Import Libraries

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

Load Dataset

```
df = pd.read_excel("/content/sample_data/Flipkart Sales Dataset.xlsx")
```

checking dataset

```
df.head()
```

	OrderDate	OrderID	Delivery Date	CustomerID	Customer Age	Customer Gender	Location	Zone	Delivery Type	Product Category	SubCategory	Product	P
0	2020-05-31	5136486	2020-06-04	230569424	57	M	Western	Zone 3	Express	Fashion	Girl's fashion	Fashion Girl's Dress Kids Children Newborn Bab...	
1	2020-05-31	5136457	2020-06-12	230568182	24	F	Western	Zone 3	Standard Delivery	Health and beauty	Medical supplies and Equipment	Blood Pressure Monitor Digital Wrist BP Pulse ...	
2	2020-05-31	5136465	2020-06-10	230567584	31	M	Weija	Zone 2	Standard Delivery	Health and beauty	Medical supplies and Equipment	Portable Blood Pressure Monitor - White	
3	2020-05-31	5136488	2020-06-05	230563788	62	F	Greater Accra	Zone 1	Express	Phones and Tablet	Mobile phones	Samsung A3 Core Dual SIM - 16GB HDD - 1GB RAM ...	
4	2020-05-31	5136449	2020-06-10	230563726	18	F	Weija	Zone 2	Shipped from Abroad	Fashion	Boy's fashion	Boys Sneakers Casual Kids Sports Shoes- Gold	

```
df.shape
```

```
(133503, 19)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 133503 entries, 0 to 133502
Data columns (total 19 columns):
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   OrderDate         133503 non-null  datetime64[ns]
 1   OrderID           133503 non-null  int64
 2   Delivery Date     133503 non-null  datetime64[ns]
 3   CustomerID        133503 non-null  int64
 4   Customer Age      133503 non-null  int64
 5   Customer Gender   133503 non-null  object
 6   Location          133503 non-null  object
 7   Zone              133503 non-null  object
 8   Delivery Type     133503 non-null  object
 9   Product Category  133503 non-null  object
 10  SubCategory       133503 non-null  object
 11  Product           133503 non-null  object
 12  Unit Price        133503 non-null  int64
 13  Shipping Fee      133503 non-null  int64
 14  Order Quantity    133503 non-null  int64
 15  Sale Price        133503 non-null  int64
 16  Status            133503 non-null  object
 17  Reason            34981 non-null   object
 18  Rating            133503 non-null  int64
dtypes: datetime64[ns](2), int64(8), object(9)
memory usage: 19.4+ MB
```

```
df.describe()
```

	OrderDate	OrderID	Delivery Date	CustomerID	Customer Age	Unit Price	Shipping Fee	C Quan
count	133503	1.335030e+05	133503	1.335030e+05	133503.000000	133503.000000	133503.000000	133503.00
mean	2018-07-03 08:44:06.951753984	5.087078e+06	2018-07-12 21:15:22.792746240	2.305156e+08	35.930129	99.919185	11.495607	5.33
min	2015-01-01 00:00:00	5.023455e+06	2015-01-03 00:00:00	2.304591e+08	17.000000	50.000000	3.000000	1.00
25%	2016-11-22 00:00:00	5.056844e+06	2016-12-03 00:00:00	2.304874e+08	28.000000	75.000000	7.000000	3.00
50%	2018-10-20 00:00:00	5.090226e+06	2018-10-29 00:00:00	2.305156e+08	35.000000	100.000000	11.000000	5.00
75%	2020-03-25 00:00:00	5.119800e+06	2020-04-03 00:00:00	2.305439e+08	43.000000	125.000000	16.000000	8.00
max	2020-12-31 00:00:00	5.136490e+06	2021-01-20 00:00:00	2.305721e+08	87.000000	150.000000	20.000000	10.00
std	NaN	3.442235e+04	NaN	3.262001e+04	11.029974	29.194562	5.188966	2.92

```
df.columns = (
    df.columns
    .str.lower()
    .str.strip()
    .str.replace(" ", "_")
)
```

```
df.columns
```

```
Index(['orderdate', 'orderid', 'delivery_date', 'customerid', 'customer_age',
       'customer_gender', 'location', 'zone', 'delivery_type',
       'product_category', 'subcategory', 'product', 'unit_price',
       'shipping_fee', 'order_quantity', 'sale_price', 'status', 'reason',
       'rating'],
      dtype='object')
```

Checking and Removing Duplicate Records

```
df.duplicated().sum()
```

```
np.int64(20502)
```

```
df = df.drop_duplicates()
```

