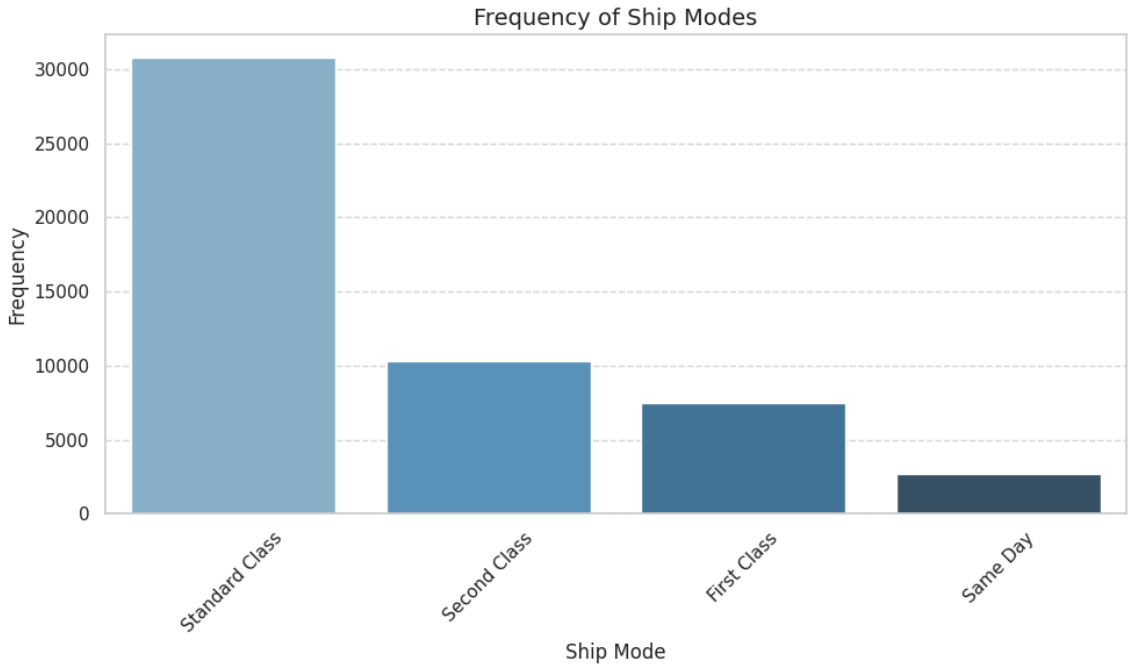
In [ ]:
```
print(sales_data['Ship Mode'].unique())
print(sales_data['Ship Mode'].nunique())
```

```
['Same Day' 'Second Class' 'First Class' 'Standard Class']
4
```

In [ ]:

```
# Set Seaborn style
sns.set(style="whitegrid")

# Count the frequency of each ship mode
ship_mode_counts = sales_data['Ship Mode'].value_counts()

# Plot the bar chart using Seaborn
plt.figure(figsize=(10, 6))
sns.barplot(x=ship_mode_counts.index, y=ship_mode_counts.values, palette="B
plt.title('Frequency of Ship Modes', fontsize=14)
plt.xlabel('Ship Mode', fontsize=12)
plt.ylabel('Frequency', fontsize=12)
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```

```
<ipython-input-24-3f784ab302dc>:9: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for
the same effect.

  sns.barplot(x=ship_mode_counts.index, y=ship_mode_counts.values, palette
="Blues_d")
```



Customer ID column

In [ ]:
```
sales_data['Customer ID']
```

Out[25]:
```
0        RH-19495
1        JR-16210
2        CR-12730
3        KM-16375
4         RH-9495
           ...
51285    KE-16420
51286    ZC-21910
51287    LB-16795
51288    RB-19795
51289    MC-18100
Name: Customer ID, Length: 51290, dtype: object
```

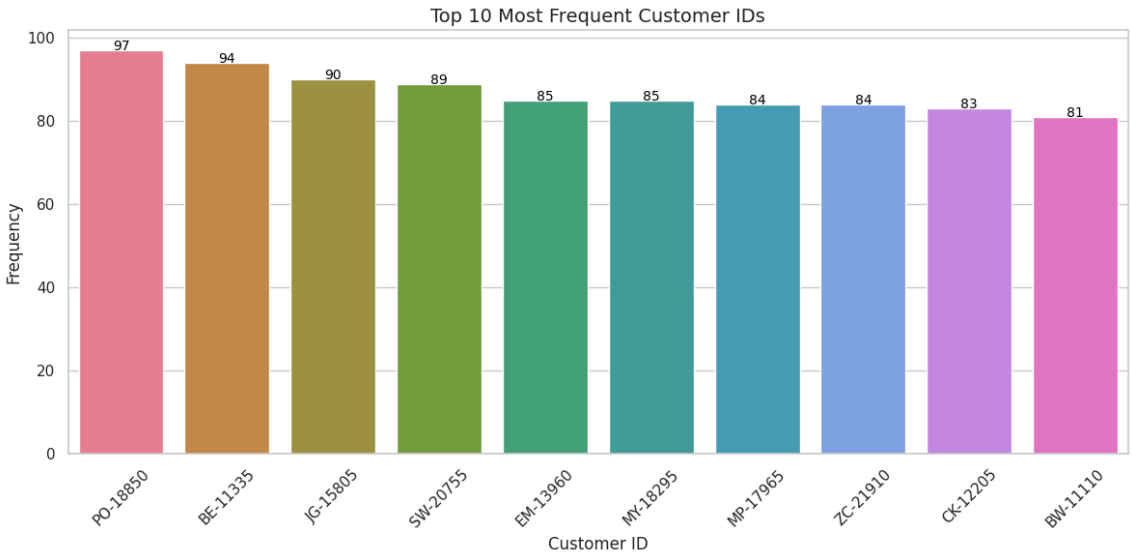
In [ ]:
```
print(sales_data['Customer ID'].unique())
print(sales_data['Customer ID'].nunique())
```

```
['RH-19495' 'JR-16210' 'CR-12730' ... 'RC-9825' 'MG-7890' 'ZC-11910']
1590
```

In [ ]:

```
# Set Seaborn style
sns.set(style="whitegrid")

# Count the frequency of each customer ID
customer_id_counts = sales_data['Customer ID'].value_counts()

# Plot the bar chart using Seaborn
plt.figure(figsize=(12, 6))
barplot = sns.barplot(x=customer_id_counts.index[:10], y=customer_id_counts
plt.title('Top 10 Most Frequent Customer IDs', fontsize=14)
plt.xlabel('Customer ID', fontsize=12)
plt.ylabel('Frequency', fontsize=12)
plt.xticks(rotation=45)

# Adding annotations
for index, value in enumerate(customer_id_counts.values[:10]):
    barplot.text(index, value, str(value), ha="center", fontsize=10, color=

plt.tight_layout()
plt.show()
```

```
<ipython-input-27-007cf4003afa>:9: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for
the same effect.

  barplot = sns.barplot(x=customer_id_counts.index[:10], y=customer_id_cou
nts.values[:10], palette="husl")
```



Customer Name Column

In [ ]:
```
sales_data['Customer Name']
```

Out[28]:
```
0             Rick Hansen
1           Justin Ritter
2            Craig Reiter
3         Katherine Murray
4              Rick Hansen
                  ...
51285      Katrina Edelman
51286     Zuschuss Carroll
51287       Laurel Beltran
51288           Ross Baird
51289        Mick Crebagga
Name: Customer Name, Length: 51290, dtype: object
```

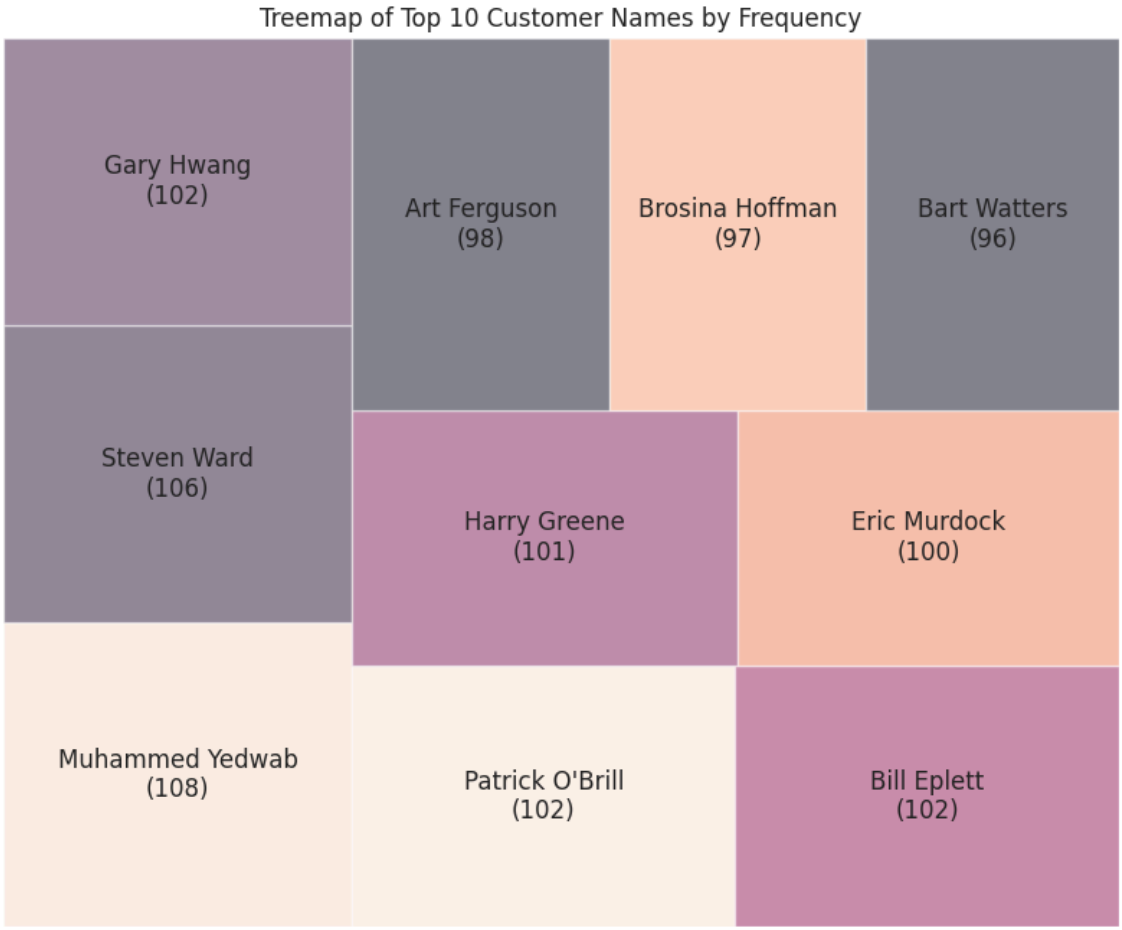
In [ ]:
```
print(sales_data['Customer Name'].unique())
print(sales_data['Customer Name'].nunique())  #795 unique customers
```

