SALES DATA ANALYSIS

BY KESHAV SHARMA

OBJECTIVE

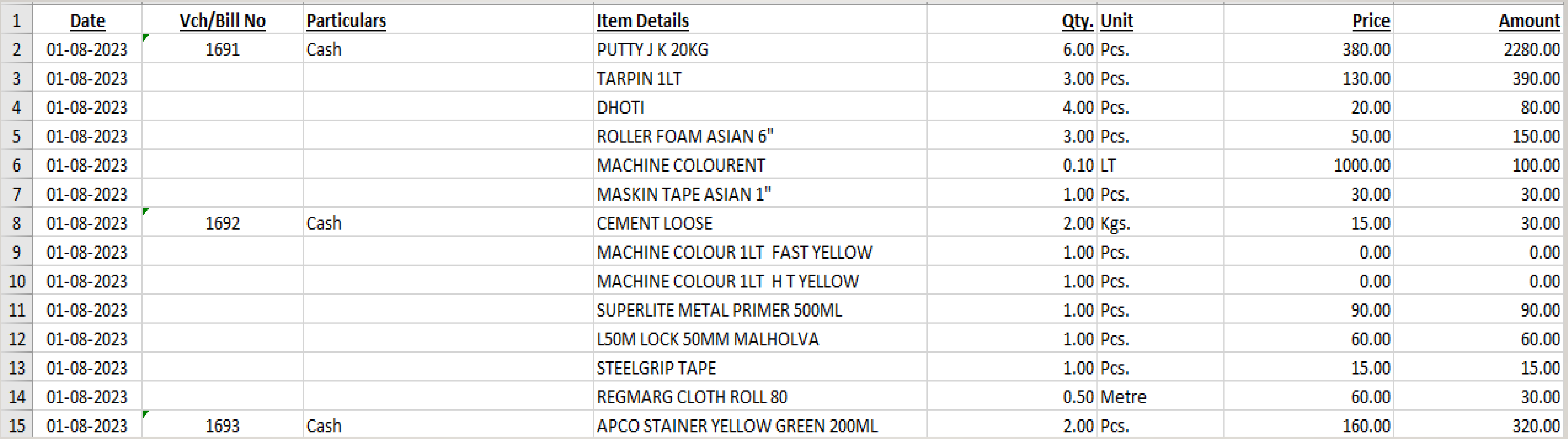
- To contribute the success of a business by utilizing data analysis techniques, specifically focusing on Profitability Analysis and Exploratory Data Analysis (EDA) to provide valuable insights and accurate sales forecasting.

DESCRIPTION

The objective can be broken down into the following detailed components:

1. Data Analysis: Provide valuable insights to business entities regarding the effectiveness of their sales strategies through visualization and charts.
2. Dashboard Creation : Identify the KPIs, design an intuitive and visually appealing dashboard, add interactive visualizations and filtering capabilities to allow users to explore the data at various levels of granularity.
3. Actionable Insights and recommendations: End goal is to share valuable insights and actionable information that can drive strategic decision making and support the company's goal for growth, efficiency and customer satisfaction.