Handling missing values

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

	0
orderdate	0
orderid	0
delivery_date	0
customerid	0
customer_age	0
customer_gender	0
location	0
zone	0
delivery_type	0
product_category	0
subcategory	0
product	0
unit_price	0
shipping_fee	0
rating	0

Checking for outliers

```
Q1 = df['sale_price'].quantile(0.25)
Q3 = df['sale_price'].quantile(0.75)
IQR = Q3 - Q1

lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
```

```
# df['sale_price'] = np.where(
#     df['sale_price'] > upper_bound,
#     upper_bound,
#     np.where(df['sale_price'] < lower_bound, lower_bound, df['sales'])
# )
```

EDA -Exploratory Data Analysis

```
total_cost = (df['unit_price'] * df['order_quantity']).sum()

total_sales_million = total_cost / 1_000_000

print("Total Cost is :",f"${total_sales_million:,.2f}M")
```

```
Total Cost is : $60.23M
```

```
Revenue = (df['sale_price'] * df['order_quantity']).sum()

total_sales_million = Revenue / 1_000_000

print("Revenue is :",f"${total_sales_million:,.2f}M")
```

```
Revenue is : $135.61M
```

```
profit = Revenue - total_cost

profit_million = profit / 1_000_000

print("Total Profit is :",f"${profit_million:,.2f}M")
```

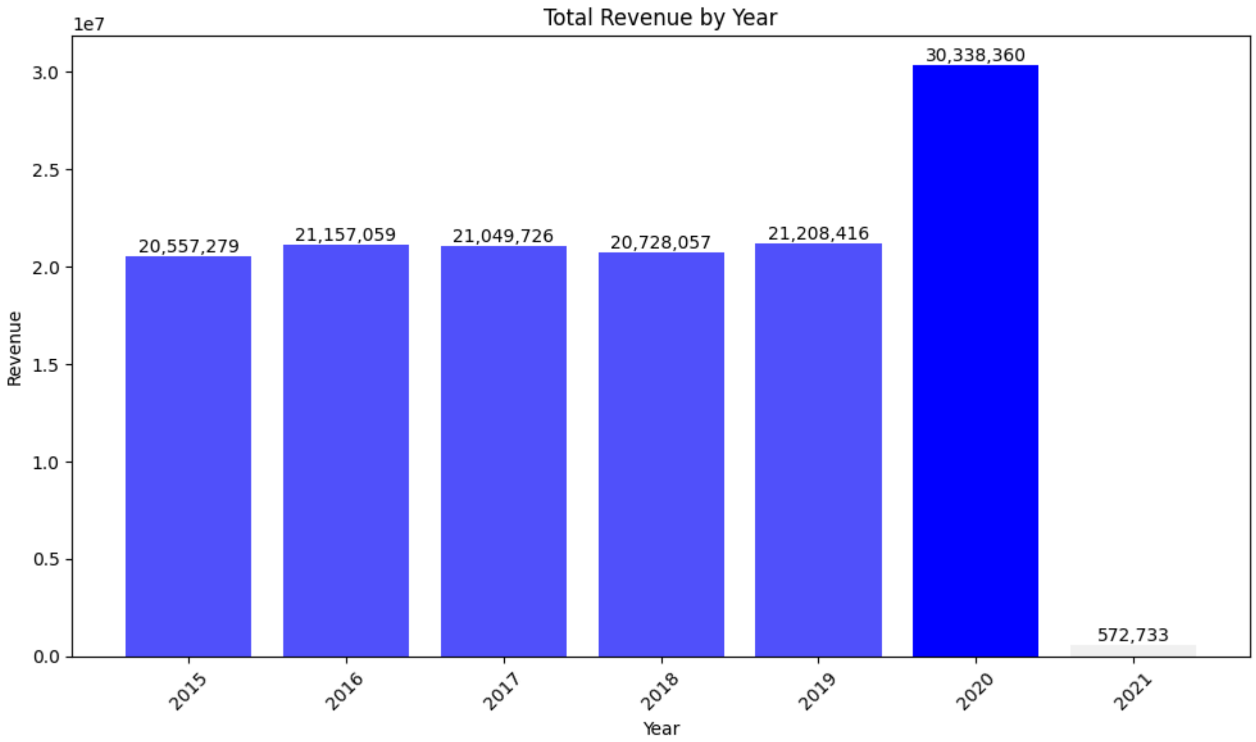
```
Total Profit is : $75.38M
```

```
total_orders = df['orderid'].count()
print("Total Orders is :",total_orders)

total_product_sold = df['order_quantity'].sum()
print("Total Product Sold is :",total_product_sold)
```

```
Total Orders is : 113001
Total Product Sold is : 602835
```