```
 'Luke Foster' 'Doug Jacobs' 'Sanjit Jacobs' 'Muhammed Lee'
 'Marc Harrigan' 'Nick Radford' 'Michael Kennedy' 'Patricia Hirasaki'
 'Alan Barnes' 'Cathy Armstrong' 'Kean Takahito' 'Ed Braxton'
 'Michael Grace' 'Matthew Grinstein' 'Matt Collister' 'Brad Thomas'
 'Emily Burns' 'Erin Ashbrook' 'Fred Harton' 'Allen Armold'
 'Bradley Nguyen' 'Ricardo Emerson' 'Neil Ducich' 'Michelle Lonsdale'
 'Sibella Parks' 'Sandra Flanagan' 'Aaron Smayling' 'Alan Haines'
 'Ken Heidel' 'Anna Andreadi' 'Lindsay Shagiari' 'Ken Lonsdale'
 'Kelly Williams' 'Frank Atkinson' 'Jill Fjeld' 'Lori Olson'
 'Bruce Stewart' 'Herbert Flentye' 'Michael Paige' 'Jennifer Jackson'
 'Logan Currie' 'Barry Französisch' 'Erin Smith' 'Fred Chung'
 'Theresa Swint' 'Jasper Cacioppo' 'Maya Herman' 'Roy Französisch'
 'Patrick Gardner' "Doug O'Connell" 'Tanja Norvell' 'Dan Reichenbach'
 'Ralph Arnett' 'Ben Ferrer' 'Shirley Daniels' 'David Bremer'
 'Michelle Ellison' 'Anna Häberlin' 'Robert Dilbeck' 'Carol Darley'
 'Chris Selesnick' 'Jay Fein' 'Adrian Shami' 'Stefania Perrino'
 'Erin Creighton' 'Todd Boyes' 'Matt Hagelstein' 'David Flashing'
 'Sonia Sunley' 'Roger Demir' 'Lisa DeCherney' 'Julie Prescott'
 'Lindsay Castell' 'Jenna Caffey' 'Ivan Liston' 'Noel Staavos' 'Tracy Z
```

In [ ]:
```
!pip install squarify
```

```
Collecting squarify
  Downloading squarify-0.4.3-py3-none-any.whl (4.3 kB)
Installing collected packages: squarify
Successfully installed squarify-0.4.3
```

In [ ]:
```
import squarify

# Get the frequency of each customer name
customer_name_counts = sales_data['Customer Name'].value_counts()

# Selecting only the top 10 customers
top_10_customers = customer_name_counts.head(10)

# Prepare the labels with frequencies
labels = [f'{name}\n({count})' for name, count in zip(top_10_customers.inde

# Plotting the treemap with labeled frequencies
plt.figure(figsize=(10, 8))
squarify.plot(sizes=top_10_customers.values, label=labels, alpha=0.5)
plt.axis('off')
plt.title('Treemap of Top 10 Customer Names by Frequency')
plt.show()
```



Segment column

In [ ]:
```
sales_data['Segment']
```

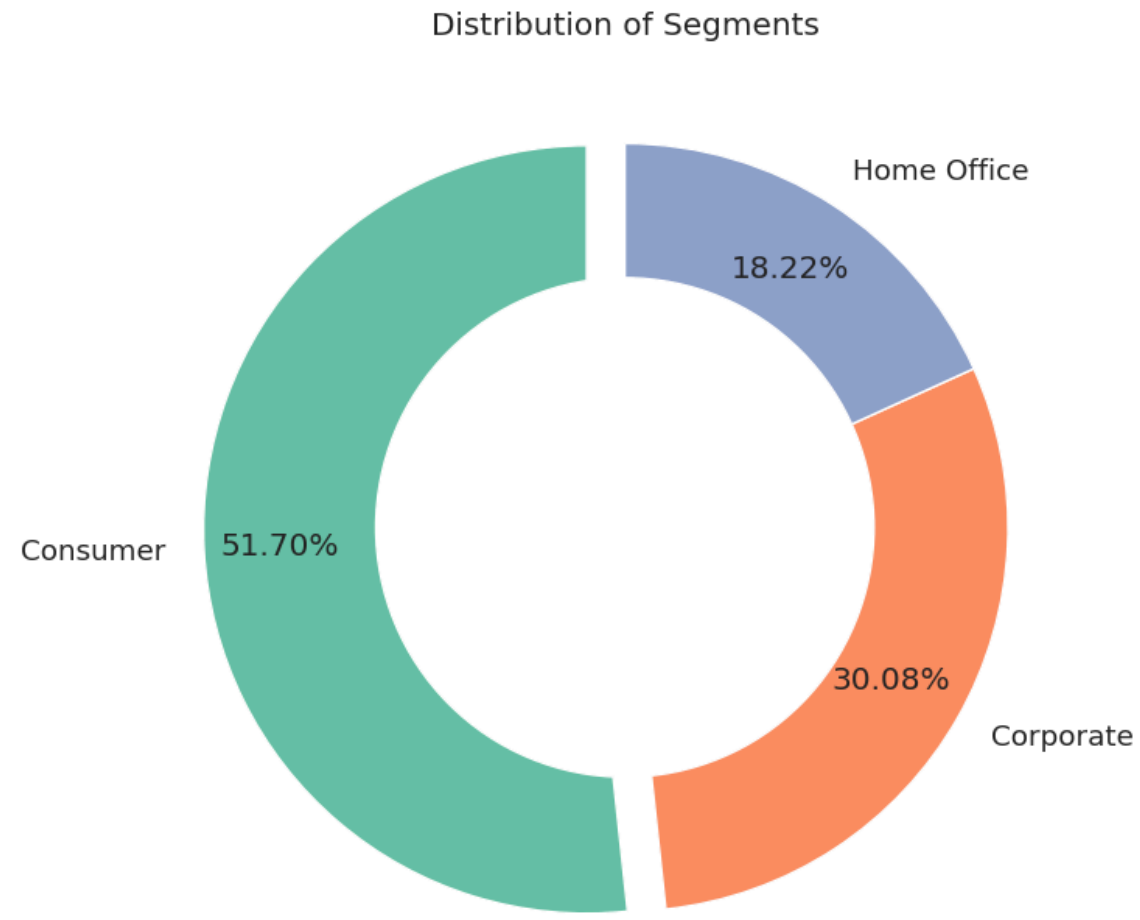
Out[32]:
```
0           Consumer
1          Corporate
2           Consumer
3        Home Office
4           Consumer
               ...
51285      Corporate
51286       Consumer
51287    Home Office
51288    Home Office
51289       Consumer
Name: Segment, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Segment'].unique())
print(sales_data['Segment'].nunique())
```

```
['Consumer' 'Corporate' 'Home Office']
3
```

In [ ]:

```
# Set the font scale for better readability
sns.set(font_scale=1.2)

# Get the unique values and their counts for the Segment column
segment_counts = sales_data['Segment'].value_counts()

# Define explode values
explode = [0.1 if seg == 'Consumer' else 0 for seg in segment_counts.index]

# Plotting the pie chart
plt.figure(figsize=(8, 8))
plt.pie(x=segment_counts, labels=segment_counts.index, colors=sns.color_pal

# Add a hole in the pie
hole = plt.Circle((0, 0), 0.65, facecolor='white')
plt.gcf().gca().add_artist(hole)

plt.title('Distribution of Segments')
plt.show()
```



***City column ***

In [ ]:
```
sales_data['City']
```

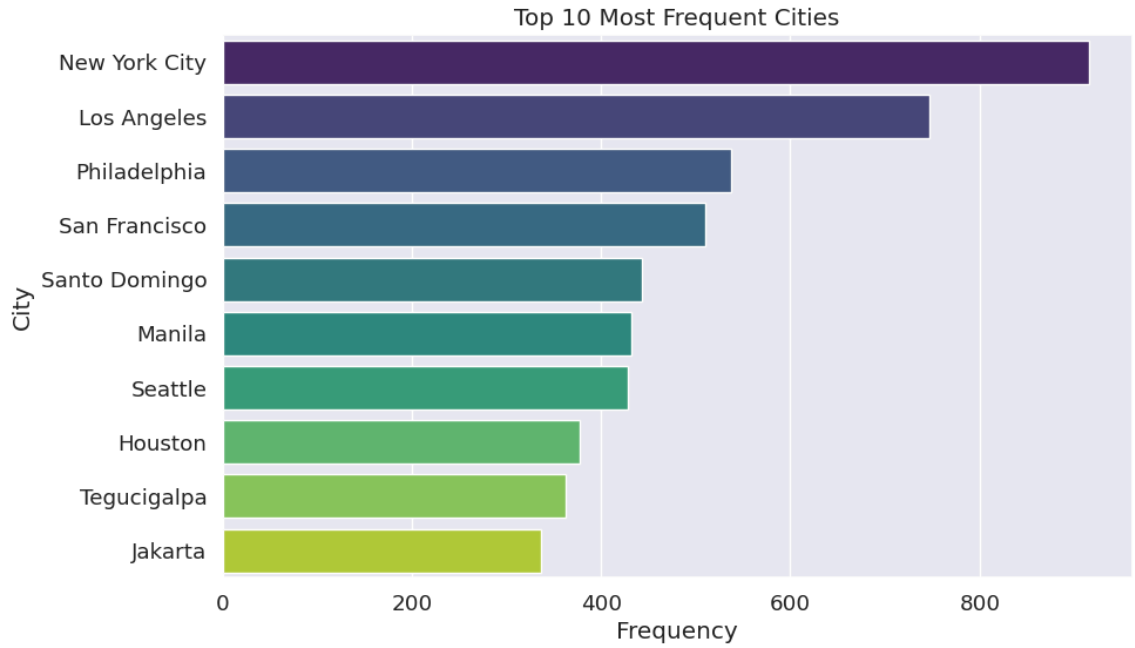
Out[35]:
```
0        New York City
1           Wollongong
2             Brisbane
3               Berlin
4                Dakar
              ...
51285             Kure
51286          Houston
51287           Oxnard
51288         Valinhos
51289         Tipitapa
Name: City, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['City'].unique())
print(sales_data['City'].nunique())
```

```
['New York City' 'Wollongong' 'Brisbane' ... 'Abilene' 'Felahiye'
 'Victoria Falls']
3636
```

In [ ]:
```
# Get the unique values and their counts for the City column
city_counts = sales_data['City'].value_counts()

# Plotting the count plot
plt.figure(figsize=(10, 6))
sns.countplot(y='City', data=sales_data, order=city_counts.index[:10], pale
plt.title('Top 10 Most Frequent Cities')
plt.xlabel('Frequency')
plt.ylabel('City')
plt.show()
```

```
<ipython-input-37-881d807890c8>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for
the same effect.