OVERVIEW OF THE DATASET



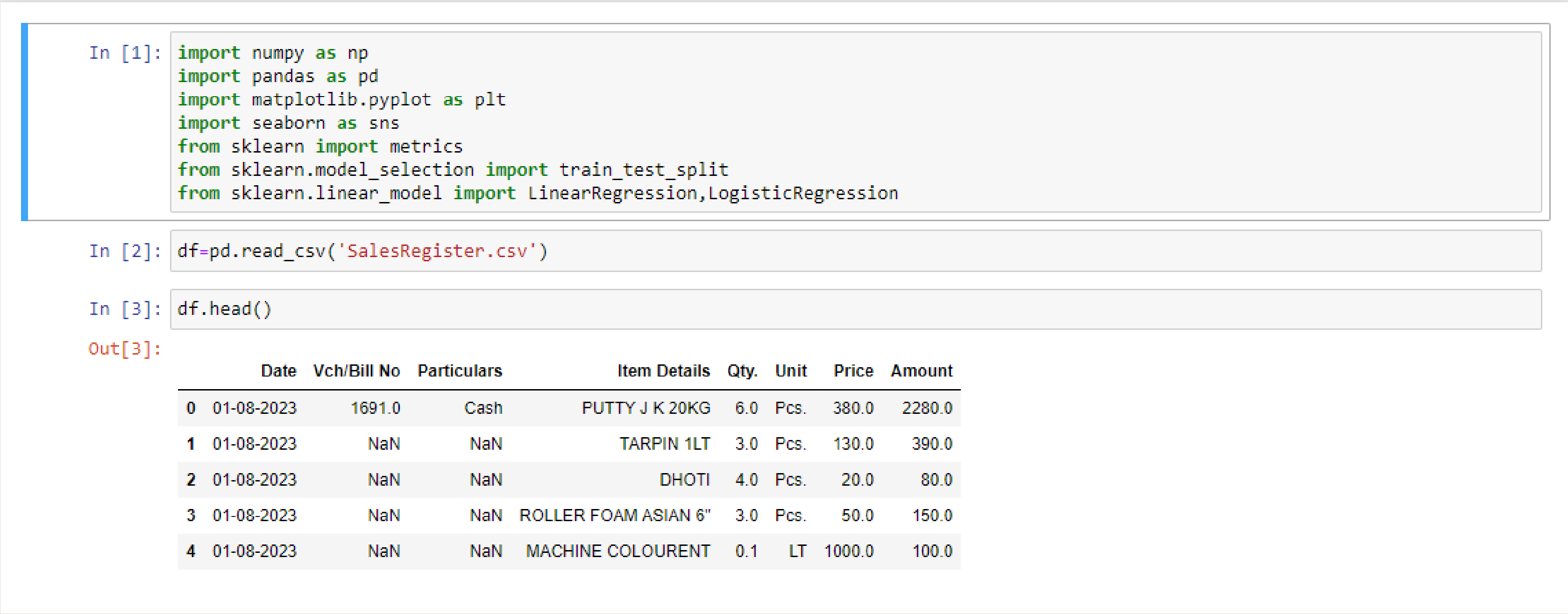
1	Date	Vch/Bill No	Particulars	Item Details	Qty.	Unit	Price	Amount
2	01-08-2023	1691	Cash	PUTTY J K 20KG	6.00	Pcs.	380.00	2280.00
3	01-08-2023			TARPIN 1LT	3.00	Pcs.	130.00	390.00
4	01-08-2023			DHOTI	4.00	Pcs.	20.00	80.00
5	01-08-2023			ROLLER FOAM ASIAN 6"	3.00	Pcs.	50.00	150.00
6	01-08-2023			MACHINE COLOURENT	0.10	LT	1000.00	100.00
7	01-08-2023			MASKIN TAPE ASIAN 1"	1.00	Pcs.	30.00	30.00
8	01-08-2023	1692	Cash	CEMENT LOOSE	2.00	Kgs.	15.00	30.00
9	01-08-2023			MACHINE COLOUR 1LT FAST YELLOW	1.00	Pcs.	0.00	0.00
10	01-08-2023			MACHINE COLOUR 1LT H T YELLOW	1.00	Pcs.	0.00	0.00
11	01-08-2023			SUPERLITE METAL PRIMER 500ML	1.00	Pcs.	90.00	90.00
12	01-08-2023			L50M LOCK 50MM MALHOLVA	1.00	Pcs.	60.00	60.00
13	01-08-2023			STEELGRIP TAPE	1.00	Pcs.	15.00	15.00
14	01-08-2023			REGMARG CLOTH ROLL 80	0.50	Metre	60.00	30.00
15	01-08-2023	1693	Cash	APCO STAINER YELLOW GREEN 200ML	2.00	Pcs.	160.00	320.00

TECHNOLOGIES AND TOOLS USED:

- **Microsoft Excel:**
  - Utilized Microsoft Excel for initial data exploration, importing, and basic data manipulation.
- **Python for Data Analysis:**
  - Employed Python, along with libraries such as Pandas, NumPy, and Matplotlib, for in-depth data analysis and manipulation.
  - Conducted Exploratory Data Analysis (EDA) using Jupyter Notebook for data visualization and statistical analysis.
  - Executed data preprocessing tasks, including handling missing values.
  - Applied machine learning algorithms for predictive analysis and insights generation.
- **Power BI for Visualization:**
  - Leveraged Power BI for advanced data visualization and interactive dashboards.
  - Created visually appealing charts, graphs, and reports to present key findings and insights.
  - Enabled stakeholders to interact with the data and explore it dynamically.