Revenue

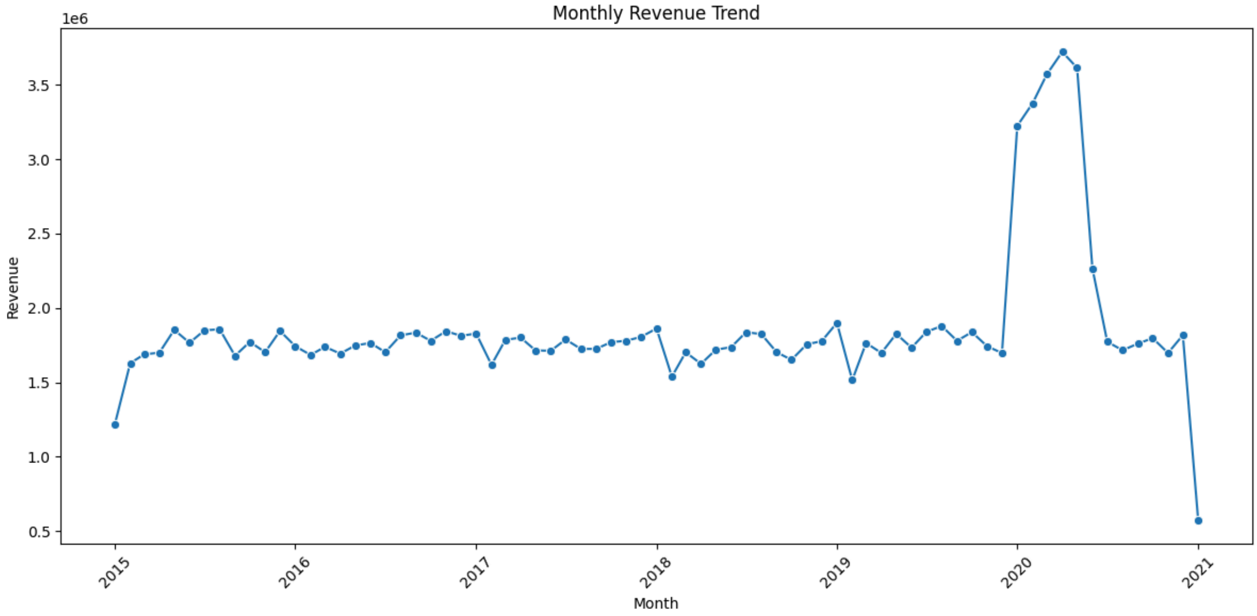
```
revenue_by_year = df.groupby(df['delivery_date'].dt.year).apply(
    lambda x: (x['sale_price'] * x['order_quantity']).sum()
).reset_index(name='Revenue_Per_Year')

# The year column created by reset_index() might not be explicitly named 'delivery_date'.
# It often defaults to 'index' if the grouped series has no name, or takes the series' name.
# To ensure it's consistently named 'Year' for plotting, we'll rename the first column.
revenue_by_year = revenue_by_year.rename(columns={revenue_by_year.columns[0]: 'Year'})

norm = (revenue_by_year['Revenue_Per_Year'] - revenue_by_year['Revenue_Per_Year'].min()) / \
       (revenue_by_year['Revenue_Per_Year'].max() - revenue_by_year['Revenue_Per_Year'].min())

# Use a sequential color map (light → dark)
colors = sns.light_palette("blue", n_colors=len(revenue_by_year), reverse=False)
# Map colors based on normalized revenue
bar_colors = [colors[int(val * (len(colors)-1))] for val in norm]

# Plotting
plt.figure(figsize=(10, 6))
bars = plt.bar(revenue_by_year['Year'], revenue_by_year['Revenue_Per_Year'], color=bar_colors)

for bar in bars:
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height, f'{int(height):,}',
             ha='center', va='bottom', fontsize=10)

plt.title('Total Revenue by Year')
plt.xlabel('Year')
plt.ylabel('Revenue')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



```
# Ensure delivery_date is datetime
df['delivery_date'] = pd.to_datetime(df['delivery_date'])

# Extract Year, Month, and Quarter
df['Year'] = df['delivery_date'].dt.year
df['Month'] = df['delivery_date'].dt.month
df['Quarter'] = df['delivery_date'].dt.quarter