  sns.countplot(y='City', data=sales_data, order=city_counts.index[:10], p
alette='viridis')
```



State coluumn

In [ ]:
```
sales_data['State']
```

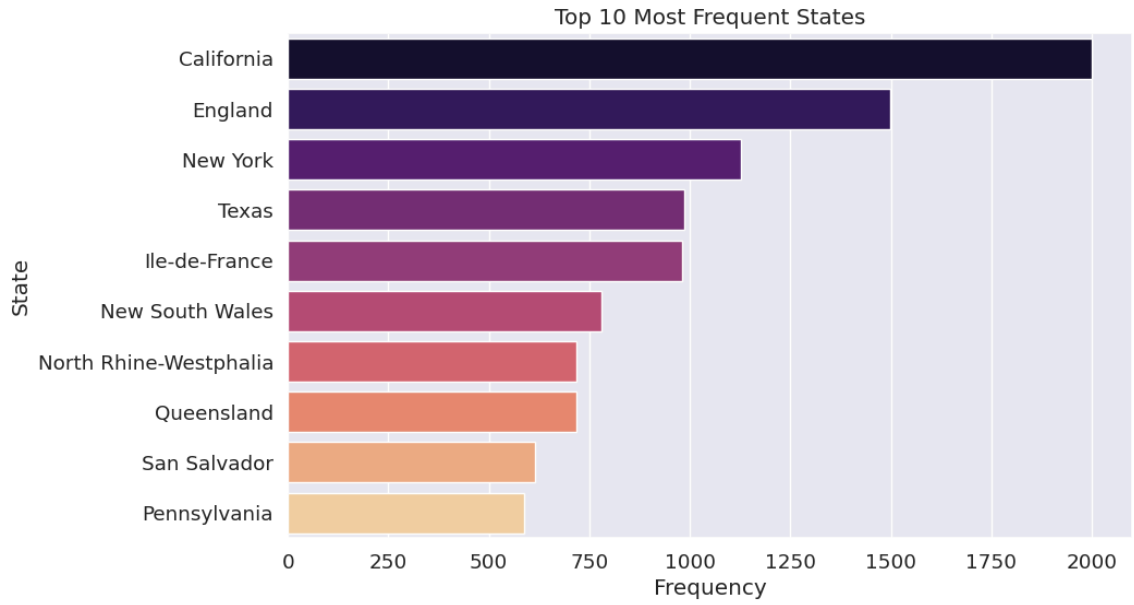
Out[38]:
```
0              New York
1        New South Wales
2             Queensland
3                 Berlin
4                  Dakar
               ...
51285          Hiroshima
51286              Texas
51287         California
51288          São Paulo
51289            Managua
Name: State, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['State'].unique())
print(sales_data['State'].nunique())
```

```
['New York' 'New South Wales' 'Queensland' ... 'Manicaland' 'Kabarole'
 'Matabeleland North']
1094
```

In [ ]:
```
state_counts = sales_data['State'].value_counts()

# Plotting the count plot
plt.figure(figsize=(10, 6))
sns.countplot(y='State', data=sales_data, order=state_counts.index[:10], pa
plt.title('Top 10 Most Frequent States')
plt.xlabel('Frequency')
plt.ylabel('State')
plt.show()
```

```
<ipython-input-40-88c50122b8d7>:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for
the same effect.

  sns.countplot(y='State', data=sales_data, order=state_counts.index[:10],
palette='magma')
```



Country column

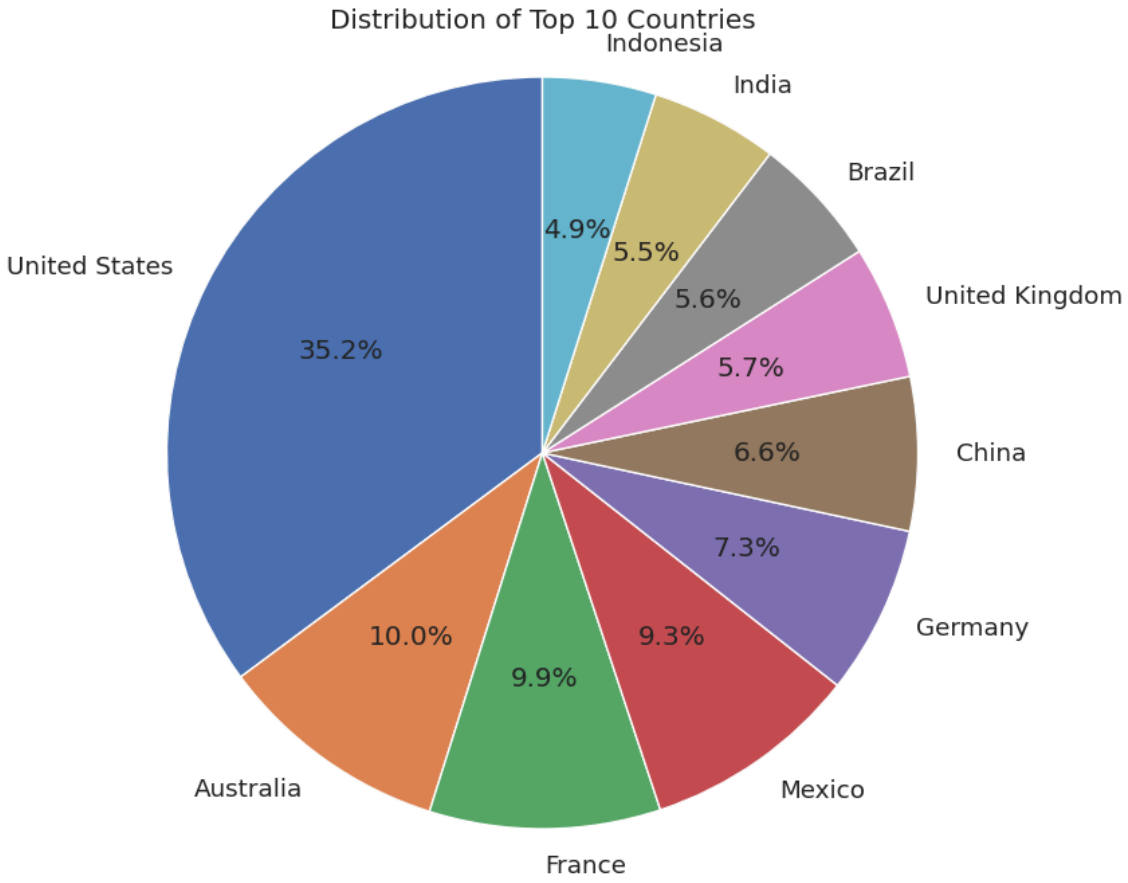
In [ ]:
```
sales_data['Country']
```

Out[41]:
```
0         United States
1             Australia
2             Australia
3               Germany
4               Senegal
               ...
51285             Japan
51286     United States
51287     United States
51288            Brazil
51289         Nicaragua
Name: Country, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Country'].unique())
print(sales_data['Country'].nunique())
```

```
['United States' 'Australia' 'Germany' 'Senegal' 'New Zealand'
 'Afghanistan' 'Saudi Arabia' 'Brazil' 'China' 'France' 'Italy' 'Tanzania'
 'Poland' 'United Kingdom' 'Mexico' 'El Salvador' 'Taiwan' 'India'
 'Dominican Republic' 'Democratic Republic of the Congo' 'Indonesia'
 'Uruguay' 'Iran' 'Mozambique' 'Bangladesh' 'Spain' 'Ukraine' 'Nicaragua'
 'Morocco' 'Canada' 'Philippines' 'Austria' 'Colombia' 'Netherlands'
 'Malaysia' 'Ecuador' 'Thailand' 'Somalia' 'Guatemala' 'Belarus'
 'Cambodia' 'South Africa' 'Japan' 'Russia' 'Egypt' 'Azerbaijan'
 'Lithuania' 'Argentina' 'Lesotho' 'Vietnam' 'Cuba' 'Romania' 'Turkey'
 'Cameroon' 'Hungary' 'Singapore' 'Angola' 'Belgium' 'Pakistan' 'Finland'
 'Ghana' 'Zambia' 'Iraq' 'Liberia' 'Georgia' 'Switzerland' 'Albania'
 'Chad' 'Montenegro' 'Namibia' 'Portugal' 'Madagascar' 'Sweden'
 'Myanmar (Burma)' 'Jamaica' 'Qatar' 'Republic of the Congo' 'Norway'
 'Algeria' 'South Korea' 'Nigeria' 'Estonia' "Cote d'Ivoire" 'Honduras'
 'Paraguay' 'Czech Republic' 'Central African Republic' 'Benin' 'Bolivia'
 'Chile' 'Martinique' 'Syria' 'Lebanon' 'Kenya' 'Mali' 'Libya' 'Venezuela'
 'Trinidad and Tobago' 'Ireland' 'Bulgaria' 'Panama' 'Israel' 'Haiti'
 'Barbados' 'Slovenia' 'Togo' 'Mauritania' 'Guinea' 'Rwanda' 'Denmark'
 'Niger' 'Papua New Guinea' 'Mongolia' 'Sudan' 'Peru' 'Sierra Leone'
 'Bosnia and Herzegovina' 'Guinea-Bissau' 'Djibouti' 'Tunisia' 'Croatia'
 'Hong Kong' 'Nepal' 'Guadeloupe' 'Kyrgyzstan' 'Zimbabwe' 'Uzbekistan'
 'South Sudan' 'Gabon' 'Bahrain' 'Yemen' 'Jordan' 'United Arab Emirates'
 'Moldova' 'Swaziland' 'Turkmenistan' 'Kazakhstan' 'Ethiopia' 'Uganda'
 'Slovakia' 'Sri Lanka' 'Tajikistan' 'Burundi' 'Macedonia' 'Eritrea'
 'Equatorial Guinea' 'Armenia']
147
```

In [ ]:
```
country_counts = sales_data['Country'].value_counts().head(10)

