Sales_Analysis

June 4, 2025

1 Importing Required Libraries

[2]:

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

[3]:

```
try:
    df = pd.read_csv("SuperMarket sales record.csv")
    print("Data loaded successfully!")
except FileNotFoundError:
    print("Error: The CSV file was not found. Please ensure 'SuperMarket sales␣
 ↪record.csv' is in the correct directory.")
    exit() # Or create a dummy df for testing purposes
```

```
Data loaded successfully!
```

[4]:

```
df.head()
```

[4]:

```
   Row ID        Order ID  Order Date   Ship Date       Ship Mode Customer ID  \
0       1  CA-2017-152156  08/11/2017  11/11/2017    Second Class    CG-12520
1       2  CA-2017-152156  08/11/2017  11/11/2017    Second Class    CG-12520
2       3  CA-2017-138688  12/06/2017  16/06/2017    Second Class    DV-13045
3       4  US-2016-108966  11/10/2016  18/10/2016  Standard Class    SO-20335
4       5  US-2016-108966  11/10/2016  18/10/2016  Standard Class    SO-20335

     Customer Name    Segment        Country             City       State  \
0      Claire Gute   Consumer  United States        Henderson    Kentucky
1      Claire Gute   Consumer  United States        Henderson    Kentucky
2  Darrin Van Huff  Corporate  United States      Los Angeles  California
3   Sean O'Donnell   Consumer  United States  Fort Lauderdale     Florida
4   Sean O'Donnell   Consumer  United States  Fort Lauderdale     Florida

   Postal Code Region       Product ID         Category Sub-Category  \
0      42420.0  South  FUR-BO-10001798        Furniture    Bookcases
1      42420.0  South  FUR-CH-10000454        Furniture       Chairs
2      90036.0   West  OFF-LA-10000240  Office Supplies       Labels
3      33311.0  South  FUR-TA-10000577        Furniture       Tables
4      33311.0  South  OFF-ST-10000760  Office Supplies      Storage
```

```
                                        Product Name     Sales
0                  Bush Somerset Collection Bookcase  261.9600
1  Hon Deluxe Fabric Upholstered Stacking Chairs,…  731.9400
2  Self-Adhesive Address Labels for Typewriters b…   14.6200
3      Bretford CR4500 Series Slim Rectangular Table  957.5775
4                     Eldon Fold 'N Roll Cart System   22.3680
```

[3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9800 entries, 0 to 9799
Data columns (total 18 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Row ID         9800 non-null   int64
 1   Order ID       9800 non-null   object
 2   Order Date     9800 non-null   object
 3   Ship Date      9800 non-null   object
 4   Ship Mode      9800 non-null   object
 5   Customer ID    9800 non-null   object
 6   Customer Name  9800 non-null   object
 7   Segment        9800 non-null   object
 8   Country        9800 non-null   object
 9   City           9800 non-null   object
 10  State          9800 non-null   object
 11  Postal Code    9789 non-null   float64
 12  Region         9800 non-null   object
 13  Product ID     9800 non-null   object
 14  Category       9800 non-null   object
 15  Sub-Category   9800 non-null   object
 16  Product Name   9800 non-null   object
 17  Sales          9800 non-null   float64
dtypes: float64(2), int64(1), object(15)
memory usage: 1.3+ MB
```

[4]:
```
df.describe()
```

[4]:
```
            Row ID   Postal Code         Sales
count  9800.000000   9789.000000   9800.000000
mean   4900.500000  55273.322403    230.769059
std    2829.160653  32041.223413    626.651875
min       1.000000   1040.000000      0.444000
25%    2450.750000  23223.000000     17.248000
50%    4900.500000  58103.000000     54.490000
75%    7350.250000  90008.000000    210.605000
max    9800.000000  99301.000000  22638.480000
```

```
[5]: df.columns
```

```
[5]: Index(['Row ID', 'Order ID', 'Order Date', 'Ship Date', 'Ship Mode',
            'Customer ID', 'Customer Name', 'Segment', 'Country', 'City', 'State',
            'Postal Code', 'Region', 'Product ID', 'Category', 'Sub-Category',
            'Product Name', 'Sales'],
           dtype='object')
```

2 Data Cleaning

```
[6]: #calculating null values

     null_count = df['Postal Code'].isnull().sum()
     print(null_count)
```

```
11
```

```
[7]: print(df.isnull().sum())
```

```
Row ID            0
Order ID          0
Order Date        0
Ship Date         0
Ship Mode         0
Customer ID       0
Customer Name     0
Segment           0
Country           0
City              0
State             0
Postal Code      11
Region            0
Product ID        0
Category          0
Sub-Category      0
Product Name      0
Sales             0
dtype: int64
```

```
[11]: # filling null values

      df.fillna({"Postal Code": 0}, inplace=True)

      # changing from float to integer
      df['Postal Code'] = df['Postal Code'].astype(int)

      df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9800 entries, 0 to 9799
Data columns (total 18 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Row ID         9800 non-null   int64
 1   Order ID       9800 non-null   object
 2   Order Date     9800 non-null   object
 3   Ship Date      9800 non-null   object
 4   Ship Mode      9800 non-null   object
 5   Customer ID    9800 non-null   object
 6   Customer Name  9800 non-null   object
 7   Segment        9800 non-null   object
 8   Country        9800 non-null   object
 9   City           9800 non-null   object
 10  State          9800 non-null   object
 11  Postal Code    9800 non-null   int64
 12  Region         9800 non-null   object
 13  Product ID     9800 non-null   object
 14  Category       9800 non-null   object
 15  Sub-Category   9800 non-null   object
 16  Product Name   9800 non-null   object
 17  Sales          9800 non-null   float64
dtypes: float64(1), int64(2), object(15)
memory usage: 1.3+ MB
```

[12]:

```python
# using conditional statement

if df.duplicated().sum()> 0:
    print('Duplicate are present')
else:
    print('No Duplicates exist')
```

```
No Duplicates exist
```

[13]:

```python
#see the actual duplicates rows
duplicates = df[df.duplicated()]
print(duplicates)
```

```
Empty DataFrame
Columns: [Row ID, Order ID, Order Date, Ship Date, Ship Mode, Customer ID,
Customer Name, Segment, Country, City, State, Postal Code, Region, Product ID,
Category, Sub-Category, Product Name, Sales]
Index: []
```

[14]:

```python
df.duplicated(keep = False).sum()
```

[14]:

```
np.int64(0)
```

[59]:

```
df.drop_duplicates(inplace=True)
print(f"Removed {duplicates.shape[0]} duplicate rows.")
```

```
Removed 0 duplicate rows.
```

3 Exploratory Data Analysis

3.1 Customer Analysis

3.1.1 Customer Segmentation

[15]:

```
# types of customers

types_of_customers = df['Segment'].unique()
print(types_of_customers)
```

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

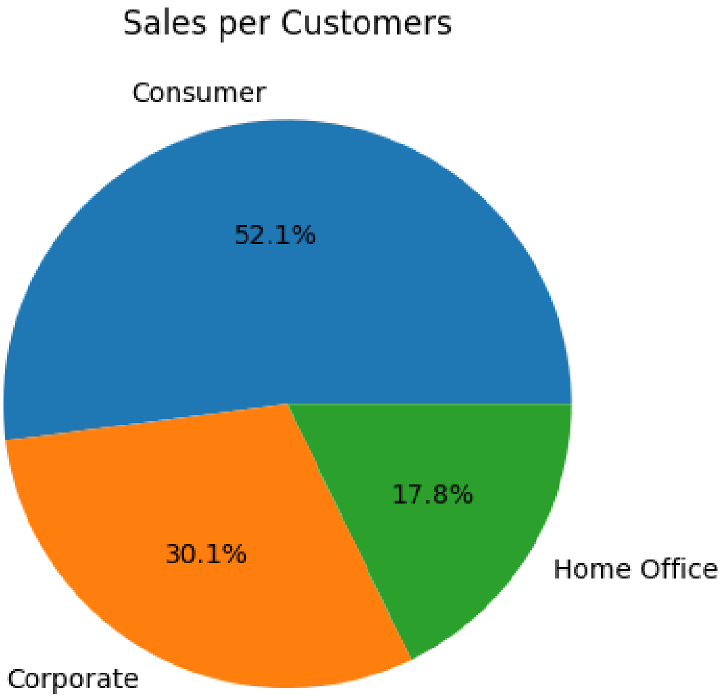
[17]:

```
# number of customer in each segment

number_of_customers = df['Segment'].value_counts().reset_index()

number_of_customers= number_of_customers.rename(columns={'Segment':'Customer␣
 ↪Type','count':'Total Customers'})

print(number_of_customers)
```

```
  Customer Type  Total Customers
0      Consumer             5101
1     Corporate             2953
2   Home Office             1746
```

[18]:

```
# Creating a pie chart

plt.pie(number_of_customers['Total Customers'],␣
 ↪labels=number_of_customers['Customer Type'], autopct= '%1.1f%%')

plt.title('Sales per Customers')

plt.show()
```

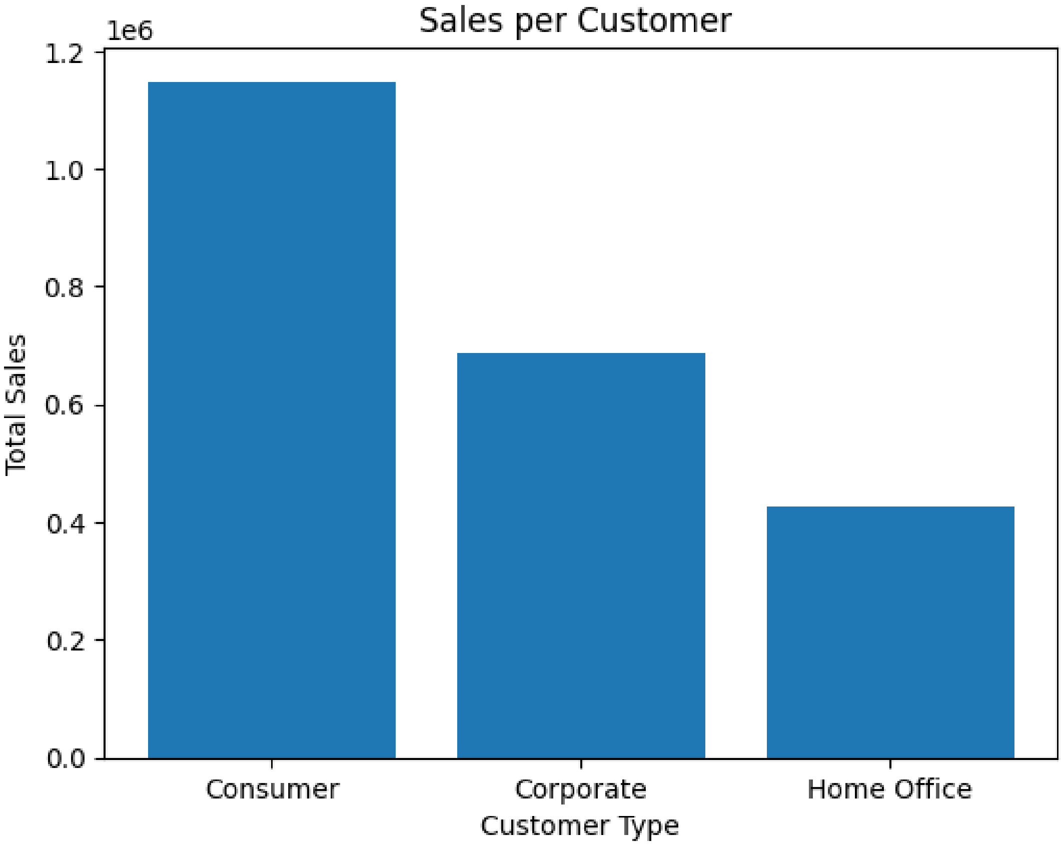


3.1.2 Customers & Sales

[19]:
```
sales_per_catogary = df.groupby('Segment')['Sales'].sum().reset_index()