# Example: Yearly revenue
revenue_yearly = df.groupby('Year').apply(lambda x: (x['sale_price'] * x['order_quantity']).sum()).reset_index(name='Revenue

# Example: Quarterly revenue
revenue_quarterly = df.groupby(['Year', 'Quarter']).apply(lambda x: (x['sale_price'] * x['order_quantity']).sum()).reset_ind
```

```
# Example: Monthly revenue
revenue_monthly = df.groupby(['Year', 'Month']).apply(lambda x: (x['sale_price'] * x['order_quantity']).sum()).reset_index(n

# Monthly revenue trend example
plt.figure(figsize=(12,6))
sns.lineplot(x=pd.to_datetime(revenue_monthly[['Year','Month']].assign(DAY=1)),
             y='Revenue', data=revenue_monthly, marker='o')
plt.title('Monthly Revenue Trend')
plt.xlabel('Month')
plt.ylabel('Revenue')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```

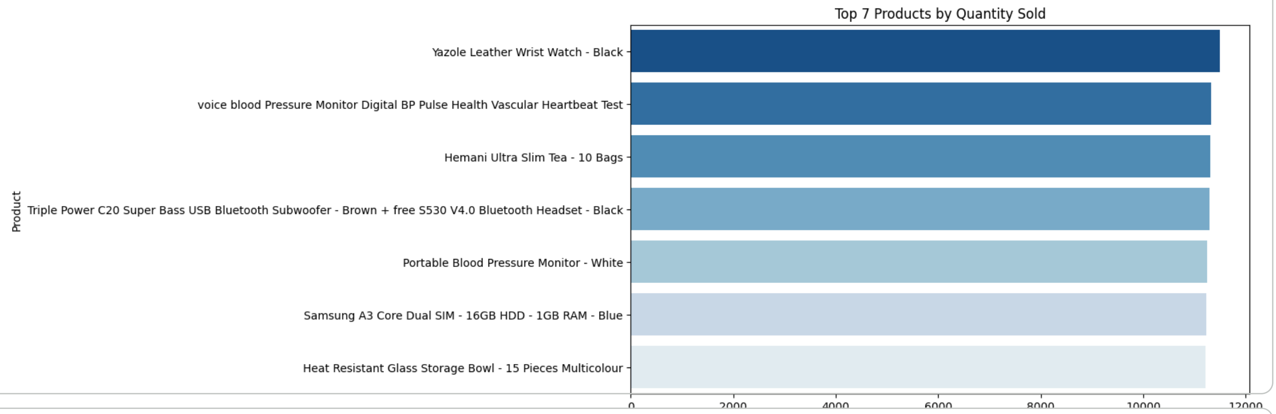
```
/tmp/ipython-input-2100779528.py:10: DeprecationWarning: DataFrameGroupBy.apply operated on the grouping columns. This behav
  revenue_yearly = df.groupby('Year').apply(lambda x: (x['sale_price'] * x['order_quantity']).sum()).reset_index(name='Rever
/tmp/ipython-input-2100779528.py:13: DeprecationWarning: DataFrameGroupBy.apply operated on the grouping columns. This behav
  revenue_quarterly = df.groupby(['Year', 'Quarter']).apply(lambda x: (x['sale_price'] * x['order_quantity']).sum()).reset_i
/tmp/ipython-input-2100779528.py:16: DeprecationWarning: DataFrameGroupBy.apply operated on the grouping columns. This behav
  revenue_monthly = df.groupby(['Year', 'Month']).apply(lambda x: (x['sale_price'] * x['order_quantity']).sum()).reset_index
```