# Plotting the pie chart
plt.figure(figsize=(10, 8))
sns.set(font_scale=1.2)
sns.color_palette("tab10")
plt.pie(country_counts, labels=country_counts.index, autopct='%1.1f%%', sta
plt.title('Distribution of Top 10 Countries')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circ
plt.show()
```



Market Column

In [ ]:
```
sales_data['Market']
```

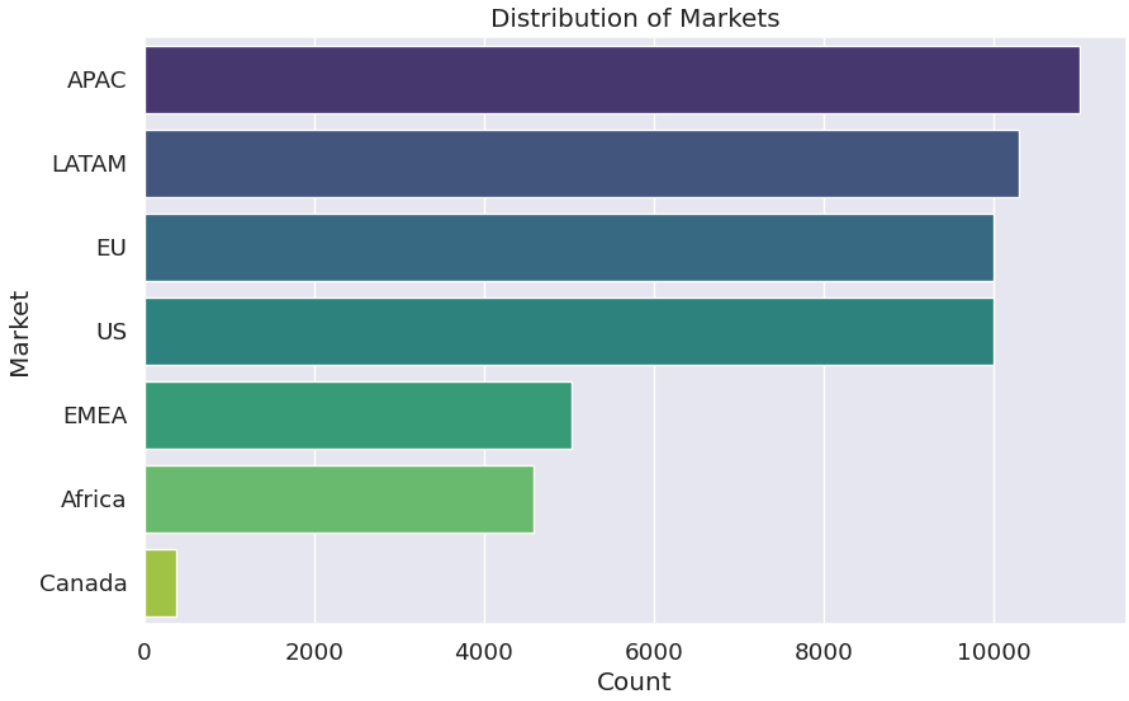
Out[44]:
```
0            US
1          APAC
2          APAC
3            EU
4        Africa
          ...
51285      APAC
51286        US
51287        US
51288     LATAM
51289     LATAM
Name: Market, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Market'].unique())
print(sales_data['Market'].nunique())
```

```
['US' 'APAC' 'EU' 'Africa' 'EMEA' 'LATAM' 'Canada']
7
```

In [ ]:
```
plt.figure(figsize=(10, 6))
sns.countplot(data=sales_data, y='Market', order=sales_data['Market'].value
plt.title('Distribution of Markets')
plt.xlabel('Count')
plt.ylabel('Market')
plt.show()
```

```
<ipython-input-46-9b1a6bffcbb0>:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for
the same effect.

  sns.countplot(data=sales_data, y='Market', order=sales_data['Market'].va
lue_counts().index, palette='viridis')
```



Region Column

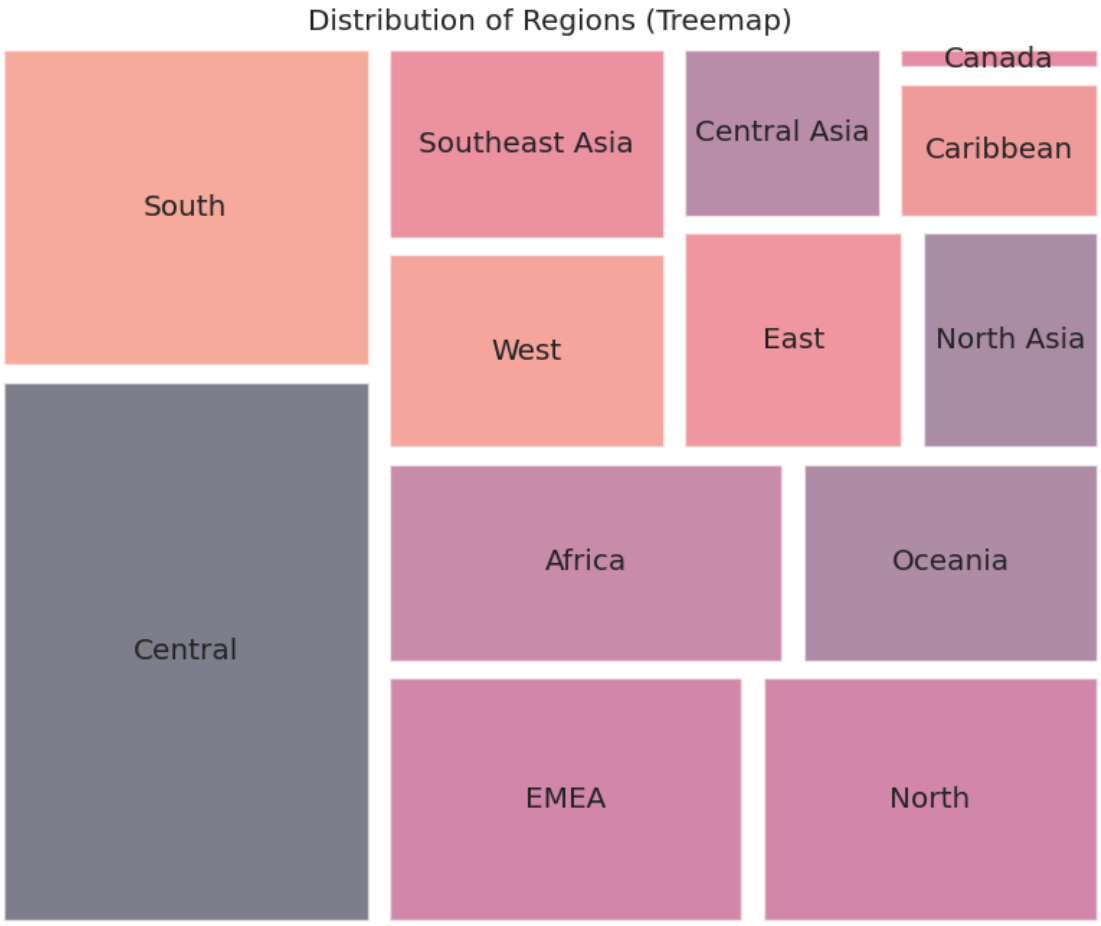
In [ ]:
```
sales_data['Region']
```

Out[47]:
```
0             East
1          Oceania
2          Oceania
3          Central
4           Africa
            ...
51285    North Asia
51286       Central
51287          West
51288         South
51289       Central
Name: Region, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Region'].unique())
print(sales_data['Region'].nunique())
```

```
['East' 'Oceania' 'Central' 'Africa' 'West' 'South' 'Central Asia' 'EMEA'
 'North Asia' 'North' 'Caribbean' 'Southeast Asia' 'Canada']
13
```

In [ ]:
```
# Get the counts for each region
region_counts = sales_data['Region'].value_counts()

# Create a squarify plot
plt.figure(figsize=(10, 8))
squarify.plot(sizes=region_counts, label=region_counts.index, alpha=0.5, pa
plt.title('Distribution of Regions (Treemap)')
plt.axis('off')  # Turn off axis
plt.show()
```



***Product ID Column ***

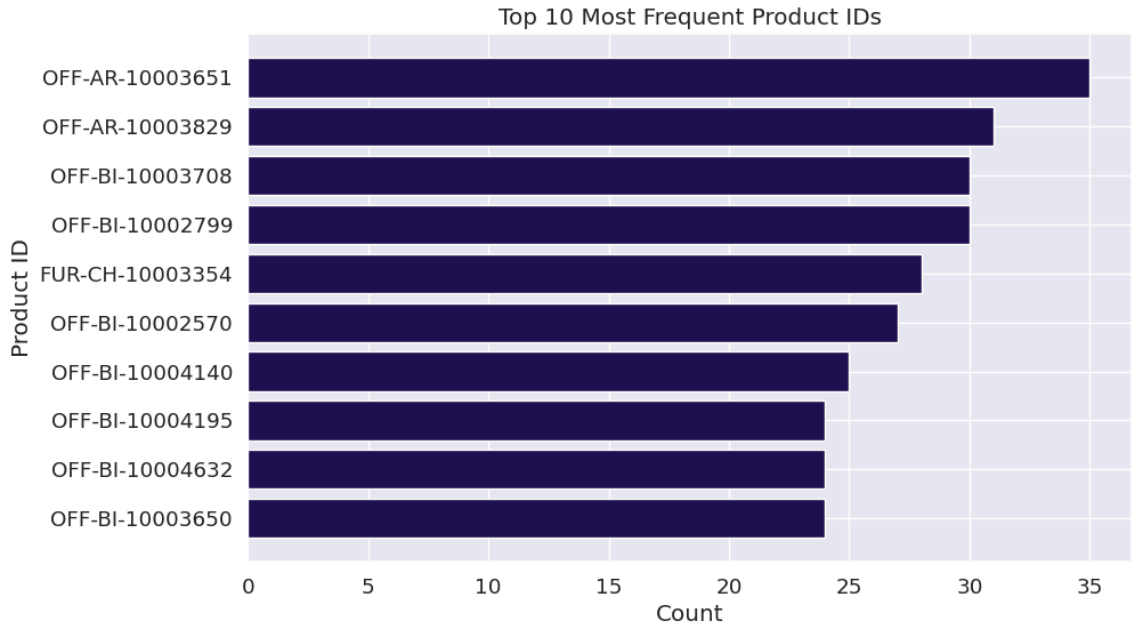
In [ ]:
```
sales_data['Product ID']
```

Out[50]:
```
0          TEC-AC-10003033
1          FUR-CH-10003950
2          TEC-PH-10004664
3          TEC-PH-10004583
4         TEC-SHA-10000501
                 ...
51285      OFF-FA-10000746
51286      OFF-AP-10002906
51287      OFF-EN-10001219
51288      OFF-BI-10000806
51289      OFF-PA-10004155
Name: Product ID, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Product ID'].unique())
print(sales_data['Product ID'].nunique())
```

```
['TEC-AC-10003033' 'FUR-CH-10003950' 'TEC-PH-10004664' ...
 'OFF-BI-10002510' 'FUR-ADV-10002329' 'OFF-AP-10002203']
10292
```

In [ ]:
```
# Define the number of top product IDs to consider
top_n = 10

# Get the top N most frequent product IDs and their counts
top_product_ids = sales_data['Product ID'].value_counts().head(top_n)
product_counts = top_product_ids.values
product_ids = top_product_ids.index

# Set Seaborn's color palette
sns.set_palette("magma")

# Create the bar plot
plt.figure(figsize=(10, 6))
plt.barh(product_ids, product_counts)
plt.xlabel('Count')
plt.ylabel('Product ID')
plt.title(f'Top {top_n} Most Frequent Product IDs')
plt.gca().invert_yaxis()  # Invert y-axis to have the highest count on top
plt.show()
```



Category column

In [ ]:
```
sales_data['Category']
```

Out[53]:
```
0             Technology
1              Furniture
2             Technology
3             Technology
4             Technology
              ...
51285    Office Supplies
51286    Office Supplies
51287    Office Supplies
51288    Office Supplies
51289    Office Supplies
Name: Category, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Category'].unique())
print(sales_data['Category'].nunique())
```