sales_per_catogary = sales_per_catogary.rename(columns={'Segment':'Customer␣
 ↪Type','Sales' : 'Total Sales'})

print(sales_per_catogary)
```

```
  Customer Type   Total Sales
0      Consumer  1.148061e+06
1     Corporate  6.884941e+05
2   Home Office  4.249822e+05
```

[20]:
```
# bar graph

plt.bar(sales_per_catogary['Customer Type'], sales_per_catogary['Total Sales'])

# for label

plt.title('Sales per Customer ')
plt.xlabel('Customer Type')
plt.ylabel('Total Sales')

plt.show()
```



3.1.3 Customers Loyalty

[21]:
```
# group data : C_Id, C_Name, Segment , calculated frequency of their orders

customer_order_freq = df.groupby(['Customer ID','Customer Name','Segment'])␣
  ↪['Order ID'].count().reset_index()

customer_order_freq.rename(columns={'Order ID': 'Total Orders'}, inplace = True)

repeat_customers = customer_order_freq[customer_order_freq['Total Orders']>=1]

sorted_repeat_customers = repeat_customers.sort_values(by='Total Orders',␣
  ↪ascending=False)
```

```python
print(sorted_repeat_customers.head(10).reset_index(drop = True))
```

```
  Customer ID        Customer Name      Segment  Total Orders
0    WB-21850        William Brown     Consumer            35
1    PP-18955           Paul Prost  Home Office            34
2    MA-17560         Matt Abelman  Home Office            34
3    JL-15835             John Lee     Consumer            33
4    SV-20365          Seth Vernon     Consumer            32
5    JD-15895     Jonathan Doherty    Corporate            32
6    CK-12205  Chloris Kastensmidt     Consumer            32
7    AP-10915       Arthur Prichep     Consumer            31
8    ZC-21910     Zuschuss Carroll     Consumer            31
9    EP-13915           Emily Phan     Consumer            31
```

[22]:
```python
# group data : C_Id, C_Name, Segment ,State

customer_sales = df.groupby(['Customer ID','Customer Name','Segment'])['Sales'].
 ↪sum().reset_index()

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

print(top_spenders.head(10). reset_index(drop=True))
```

```
  Customer ID       Customer Name      Segment      Sales
0    SM-20320         Sean Miller  Home Office  25043.050
1    TC-20980        Tamara Chand    Corporate  19052.218
2    RB-19360        Raymond Buch     Consumer  15117.339
3    TA-21385        Tom Ashbrook  Home Office  14595.620
4    AB-10105       Adrian Barton     Consumer  14473.571
5    KL-16645        Ken Lonsdale     Consumer  14175.229
6    SC-20095        Sanjit Chand     Consumer  14142.334
7    HL-15040        Hunter Lopez     Consumer  12873.298
8    SE-20110        Sanjit Engle     Consumer  12209.438
9    CC-12370  Christopher Conant     Consumer  12129.072
```

3.2 Mode of Shipping

[23]:
```python
# sorting unique valuss in the ship mode cloumn into a new series

type_of_shipping = df['Ship Mode'].unique()
print(type_of_shipping)
```

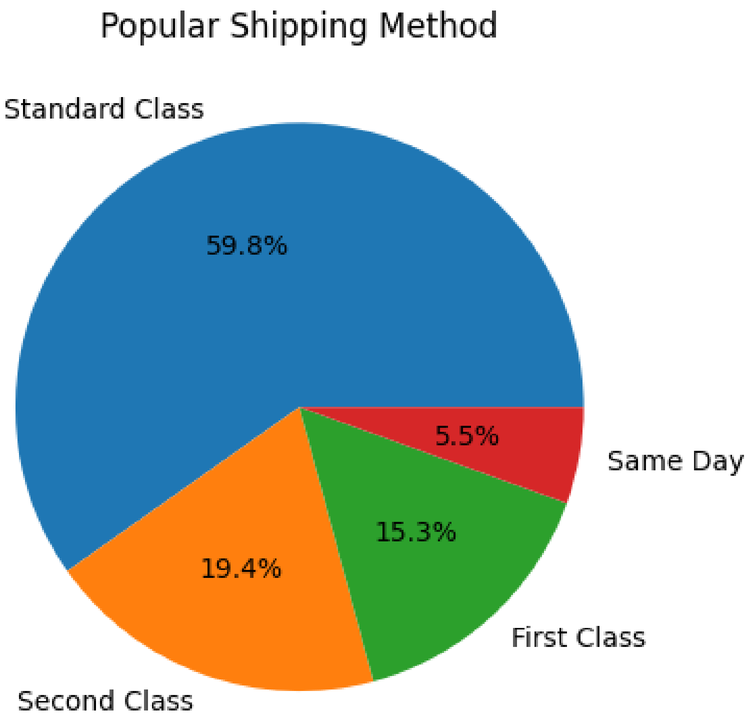
```
['Second Class' 'Standard Class' 'First Class' 'Same Day']
```

[24]:
```python
# frequency of shipping methods