Order Details Analysis

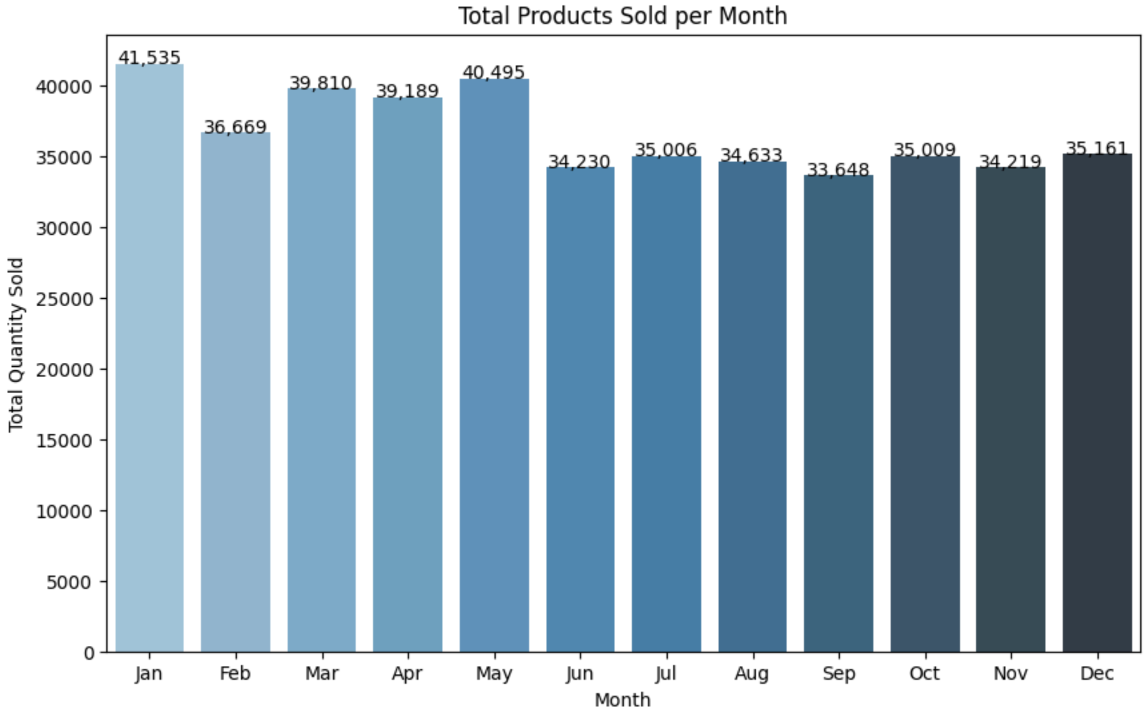
```
completed_orders = df[df['status'] == 'Delivered']

top_products = completed_orders.groupby('product')['order_quantity'].sum().reset_index()

top_products = top_products.sort_values(by='order_quantity', ascending=False).head(7)

print(top_products)

# Plot top 7 products
plt.figure(figsize=(10,6))
sns.barplot(x='order_quantity', y='product', data=top_products, palette='Blues_r')
plt.title('Top 7 Products by Quantity Sold')
plt.xlabel('Total Quantity Sold')
plt.ylabel('Product')
plt.show()
```

```
                                              product  order_quantity
42                 Yazole Leather Wrist Watch - Black           11501
43  voice blood Pressure Monitor Digital BP Pulse ...           11316
21                     Hemani Ultra Slim Tea - 10 Bags           11303
38  Triple Power C20 Super Bass USB Bluetooth Subw...           11292
31             Portable Blood Pressure Monitor - White           11241
33  Samsung A3 Core Dual SIM - 16GB HDD - 1GB RAM ...           11230
20  Heat Resistant Glass Storage Bowl - 15 Pieces ...           11214
/tmp/ipython-input-822897545.py:11: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` and

  sns.barplot(x='order_quantity', y='product', data=top_products, palette='Blues_r')
```



```
# Ensure orderdate is datetime
df['orderdate'] = pd.to_datetime(df['orderdate'])

# Extract month
df['Month'] = df['orderdate'].dt.month

# Filter delivered orders
df_delivered = df[df['status'] == 'Delivered']

# Total products sold per month
monthly_sales = df_delivered.groupby('Month')['order_quantity'].sum().reset_index()

# Plot bar chart
plt.figure(figsize=(10,6))
sns.barplot(x='Month', y='order_quantity', data=monthly_sales, palette='Blues_d')

# Add data labels on top
for index, row in monthly_sales.iterrows():
    plt.text(row['Month']-1, row['order_quantity'] + 5, f"{int(row['order_quantity']):,}", ha='center')

plt.title('Total Products Sold per Month')
plt.xlabel('Month')
plt.ylabel('Total Quantity Sold')
plt.xticks(ticks=range(0,12), labels=['Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec'])
plt.show()
```

```
/tmp/ipython-input-2839187876.py:15: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` anc

  sns.barplot(x='Month', y='order_quantity', data=monthly_sales, palette='Blues_d')
```