```
['Technology' 'Furniture' 'Office Supplies']
3
```

In [ ]:
```
from wordcloud import WordCloud

# Concatenate all categories into a single string
categories_text = ' '.join(sales_data['Category'])

# Generate word cloud
wordcloud = WordCloud(width=800, height=400, background_color='white').gene

# Display the word cloud
plt.figure(figsize=(10, 6))
plt.imshow(wordcloud, interpolation='bilinear')
plt.title('Word Cloud of Categories')
plt.axis('off')
plt.show()
```

Sub-Category Column

In [ ]:
```
sales_data['Sub-Category']
```

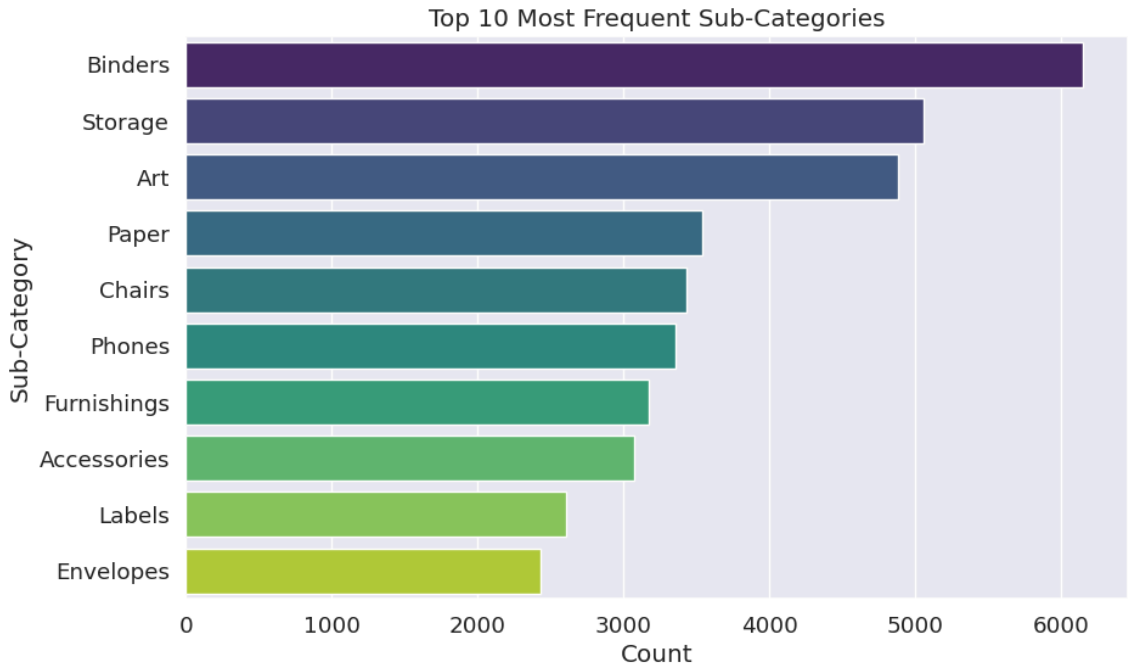
Out[56]:
```
0        Accessories
1             Chairs
2             Phones
3             Phones
4            Copiers
             ...
51285      Fasteners
51286     Appliances
51287      Envelopes
51288        Binders
51289          Paper
Name: Sub-Category, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Sub-Category'].unique())
print(sales_data['Sub-Category'].nunique())
```

```
['Accessories' 'Chairs' 'Phones' 'Copiers' 'Tables' 'Binders' 'Supplies'
 'Appliances' 'Machines' 'Bookcases' 'Storage' 'Furnishings' 'Art' 'Paper'
 'Envelopes' 'Fasteners' 'Labels']
17
```

In [ ]:
```
# Get the top 10 most frequent sub-categories and their counts
top_subcategories = sales_data['Sub-Category'].value_counts().head(10)

# Create the vertical bar plot
plt.figure(figsize=(10, 6))
sns.barplot(x=top_subcategories.values, y=top_subcategories.index, palette=
plt.xlabel('Count')
plt.ylabel('Sub-Category')
plt.title('Top 10 Most Frequent Sub-Categories')
plt.show()
```

```
<ipython-input-58-321a8e793935>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for
the same effect.

  sns.barplot(x=top_subcategories.values, y=top_subcategories.index, palet
te='viridis')
```



Product name

In [ ]:
```
sales_data['Product Name']
```

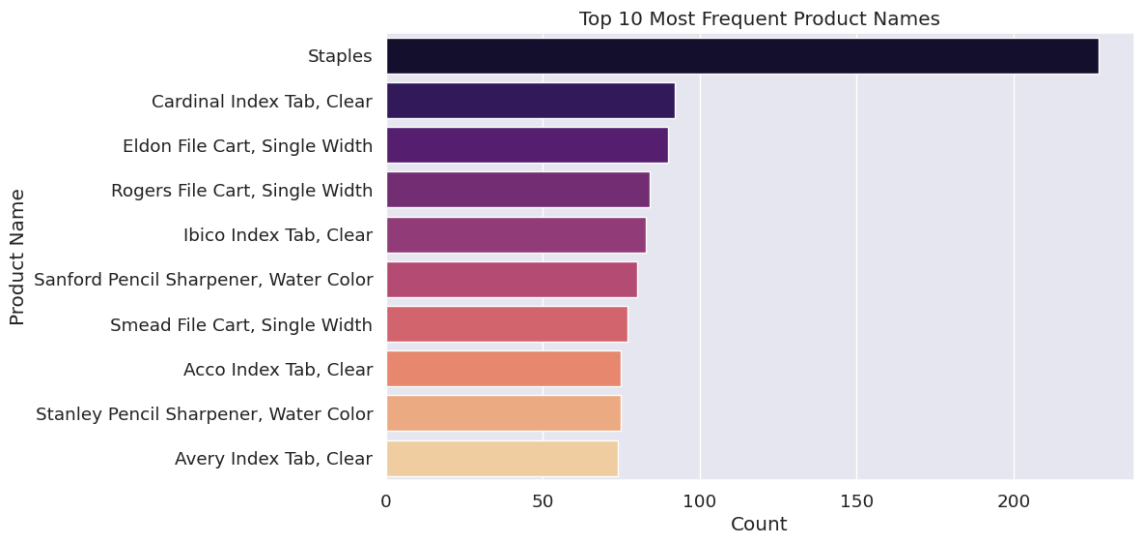
Out[59]:
```
0        Plantronics CS510 - Over-the-Head monaural Wir...
1                Novimex Executive Leather Armchair, Black
2                        Nokia Smart Phone, with Caller ID
3                           Motorola Smart Phone, Cordless
4                           Sharp Wireless Fax, High-Speed
                               ...
51285                        Advantus Thumb Tacks, 12 Pack
51286    Hoover Replacement Belt for Commercial Guardsm...
51287         #10- 4 1/8" x 9 1/2" Security-Tint Envelopes
51288                                Acco Index Tab, Economy
51289              Eaton Computer Printout Paper, 8.5 x 11
Name: Product Name, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Product Name'].unique())
print(sales_data['Product Name'].nunique())
```

```
['Plantronics CS510 - Over-the-Head monaural Wireless Headset System'
 'Novimex Executive Leather Armchair, Black'
 'Nokia Smart Phone, with Caller ID' ...
 'Kleencut Forged Office Shears by Acme United Corporation'
 'Holmes Visible Mist Ultrasonic Humidifier with 2.3-Gallon Output per Da
y, Replacement Filter'
 'Eureka Disposable Bags for Sanitaire Vibra Groomer I Upright Vac']
3788
```

In [ ]:
```
# Get the top 10 most frequent product names and their counts
top_product_names = sales_data['Product Name'].value_counts().head(10)

# Create the horizontal bar plot
plt.figure(figsize=(10, 6))
sns.barplot(x=top_product_names.values, y=top_product_names.index, palette=
plt.xlabel('Count')
plt.ylabel('Product Name')
plt.title('Top 10 Most Frequent Product Names')
plt.show()
```

```
<ipython-input-61-f9b85084377e>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for
the same effect.

  sns.barplot(x=top_product_names.values, y=top_product_names.index, palet
te='magma')
```



Sales Column

In [ ]:
```
sales_data['Sales']
```

Out[62]:
```
0        2309.650
1        3709.395
2        5175.171
3        2892.510
4        2832.960
           ...
51285      65.100
51286       0.444
51287      22.920
51288      13.440
51289      61.380
Name: Sales, Length: 51290, dtype: float64
```

In [ ]:
```
print(sales_data['Sales'].unique())
print(sales_data['Sales'].nunique())
```

```
[2.309650e+03 3.709395e+03 5.175171e+03 ... 1.624000e+00 5.364000e+00
 4.440000e-01]
24988
```

Qunatity column

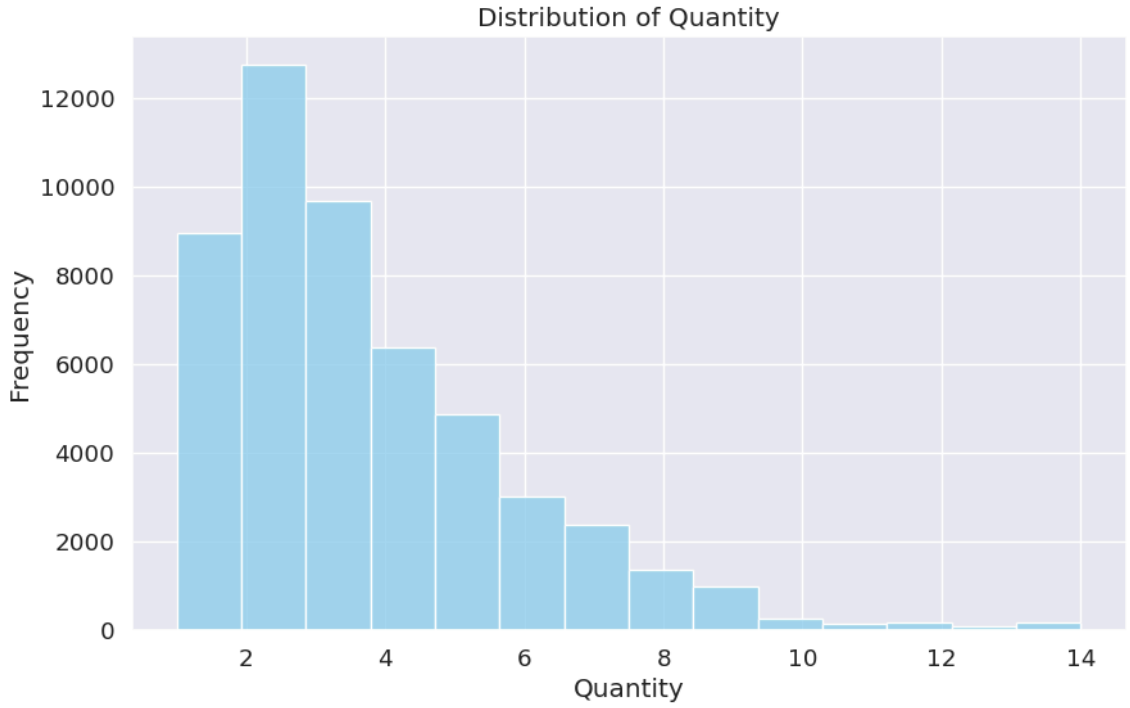
In [ ]:
```
sales_data['Quantity']
```

Out[64]:
```
0        7
1        9
2        9
3        5
4        8
        ..
51285    5
51286    1
51287    3
51288    2
51289    3
Name: Quantity, Length: 51290, dtype: int64
```

In [ ]:
```
print(sales_data['Quantity'].unique())
print(sales_data['Quantity'].nunique())
```