shipping_mode = df['Ship Mode'].value_counts().reset_index()
shipping_mode = shipping_mode.rename(columns={'Ship Mode':'Mode of Shipment',␣
 ↪'count': 'Use Frequency'})

print(shipping_mode)
```

```
  Mode of Shipment  Use Frequency
0   Standard Class           5859
1     Second Class           1902
2      First Class           1501
3         Same Day            538
```

[25]:

```
plt.pie(shipping_mode['Use Frequency'],labels=shipping_mode['Mode of␣
 ↪Shipment'], autopct= '%1.1f%%')

plt.title('Popular Shipping Method')
plt.show()
```



3.3 Graphical Analysis

[26]:

```
# Customer by state

state = df['State'].value_counts().reset_index()

state= state.rename(columns={'count':'Number of customers'})
print(state.head(5))
```

```
          State  Number of customers
0    California                 1946
1      New York                 1097
2         Texas                  973
3  Pennsylvania                  582
4    Washington                  504
```

[27]:

```
# customer by city

city = df['City'].value_counts().reset_index()

city= city.rename(columns={'count':'Number of customers'})
print(city.head(5))
```

```
            City  Number of customers
0  New York City                  891
1    Los Angeles                  728
2   Philadelphia                  532
3  San Francisco                  500
4        Seattle                  426
```

[28]:

```
# sales per state

states_sales = df.groupby(['State'])['Sales'].sum().reset_index()

top_state_sales = states_sales.sort_values(by='Sales', ascending=False)

print(top_state_sales.head(11).reset_index(drop=True))
```

```
             State        Sales
0       California  446306.4635
1         New York  306361.1470
2            Texas  168572.5322
3       Washington  135206.8500
4     Pennsylvania  116276.6500
5          Florida   88436.5320
6         Illinois   79236.5170
7         Michigan   76136.0740
8             Ohio   75130.3500
9         Virginia   70636.7200
```

```
10  North Carolina   55165.9640
```

[29]:

```
# sales per city

city_sales = df.groupby(['City'])['Sales'].sum().reset_index()

top_city_sales = city_sales.sort_values(by='Sales', ascending=False)

print(top_city_sales.head(11).reset_index(drop=True))
```

```
             City        Sales
0   New York City  252462.5470
1     Los Angeles  173420.1810
2         Seattle  116106.3220
3   San Francisco  109041.1200
4    Philadelphia  108841.7490
5         Houston   63956.1428
6         Chicago   47820.1330
7       San Diego   47521.0290
8    Jacksonville   44713.1830
9         Detroit   42446.9440
10    Springfield   41827.8100
```

3.4 Product Analysis

[30]:

```
# types of product

product_category = df['Category'].unique()
print(product_category)
```

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

[31]:

```
# types of product by sub category

subcategory_count = df.groupby('Category')['Sub-Category'].nunique().
  ↪reset_index()

subcategory_count= subcategory_count.sort_values(by='Sub-Category', ascending =␣
  ↪False)

print(subcategory_count.reset_index(drop=True))
```

```
          Category  Sub-Category
0  Office Supplies             9
1        Furniture             4
2       Technology             4
```

[32]:

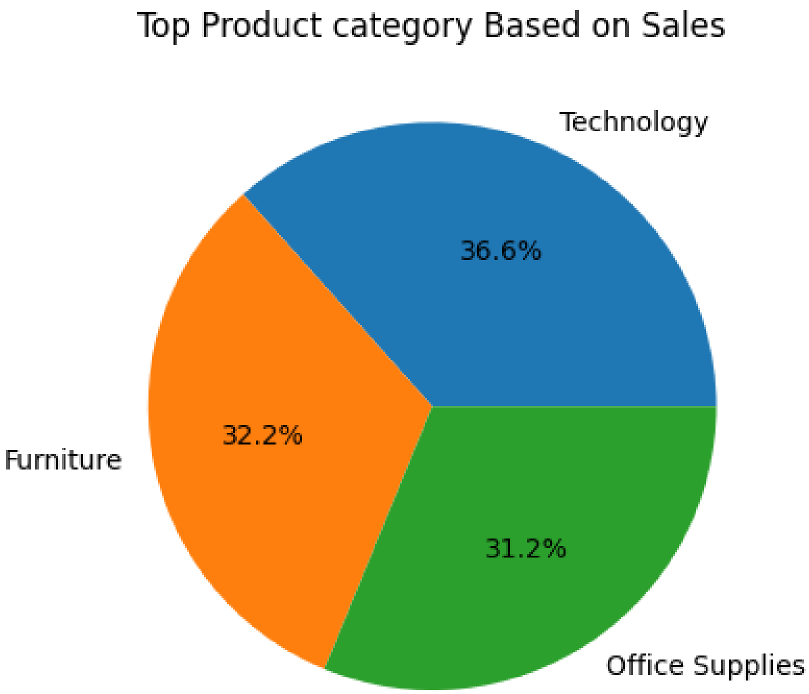
```
# sales per each category
```