DATA PREPARATION

- Importing Libraries and making and importing csv file.



```
In [1]: import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        import seaborn as sns
        from sklearn import metrics
        from sklearn.model_selection import train_test_split
        from sklearn.linear_model import LinearRegression,LogisticRegression
```

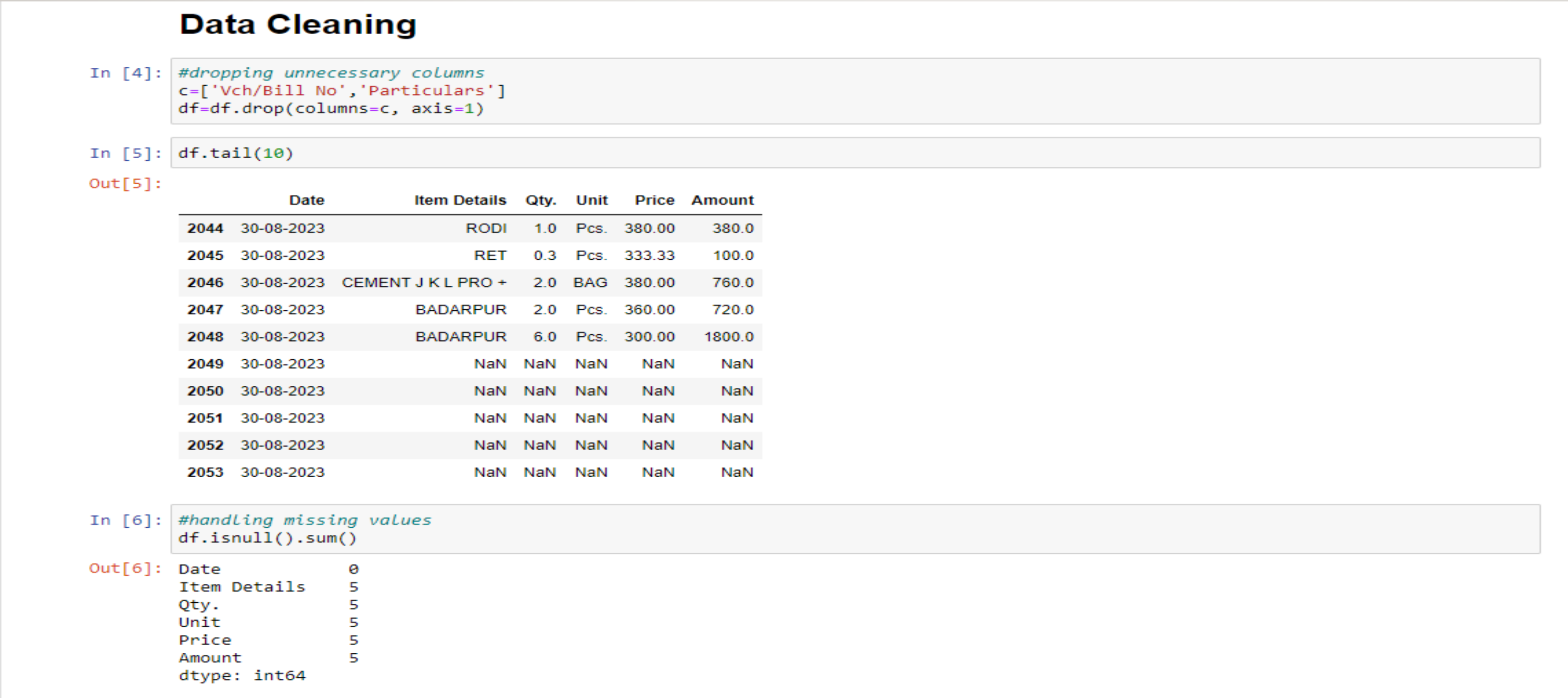
```
In [2]: df=pd.read_csv('SalesRegister.csv')
```

```
In [3]: df.head()
```

Out[3]:

	Date	Vch/Bill No	Particulars	Item Details	Qty.	Unit	Price	Amount
0	01-08-2023	1691.0	Cash	PUTTY J K 20KG	6.0	Pcs.	380.0	2280.0
1	01-08-2023	NaN	NaN	TARPIN 1LT	3.0	Pcs.	130.0	390.0
2	01-08-2023	NaN	NaN	DHOTI	4.0	Pcs.	20.0	80.0
3	01-08-2023	NaN	NaN	ROLLER FOAM ASIAN 6"	3.0	Pcs.	50.0	150.0
4	01-08-2023	NaN	NaN	MACHINE COLOURENT	0.1	LT	1000.0	100.0