Product Analysis

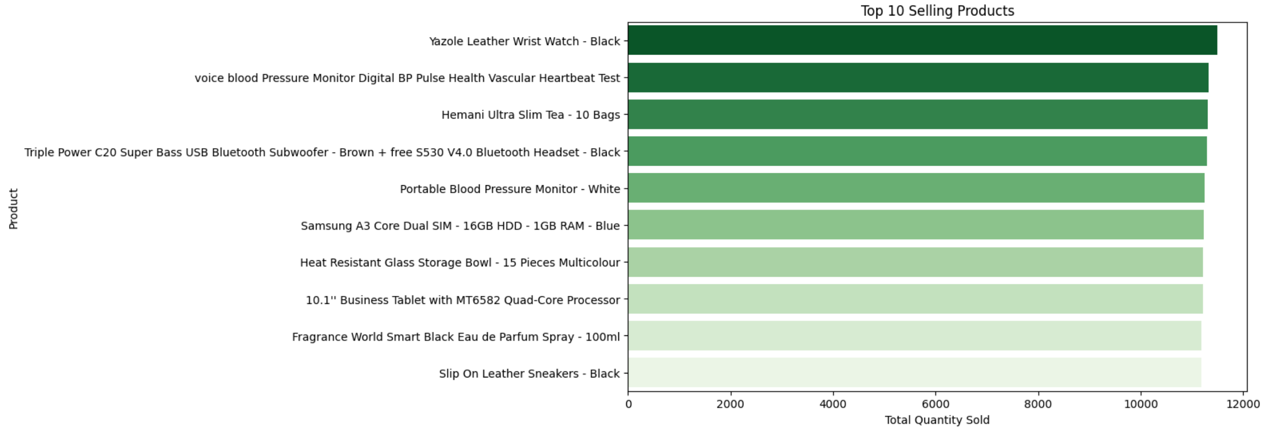
```
# Consider only delivered orders
df_prod = df[df['status'] == 'Delivered']

# Product performance table
product_performance = df_prod.groupby('product').agg(
    total_quantity_sold=('order_quantity', 'sum'),
    total_revenue=('sale_price', lambda x: (x * df_prod.loc[x.index, 'order_quantity']).sum()),
    avg_unit_price=('unit_price', 'mean')
).reset_index()

product_performance.head()
```

	product	total_quantity_sold	total_revenue	avg_unit_price
0	10.1" Business Tablet with MT6582 Quad-Core P...	11209	2534479	100.756851
1	100%Cotton 4 Piece Short Sleeve T-Shirts - Mul...	11141	2492681	98.896142
2	6030 3.1 Bluetooth Home Theatre With Remote Co...	9492	2131357	100.800230
3	8 Cubes Plastic Wardrobe - Blue/White	10992	2467301	99.379500
4	Aichun Beauty Eight Pack Essential Oil - 30ml	9165	2075433	98.550581

Next steps: Generate code with product_performance New interactive sheet

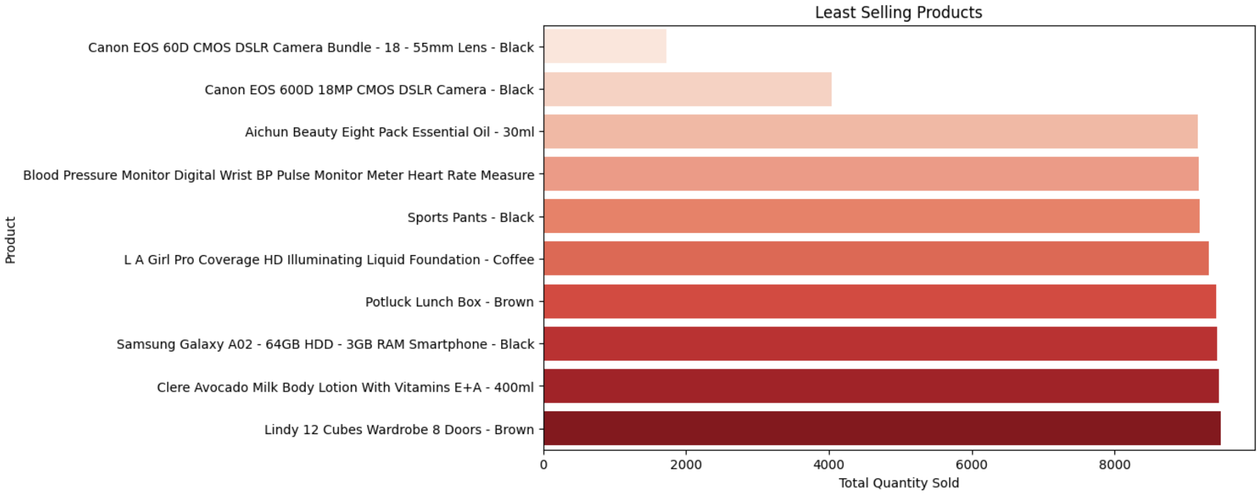
```
top_products = product_performance.sort_values(
    by='total_quantity_sold', ascending=False
).head(10)

# Plot
plt.figure(figsize=(10,6))
sns.barplot(
    x='total_quantity_sold',
    y='product',
    data=top_products,
    palette='Greens_r'
)
plt.title('Top 10 Selling Products')
plt.xlabel('Total Quantity Sold')
plt.ylabel('Product')
plt.show()
```

```
/tmp/ipython-input-3594092204.py:7: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` anc

  sns.barplot(
```