```
category_sales = df.groupby(['Category'])['Sales'].sum().reset_index()

category_sales= category_sales.sort_values(by='Sales', ascending = False)


print(category_sales)
```

```
          Category        Sales
2       Technology  827455.8730
0        Furniture  728658.5757
1  Office Supplies  705422.3340
```

[33]:

```
plt.pie(category_sales['Sales'],labels=category_sales['Category'], autopct= '%1.1f%%')

plt.title('Top Product category Based on Sales')
plt.show()
```



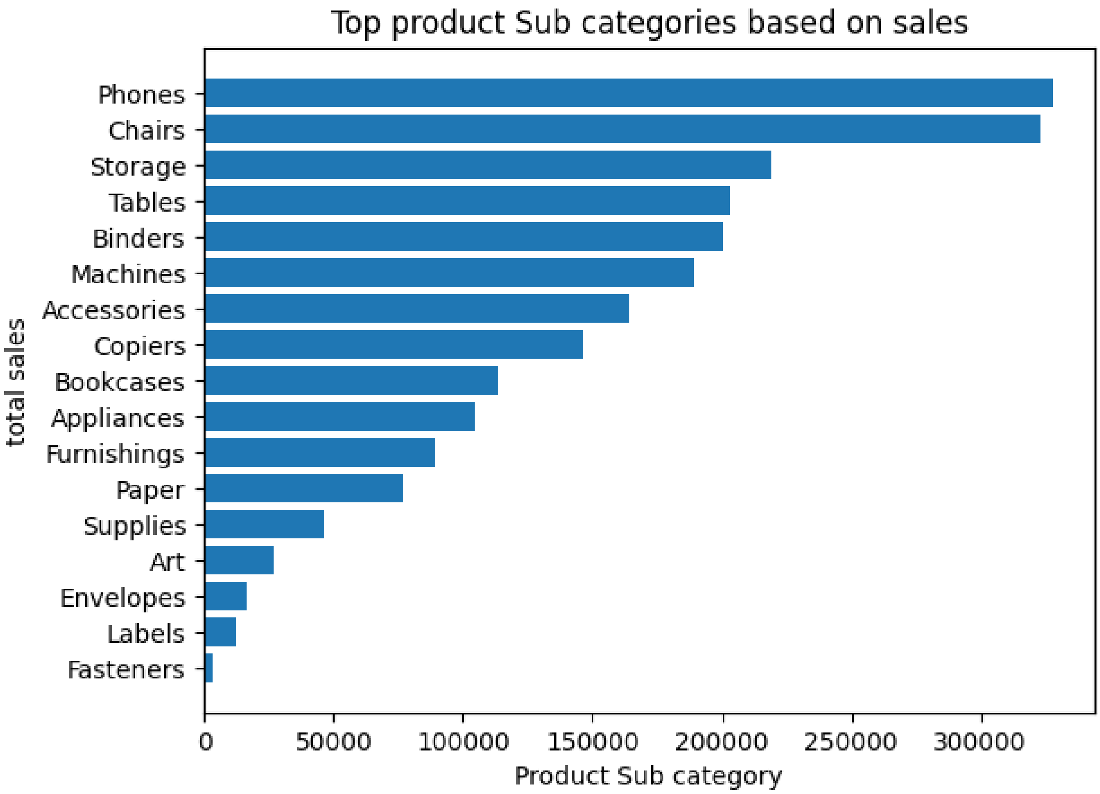
[36]:

```
# group data by product sub category vs sales
pdt_subcategory = df.groupby(['Sub-Category'])['Sales'].sum().reset_index()

top_pdt_subcategory = pdt_subcategory.sort_values(by='Sales',ascending=False)
```

```
print(top_pdt_subcategory.reset_index(drop=True))
```

```
   Sub-Category        Sales
0        Phones  327782.4480
1        Chairs  322822.7310
2       Storage  219343.3920
3        Tables  202810.6280
4       Binders  200028.7850
5      Machines  189238.6310
6   Accessories  164186.7000
7       Copiers  146248.0940
8     Bookcases  113813.1987
9    Appliances  104618.4030
10  Furnishings   89212.0180
11        Paper   76828.3040
12     Supplies   46420.3080
13          Art   26705.4100
14    Envelopes   16128.0460
15       Labels   12347.7260
16    Fasteners    3001.9600
```

[40]:
```
top_pdt_subcategory = top_pdt_subcategory.sort_values(by='Sales',ascending=True)

plt.barh(top_pdt_subcategory['Sub-Category'],top_pdt_subcategory['Sales'])

plt.title('Top product Sub categories based on sales')
plt.xlabel('Product Sub category')
plt.ylabel('total sales')