```
[ 7  9  5  8  4  6 13 12 14 10  2 11  3  1]
14
```

In [ ]:
```
# Create the histogram
plt.figure(figsize=(10, 6))
sns.histplot(sales_data['Quantity'], bins=14, color='skyblue')
plt.xlabel('Quantity')
plt.ylabel('Frequency')
plt.title('Distribution of Quantity')
plt.grid(True)
plt.show()
```



***Discount ***

In [ ]:
```
sales_data['Discount']
```

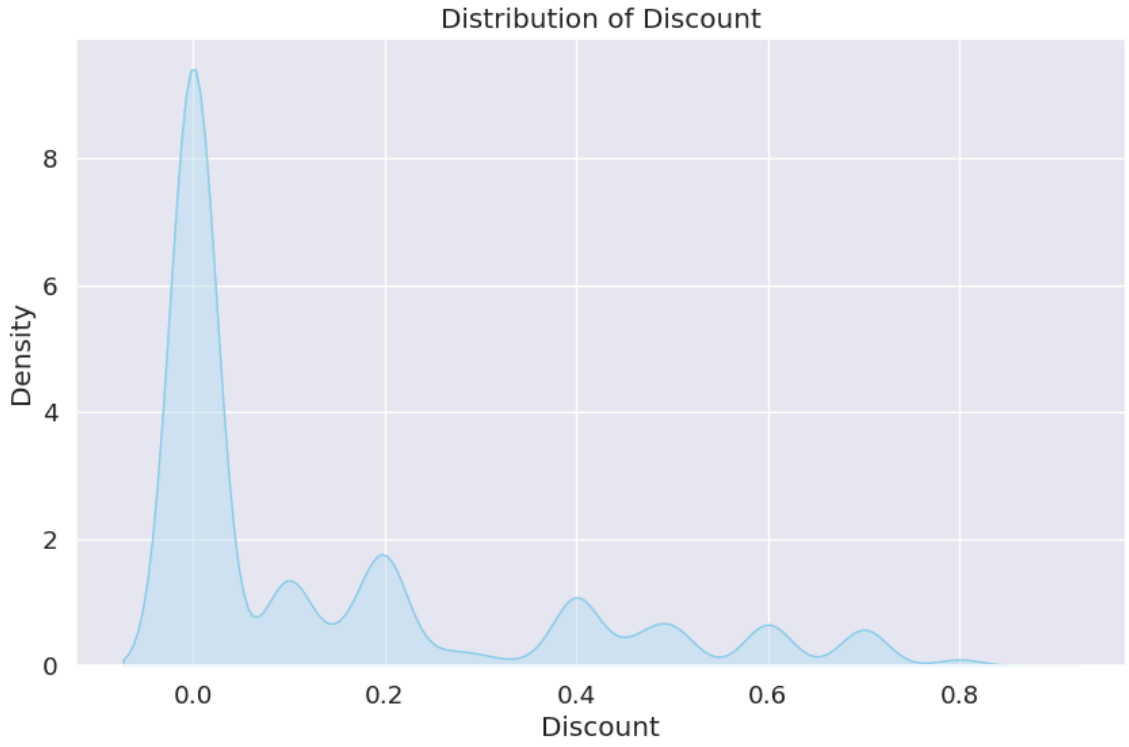
Out[67]:
```
0        0.0
1        0.1
2        0.1
3        0.1
4        0.0
        ...
51285    0.0
51286    0.8
51287    0.0
51288    0.0
51289    0.0
Name: Discount, Length: 51290, dtype: float64
```

In [ ]:
```
print(sales_data['Discount'].unique())
print(sales_data['Discount'].nunique())
```

```
[0.    0.1   0.2   0.4   0.15  0.3   0.5   0.17  0.47  0.25  0.002 0.07
 0.32  0.27  0.7   0.35  0.6   0.65  0.8   0.57  0.37  0.402 0.55  0.202
 0.45  0.602 0.85 ]
27
```

In [ ]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Create the KDE plot
plt.figure(figsize=(10, 6))
sns.kdeplot(sales_data['Discount'], shade=True, color='skyblue')
plt.xlabel('Discount')
plt.ylabel('Density')
plt.title('Distribution of Discount')
plt.grid(True)
plt.show()
```

```
<ipython-input-76-4ef045299e43>:6: FutureWarning:

`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.

  sns.kdeplot(sales_data['Discount'], shade=True, color='skyblue')
```



profit column

In [ ]:
```
sales_data['Profit']
```

Out[69]:
```
0        762.1845
1       -288.7650
2        919.9710
3        -96.5400
4        311.5200
            ...
51285      4.5000
51286     -1.1100
51287     11.2308
51288      2.4000
51289      1.8000
Name: Profit, Length: 51290, dtype: float64
```

In [ ]:
```
print(sales_data['Profit'].unique())
print(sales_data['Profit'].nunique())
```

```
[ 762.1845 -288.765   919.971  ...   -4.466    -6.456   -49.572 ]
27085
```

Shipping Cost

In [ ]:
```
sales_data['Shipping Cost']
```

Out[71]:
```
0        933.570
1        923.630
2        915.490
3        910.160
4        903.040
          ...
51285      0.010
51286      0.010
51287      0.010
51288      0.003
51289      0.002
Name: Shipping Cost, Length: 51290, dtype: float64
```

In [ ]:
```
print(sales_data['Shipping Cost'].unique())
print(sales_data['Shipping Cost'].nunique())
```

```
[9.3357e+02 9.2363e+02 9.1549e+02 ... 1.0000e-02 3.0000e-03 2.0000e-03]
16936
```

Order Priority

In [ ]:
```
sales_data['Order Priority']
```

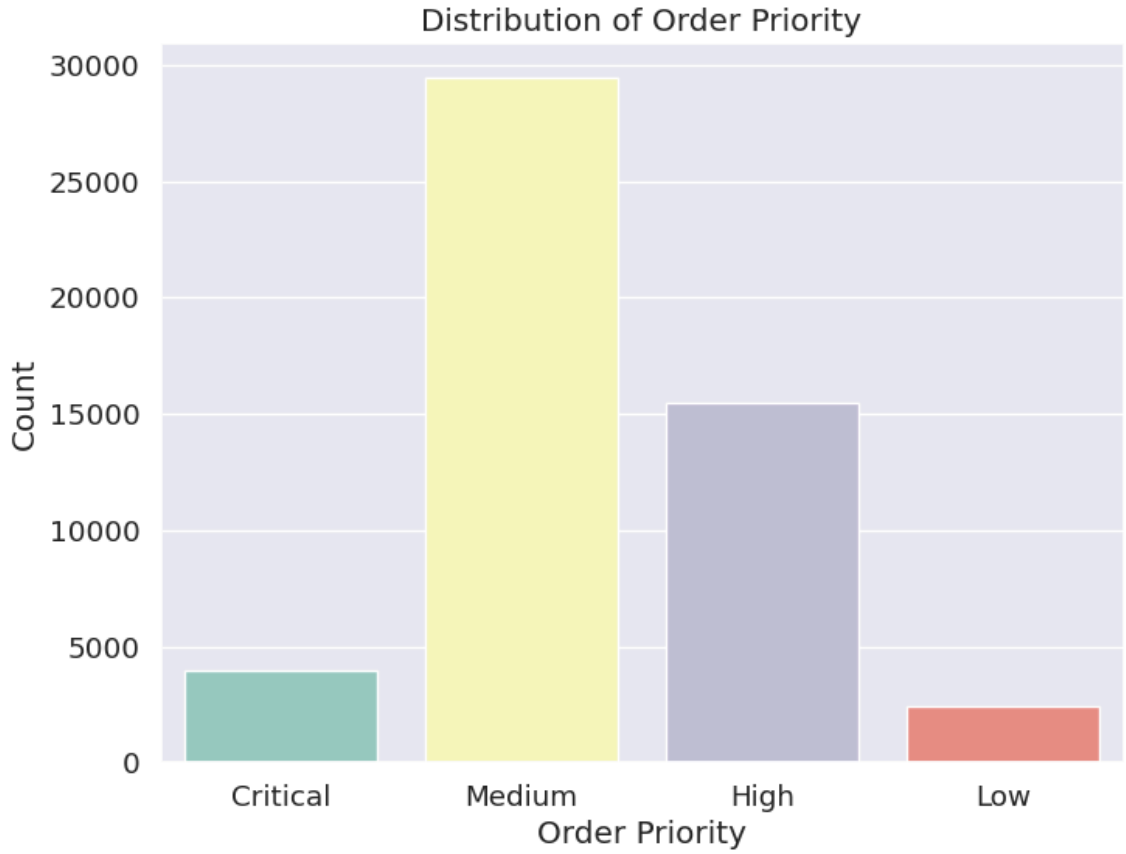
Out[74]:
```
0        Critical
1        Critical
2          Medium
3          Medium
4        Critical
            ...
51285      Medium
51286      Medium
51287        High
51288      Medium
51289        High
Name: Order Priority, Length: 51290, dtype: object
```

In [ ]:
```
print(sales_data['Order Priority'].unique())
print(sales_data['Order Priority'].nunique())
```

```
['Critical' 'Medium' 'High' 'Low']
4
```

In [ ]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Create the count plot
plt.figure(figsize=(8, 6))
sns.countplot(x='Order Priority', data=sales_data, palette='Set3')
plt.xlabel('Order Priority')
plt.ylabel('Count')
plt.title('Distribution of Order Priority')
plt.show()
```

```
<ipython-input-77-8a8241bbcc37>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for
the same effect.