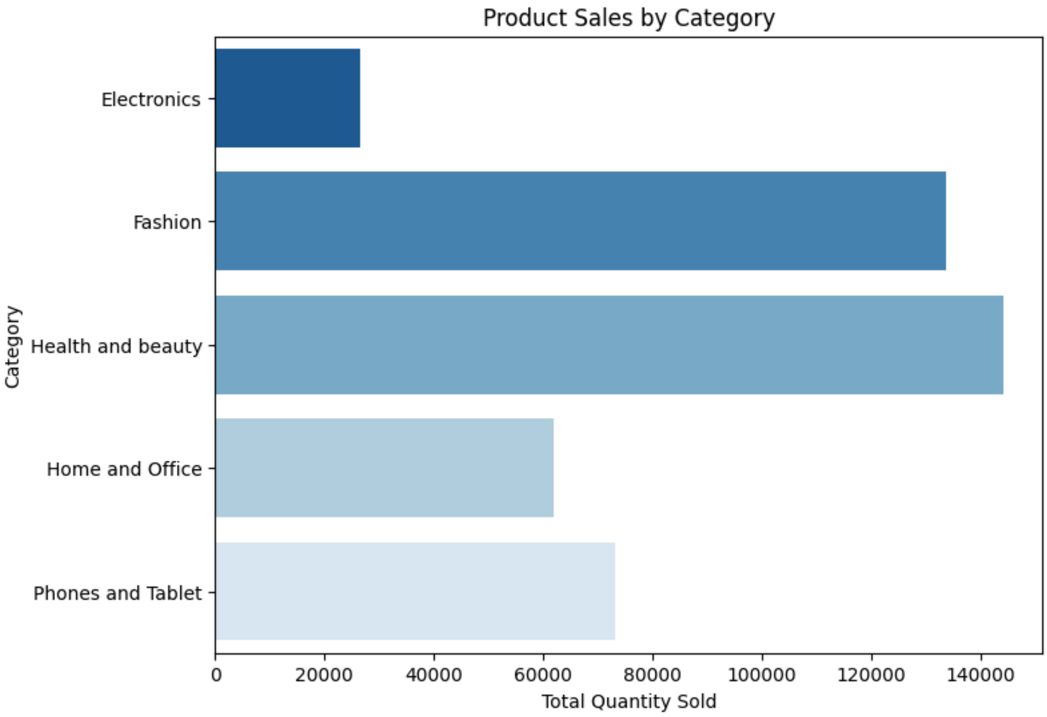
```
least_products = product_performance.sort_values(
    by='total_quantity_sold', ascending=True
).head(10)

plt.figure(figsize=(10,6))
sns.barplot(
    x='total_quantity_sold',
    y='product',
    data=least_products,
    palette='Reds'
)
plt.title('Least Selling Products')
plt.xlabel('Total Quantity Sold')
plt.ylabel('Product')
plt.show()
```

```
/tmp/ipython-input-4286192045.py:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` anc

  sns.barplot(
```