plt.show()
```



3.5 Sales Trends

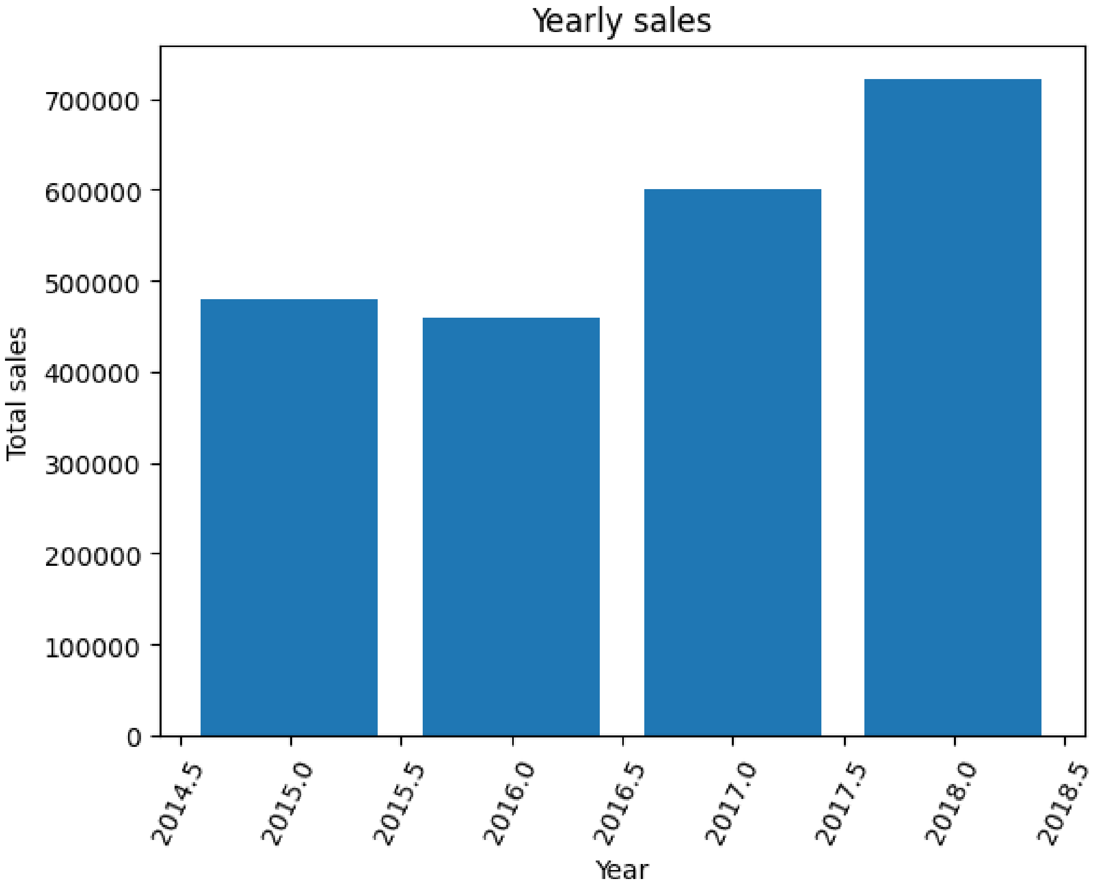
[41]:

```
# converting order date to date time format

df['Order Date']= pd.to_datetime(df['Order Date'],dayfirst=True)

# grouping by year and summing sales per year

yearly_sales= df.groupby(df['Order Date'].dt.year)['Sales'].sum()

yearly_sales = yearly_sales.reset_index()
yearly_sales = yearly_sales.rename(columns={'Order Date':'Year','Sales':'Total␣
 ↪Sales'})

print(yearly_sales)
```

```
   Year  Total Sales
0  2015  479856.2081
1  2016  459436.0054
2  2017  600192.5500
3  2018  722052.0192
```

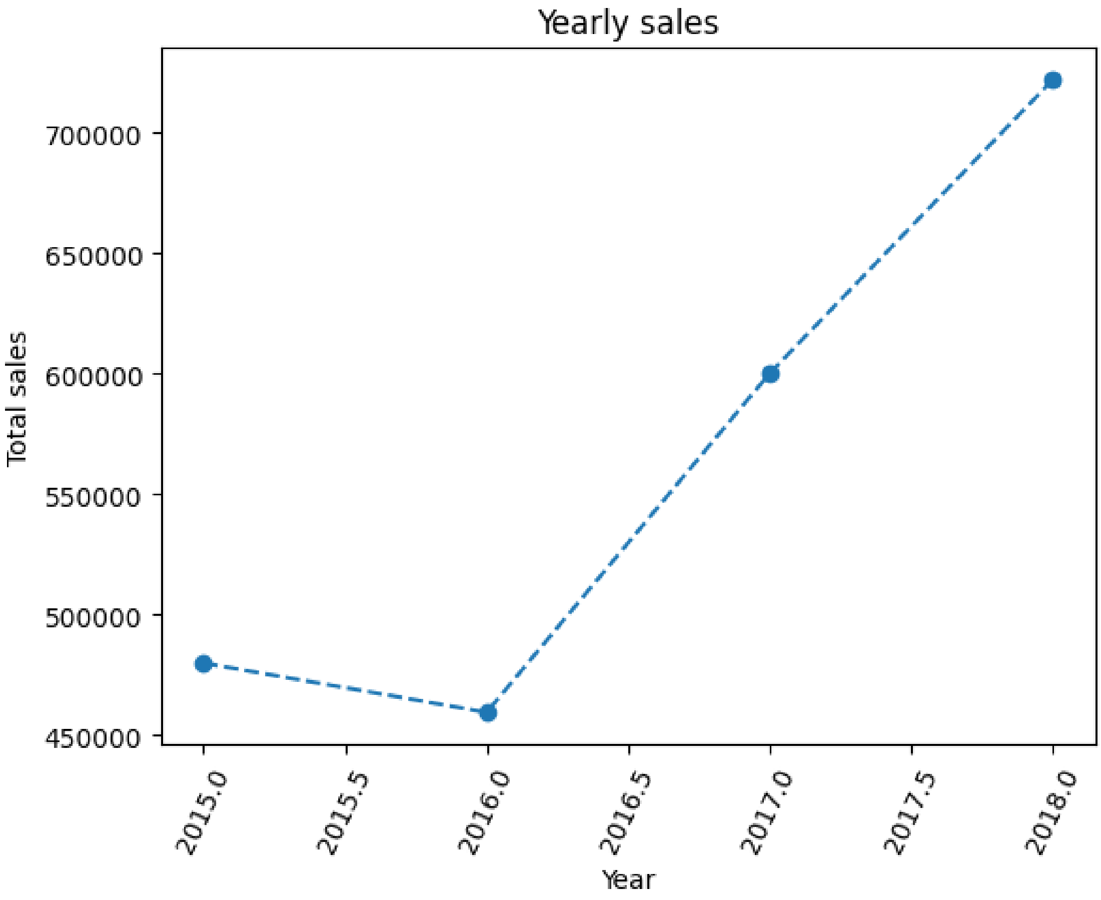
[42]:

```
plt.bar(yearly_sales['Year'],yearly_sales['Total Sales'])

plt.title('Yearly sales')
plt.xlabel('Year')
plt.ylabel('Total sales')

plt.xticks(rotation=65)
plt.show()
```



[43]:

```
plt.plot(yearly_sales['Year'],yearly_sales['Total Sales'], marker='o',␣
  ↪linestyle='--')

plt.title('Yearly sales')
plt.xlabel('Year')
plt.ylabel('Total sales')

plt.xticks(rotation=65)
plt.show()
```

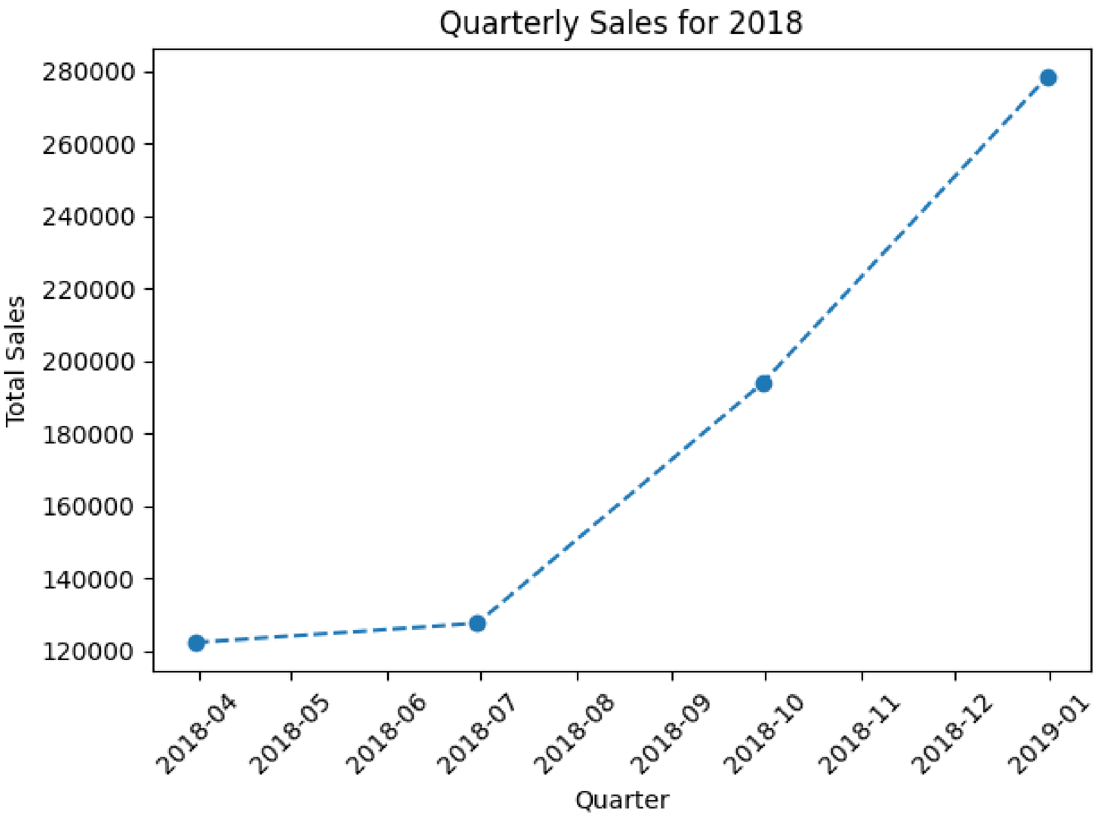


3.5.1 Quaterly Sales Trends

[45]:
```
# Convert Order Date to datetime format
df['Order Date'] = pd.to_datetime(df['Order Date'], dayfirst=True)

# Filter for year 2018
year_sales = df[df['Order Date'].dt.year == 2018]

# Calculate quarterly sales (using updated resampling frequency)
quaterly_sales = year_sales.resample('QE-DEC', on='Order Date')['Sales'].sum().
 ↪reset_index()

# Rename columns for clarity
quaterly_sales = quaterly_sales.rename(columns={'Order Date': 'Quarter',␣
 ↪'Sales': 'Total Sales'})