  sns.countplot(x='Order Priority', data=sales_data, palette='Set3')
```



***Now Lets derive some insights from this Dataset ***

In [ ]:
```
sales_data.columns
```

Out[102]:
```
Index(['Row ID', 'Order ID', 'Order Date', 'Ship Date', 'Ship Mode',
       'Customer ID', 'Customer Name', 'Segment', 'City', 'State', 'Countr
y',
       'Postal Code', 'Market', 'Region', 'Product ID', 'Category',
       'Sub-Category', 'Product Name', 'Sales', 'Quantity', 'Discount',
       'Profit', 'Shipping Cost', 'Order Priority'],
      dtype='object')
```

***Total Sales ***

In [ ]:
```
total_sales = sales_data['Sales'].sum()
print("Total Sales:", total_sales)
```

```
Total Sales: 12642501.909880001
```

In [ ]:
```
# Calculate total sales and round to 2 decimal places
total_sales = round(sales_data['Sales'].sum(), 2)
print("Total Sales:", total_sales)
```

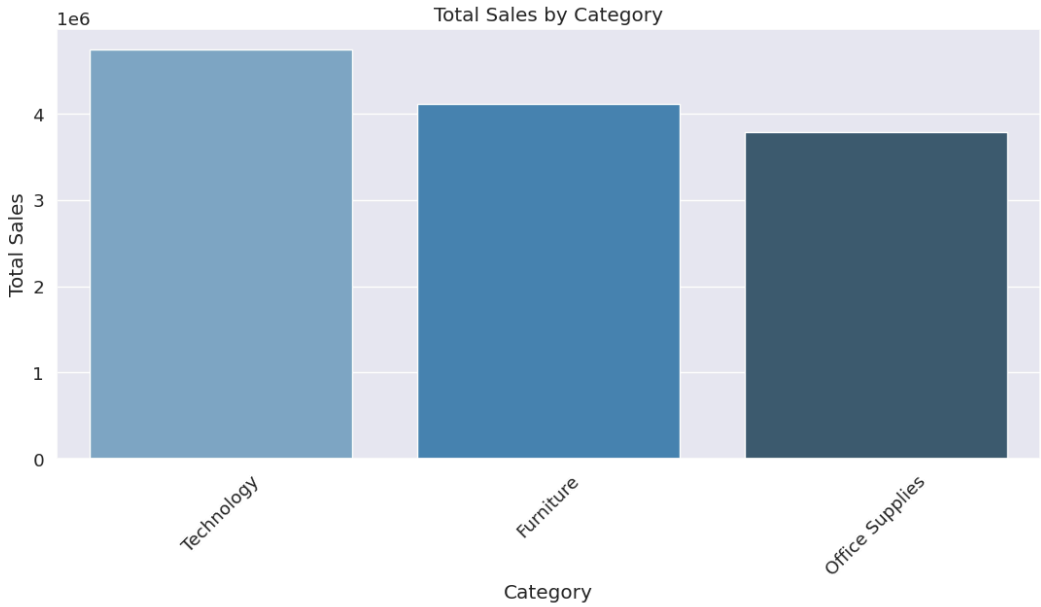
```
Total Sales: 12642501.91
```

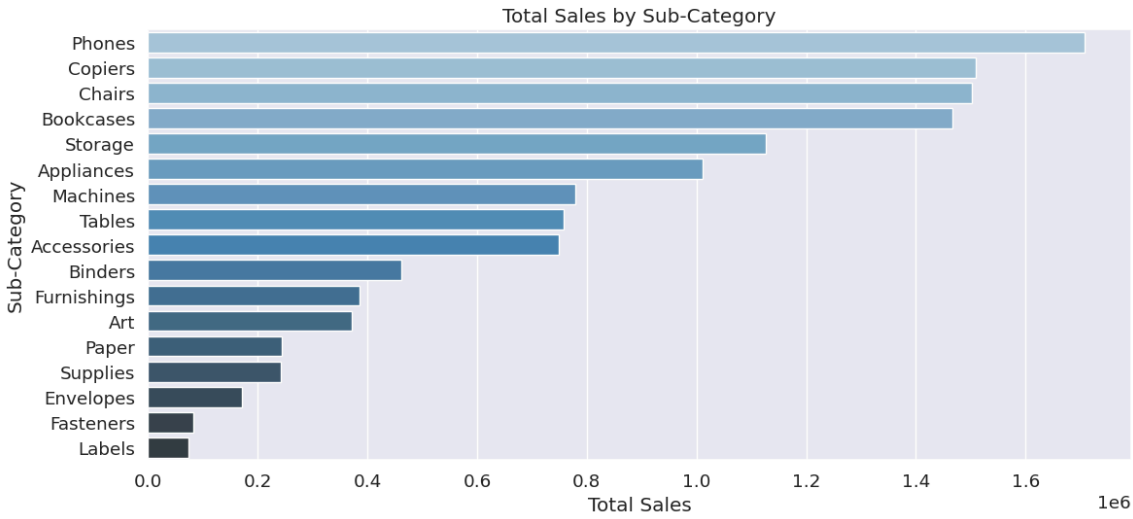
Total sales by category and subcategory

In [ ]:

```
total_sales_by_category = sales_data.groupby('Category')['Sales'].sum().res

# Group the data by 'Sub-Category' and calculate total sales for each sub-c
total_sales_by_subcategory = sales_data.groupby(['Category', 'Sub-Category'

# Plotting
fig, axes = plt.subplots(2, 1, figsize=(12, 12))

# Plot for Total Sales by Category
sns.barplot(x='Category', y='Sales', data=total_sales_by_category, ax=axes[
axes[0].set_title('Total Sales by Category')
axes[0].set_xlabel('Category')
axes[0].set_ylabel('Total Sales')
axes[0].tick_params(axis='x', rotation=45)

# Plot for Total Sales by Sub-Category
sns.barplot(x='Sales', y='Sub-Category', data=total_sales_by_subcategory, a
axes[1].set_title('Total Sales by Sub-Category')
axes[1].set_xlabel('Total Sales')
axes[1].set_ylabel('Sub-Category')

plt.tight_layout()
plt.show()
```

```
<ipython-input-109-00dbef1acce7>:10: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for
the same effect.

  sns.barplot(x='Category', y='Sales', data=total_sales_by_category, ax=ax
es[0], palette='Blues_d')
<ipython-input-109-00dbef1acce7>:17: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for
the same effect.

  sns.barplot(x='Sales', y='Sub-Category', data=total_sales_by_subcategor
y, ax=axes[1], palette='Blues_d')
```

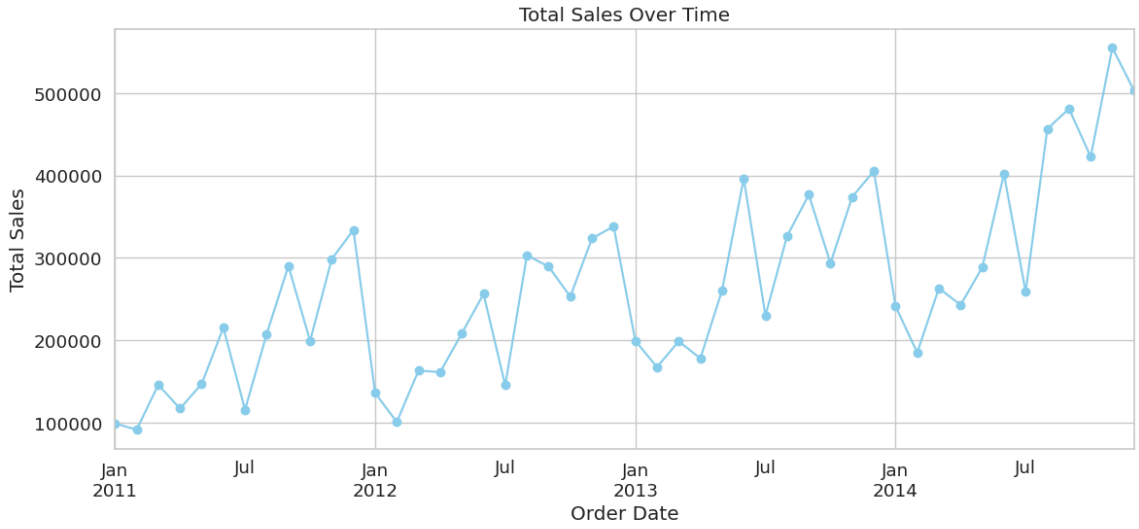


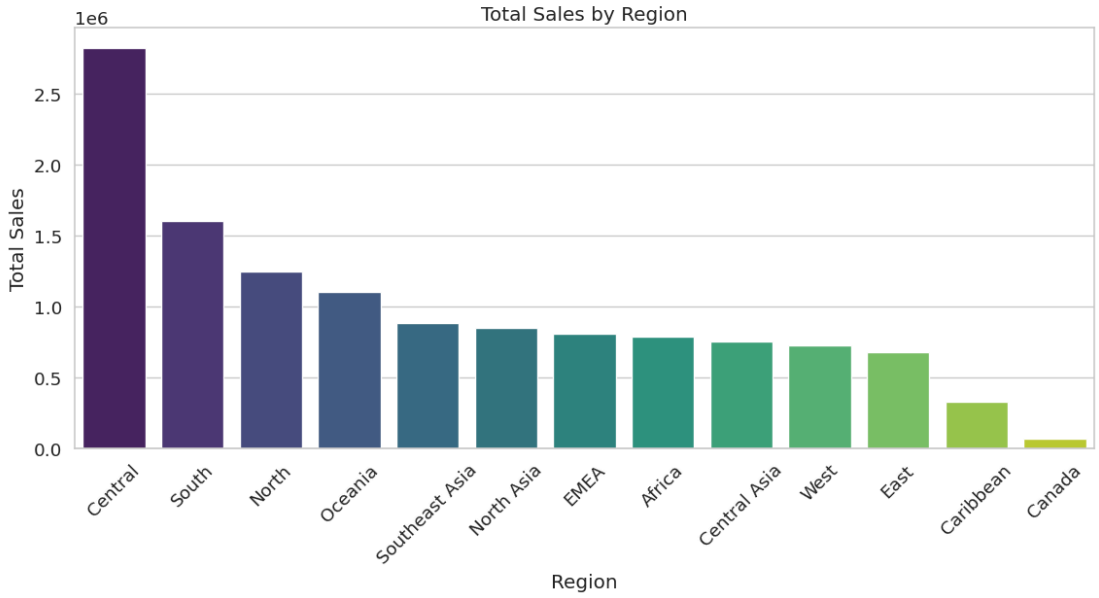


Total sales over time and Total sales by Region

In [ ]:
```
sns.set_style("whitegrid")

# Plotting
fig, axes = plt.subplots(2, 1, figsize=(12, 12))

# Total Sales Over Time
sales_data['Order Date'] = pd.to_datetime(sales_data['Order Date'])  # Conv
total_sales_over_time = sales_data.groupby(sales_data['Order Date'].dt.to_p
total_sales_over_time.plot(ax=axes[0], marker='o', color='skyblue')
axes[0].set_title('Total Sales Over Time')
axes[0].set_xlabel('Order Date')
axes[0].set_ylabel('Total Sales')