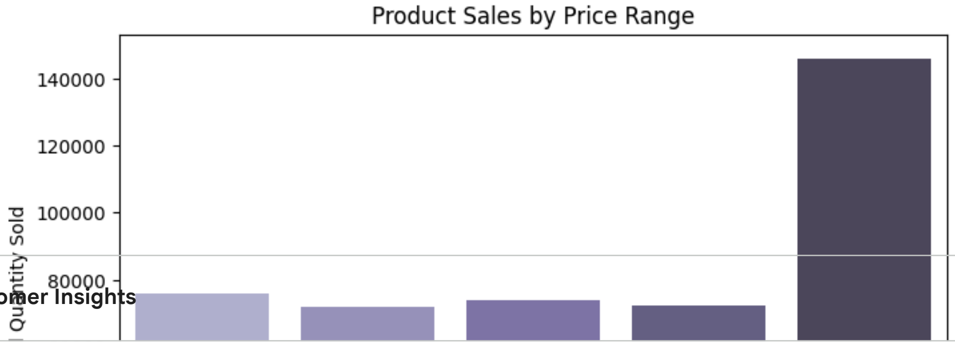
```
category_performance = df_prod.groupby('product_category')['order_quantity'].sum().reset_index()

plt.figure(figsize=(8,6))
sns.barplot(
    x='order_quantity',
    y='product_category',
    data=category_performance,
    palette='Blues_r'
)
plt.title('Product Sales by Category')
plt.xlabel('Total Quantity Sold')
plt.ylabel('Category')
plt.show()
```

```
/tmp/ipython-input-3888166944.py:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` anc

  sns.barplot(
```



```
# Create price ranges
bins = [0, 175, 200, 225, 250, 301] # Adjusted bins to be monotonically increasing and cover the actual sale_price range (ma
labels = ['Low', 'Mid', 'Upper-Mid', 'High', 'Premium']

df_prod['price_range'] = pd.cut(df_prod['sale_price'], bins=bins, labels=labels)

price_range_sales = df_prod.groupby('price_range')['order_quantity'].sum().reset_index()

plt.figure(figsize=(8,5))
sns.barplot(
    x='price_range',
    y='order_quantity',
    data=price_range_sales,
    palette='Purples_d'
)
plt.title('Product Sales by Price Range')
plt.xlabel('Price Range')
plt.ylabel('Total Quantity Sold')
plt.show()
```

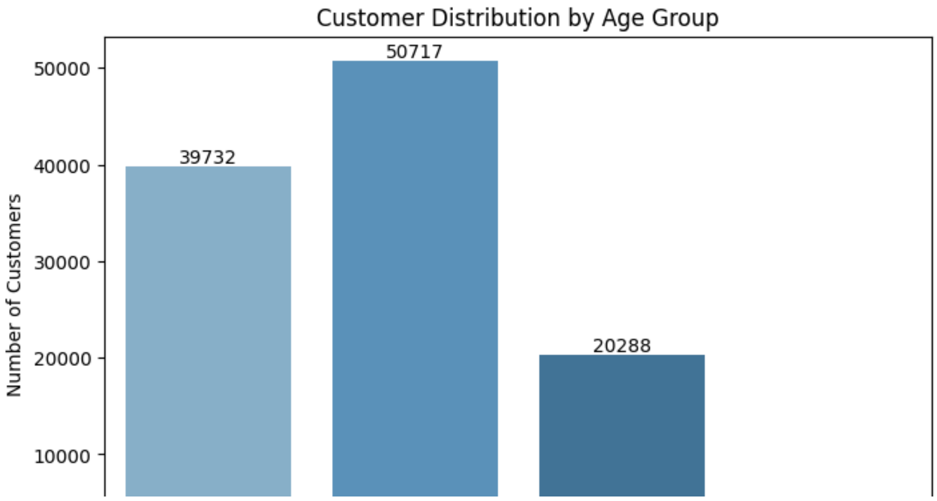
```
/tmp/ipython-input-806328235.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view
  df_prod['price_range'] = pd.cut(df_prod['sale_price'], bins=bins, labels=labels)
/tmp/ipython-input-806328235.py:7: FutureWarning: The default of observed=False is deprecated and will be changed to True ir
  price_range_sales = df_prod.groupby('price_range')['order_quantity'].sum().reset_index()
/tmp/ipython-input-806328235.py:10: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` anc

  sns.barplot(
```



Customer Insights

```
bins = [15, 30, 45, 60, 80]
labels = ['15-30', '30-45', '45-60', '60-80']

df['age_group'] = pd.cut(df['customer_age'], bins=bins, labels=labels, right=True)

age_group_counts = df.groupby('age_group')['customerid'].nunique().reset_index()
age_group_counts.rename(columns={'customerid': 'number_of_customers'}, inplace=True)

plt.figure(figsize=(8,5))
sns.barplot(
    x='age_group',
    y='number_of_customers',
    data=age_group_counts,
    palette='Blues_d'
)

# Data labels
for index, row in age_group_counts.iterrows():
    plt.text(index, row['number_of_customers'], row['number_of_customers'], ha='center', va='bottom')

plt.title('Customer Distribution by Age Group')
plt.xlabel('Age Group')
plt.ylabel('Number of Customers')
plt.show()
```

```
/tmp/ipython-input-3364322749.py:6: FutureWarning: The default of observed=False is deprecated and will be changed to True i
  age_group_counts = df.groupby('age_group')['customerid'].nunique().reset_index()
/tmp/ipython-input-3364322749.py:10: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` anc

  sns.barplot(
```


Customer Distribution by Age Group
Number of Customers