# Display the results
print('These are the quarterly sales for 2018:')
print(quaterly_sales)
```

```
These are the quarterly sales for 2018:
     Quarter  Total Sales
0 2018-03-31  122260.8842
1 2018-06-30  127558.6200
2 2018-09-30  193815.8400
3 2018-12-31  278416.6750
```

```
[50]: plt.plot(quaterly_sales['Quarter'], quaterly_sales['Total Sales'], marker='o',␣
       ↪linestyle='--')

      plt.title('Quarterly Sales for 2018')
      plt.xlabel('Quarter')
      plt.ylabel('Total Sales')

      plt.xticks(rotation=45)
      plt.tight_layout()
      plt.show()
```



3.5.2 Monthly Sales Trends

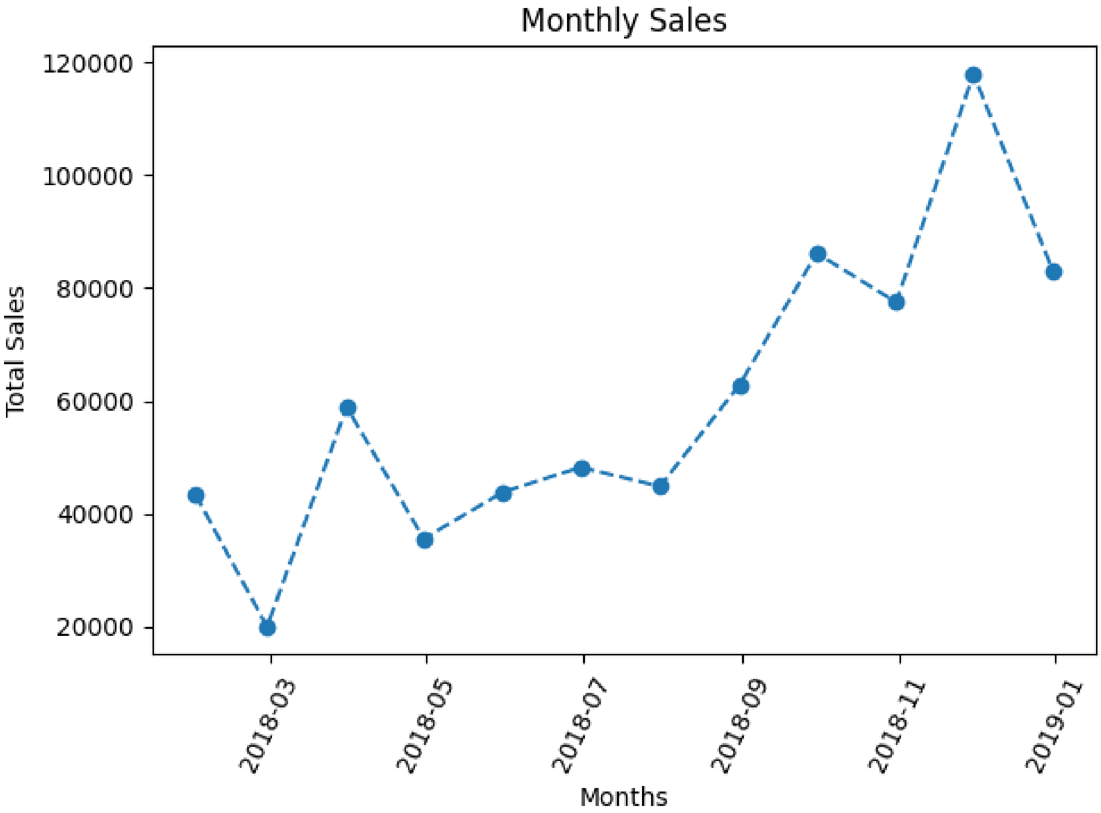
[53]:

```
# Convert Order Date to datetime
df['Order Date'] = pd.to_datetime(df['Order Date'], dayfirst=True)

# Filter for 2018 data
year_sales = df[df['Order Date'].dt.year == 2018]

# Calculate monthly sales (use 'ME' instead of deprecated 'M')
monthly_sales = year_sales.resample('ME', on='Order Date')['Sales'].sum()

# Clean up the result
monthly_sales = monthly_sales.reset_index()
monthly_sales = monthly_sales.rename(columns={'Order Date': 'Month', 'Sales':␣
 ↪'Total Sales'})

# Print the result
print('These are the monthly sales for 2018:')
print(monthly_sales)
```

```
These are the monthly sales for 2018:
        Month  Total Sales
0  2018-01-31   43476.4740
1  2018-02-28   19920.9974
2  2018-03-31   58863.4128
3  2018-04-30   35541.9101
4  2018-05-31   43825.9822
5  2018-06-30   48190.7277
6  2018-07-31   44825.1040
7  2018-08-31   62837.8480
8  2018-09-30   86152.8880
9  2018-10-31   77448.1312
10 2018-11-30  117938.1550
11 2018-12-31   83030.3888
```

[55]:

```
plt.plot(monthly_sales['Month'], monthly_sales['Total Sales'], marker='o',␣
 ↪linestyle='--')

plt.title('Monthly Sales')
plt.xlabel('Months')
plt.ylabel('Total Sales')

plt.xticks(rotation=65)
plt.tight_layout()
plt.show()
```


Monthly Sales
Total Sales
120000
100000
80000
60000
40000
20000
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
Months