# Total Sales by Region
total_sales_by_region = sales_data.groupby('Region')['Sales'].sum().sort_va
sns.barplot(x=total_sales_by_region.index, y=total_sales_by_region.values,
axes[1].set_title('Total Sales by Region')
axes[1].set_xlabel('Region')
axes[1].set_ylabel('Total Sales')
axes[1].tick_params(axis='x', rotation=45)  # Rotate x-axis labels

plt.tight_layout()
plt.show()
```

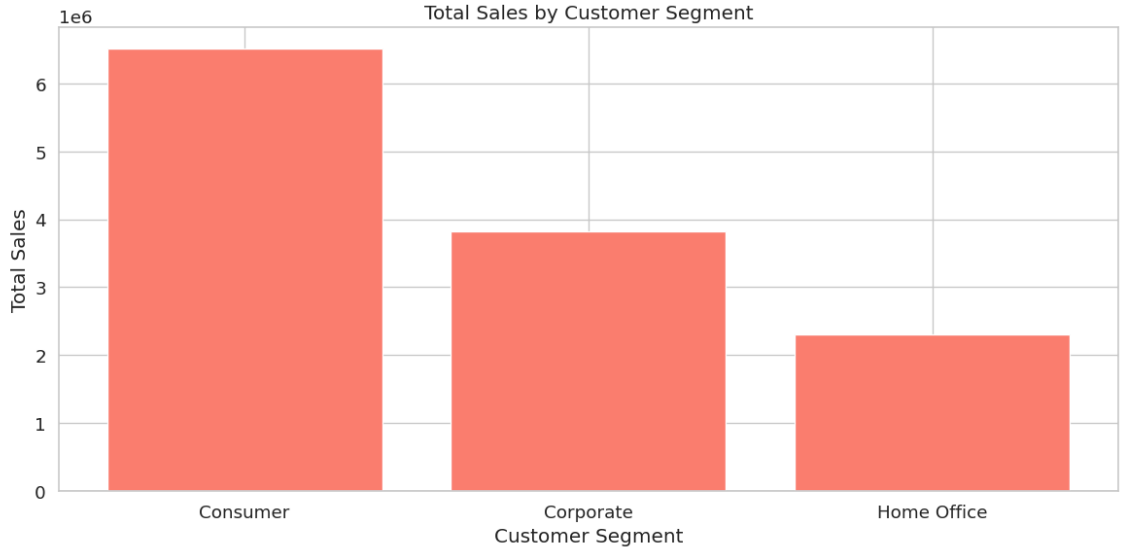
```
<ipython-input-111-d3b1712da16b>:16: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be remove
d in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for
the same effect.

  sns.barplot(x=total_sales_by_region.index, y=total_sales_by_region.value
s, ax=axes[1], palette='viridis')
```

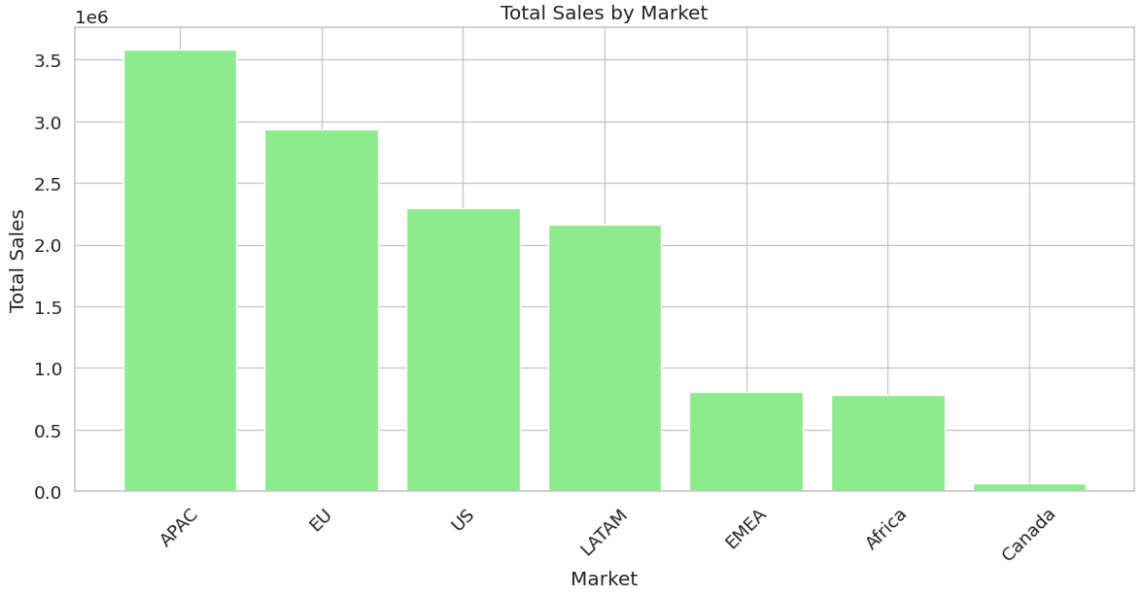




Total sales by Order Priority,Customer Segment and Market

In [ ]:
```
sns.set_style("whitegrid")

# Plotting
fig, axes = plt.subplots(3, 1, figsize=(12, 18))

# Total Sales by Order Priority
total_sales_by_order_priority = sales_data.groupby('Order Priority')['Sales
axes[0].bar(total_sales_by_order_priority.index, total_sales_by_order_prior
axes[0].set_title('Total Sales by Order Priority')
axes[0].set_xlabel('Order Priority')
axes[0].set_ylabel('Total Sales')

# Total Sales by Customer Segment
total_sales_by_customer_segment = sales_data.groupby('Segment')['Sales'].su
axes[1].bar(total_sales_by_customer_segment.index, total_sales_by_customer_
axes[1].set_title('Total Sales by Customer Segment')
axes[1].set_xlabel('Customer Segment')
axes[1].set_ylabel('Total Sales')

# Total Sales by Market
total_sales_by_market = sales_data.groupby('Market')['Sales'].sum().sort_va
axes[2].bar(total_sales_by_market.index, total_sales_by_market.values, colo
axes[2].set_title('Total Sales by Market')
axes[2].set_xlabel('Market')
axes[2].set_ylabel('Total Sales')
axes[2].tick_params(axis='x', rotation=45)  # Rotate x-axis labels

plt.tight_layout()
plt.show()
```





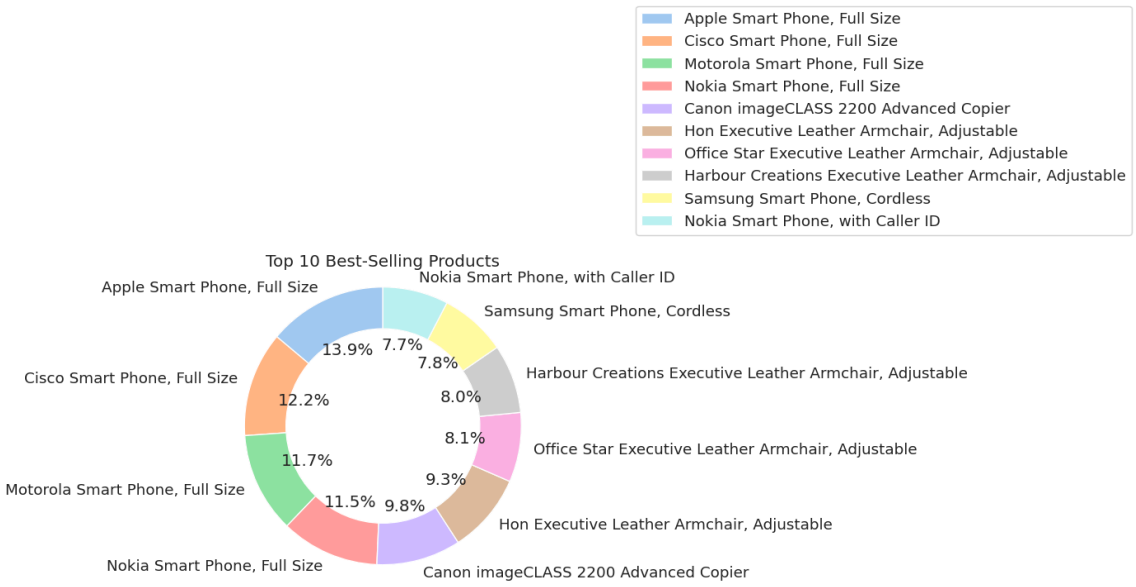
best-selling products

In [ ]:
```
total_sales_by_product = sales_data.groupby('Product Name')['Sales'].sum().

# Identifying the best-selling products (top 10)
best_selling_products = total_sales_by_product.head(10)

# Displaying the best-selling products
print("Top 10 Best-Selling Products:")
print(best_selling_products)
```

```
Top 10 Best-Selling Products:
Product Name
Apple Smart Phone, Full Size                              86935.7786
Cisco Smart Phone, Full Size                              76441.5306
Motorola Smart Phone, Full Size                           73156.3030
Nokia Smart Phone, Full Size                              71904.5555
Canon imageCLASS 2200 Advanced Copier                     61599.8240
Hon Executive Leather Armchair, Adjustable                58193.4841
Office Star Executive Leather Armchair, Adjustable        50661.6840
Harbour Creations Executive Leather Armchair, Adjustable  50121.5160
Samsung Smart Phone, Cordless                             48653.4600
Nokia Smart Phone, with Caller ID                         47877.7857
Name: Sales, dtype: float64
```

In [ ]:

```
# Define colors for the pie chart
colors = sns.color_palette('pastel')[0:len(best_selling_products)]

# Plotting the donut chart
patches, texts, autotexts = plt.pie(best_selling_products, labels=best_sell
plt.title('Top 10 Best-Selling Products')

# Draw a circle in the middle to create the donut shape
centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

# Create legend based on sales
sorted_labels = [label for _, label in sorted(zip(best_selling_products, be
plt.legend(handles=patches, labels=sorted_labels, loc="center left", bbox_t

# Equal aspect ratio ensures that pie is drawn as a circle
plt.axis('equal')
plt.show()
```



Order processing Analysis

In [ ]:

```
# Replace non-numeric values with zeros
order_processing_efficiency = order_processing_efficiency.fillna(0)

# Convert values to integers
order_processing_efficiency = order_processing_efficiency.astype(int)

# Plotting
plt.figure(figsize=(10, 6))
sns.heatmap(order_processing_efficiency, annot=True, cmap='Blues', fmt='d')
plt.title('Order Processing Efficiency by Ship Mode and Order Priority')
plt.xlabel('Order Priority')
plt.ylabel('Ship Mode')
plt.xticks(rotation=45)
plt.yticks(rotation=0)
plt.show()
```