DATA PRE-PROCESSING



Data Cleaning

In [4]:
```
#dropping unnecessary columns
c=['Vch/Bill No','Particulars']
df=df.drop(columns=c, axis=1)
```

In [5]:
```
df.tail(10)
```

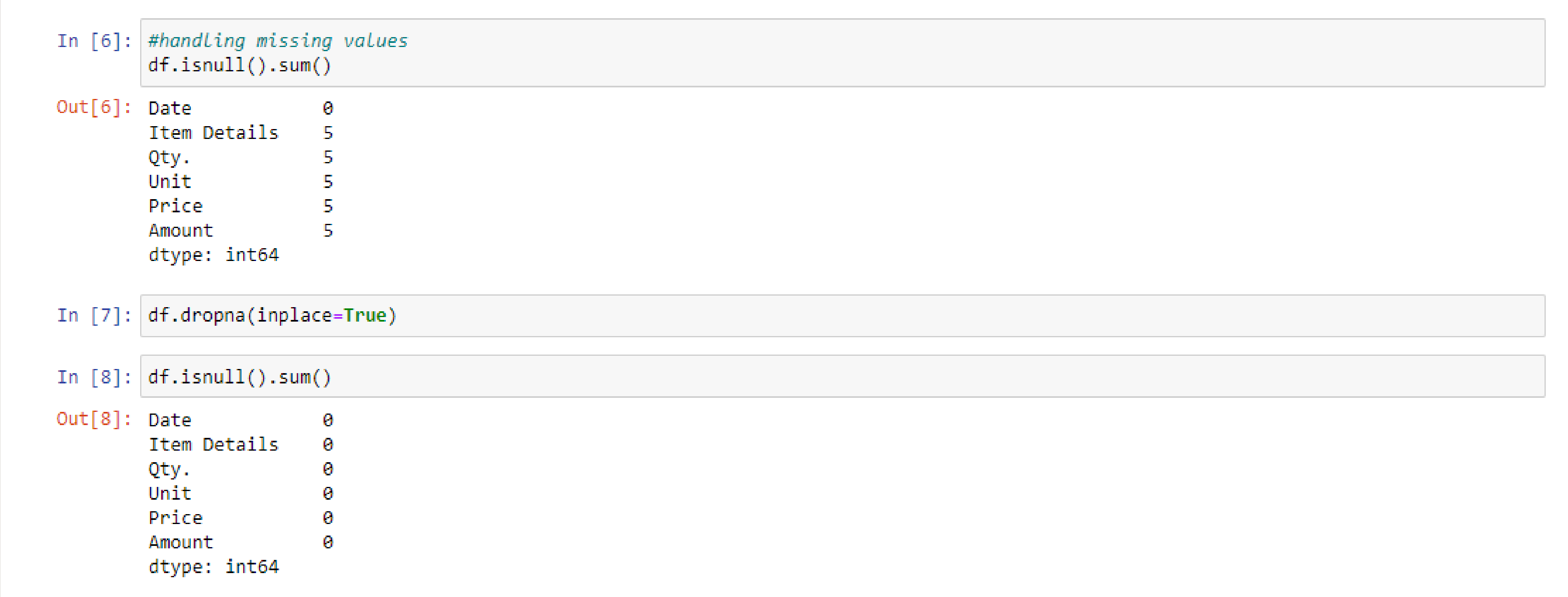
Out[5]:

	Date	Item Details	Qty.	Unit	Price	Amount
2044	30-08-2023	RODI	1.0	Pcs.	380.00	380.0
2045	30-08-2023	RET	0.3	Pcs.	333.33	100.0
2046	30-08-2023	CEMENT J K L PRO +	2.0	BAG	380.00	760.0
2047	30-08-2023	BADARPUR	2.0	Pcs.	360.00	720.0
2048	30-08-2023	BADARPUR	6.0	Pcs.	300.00	1800.0
2049	30-08-2023	NaN	NaN	NaN	NaN	NaN
2050	30-08-2023	NaN	NaN	NaN	NaN	NaN
2051	30-08-2023	NaN	NaN	NaN	NaN	NaN
2052	30-08-2023	NaN	NaN	NaN	NaN	NaN
2053	30-08-2023	NaN	NaN	NaN	NaN	NaN

In [6]:
```
#handling missing values
df.isnull().sum()
```

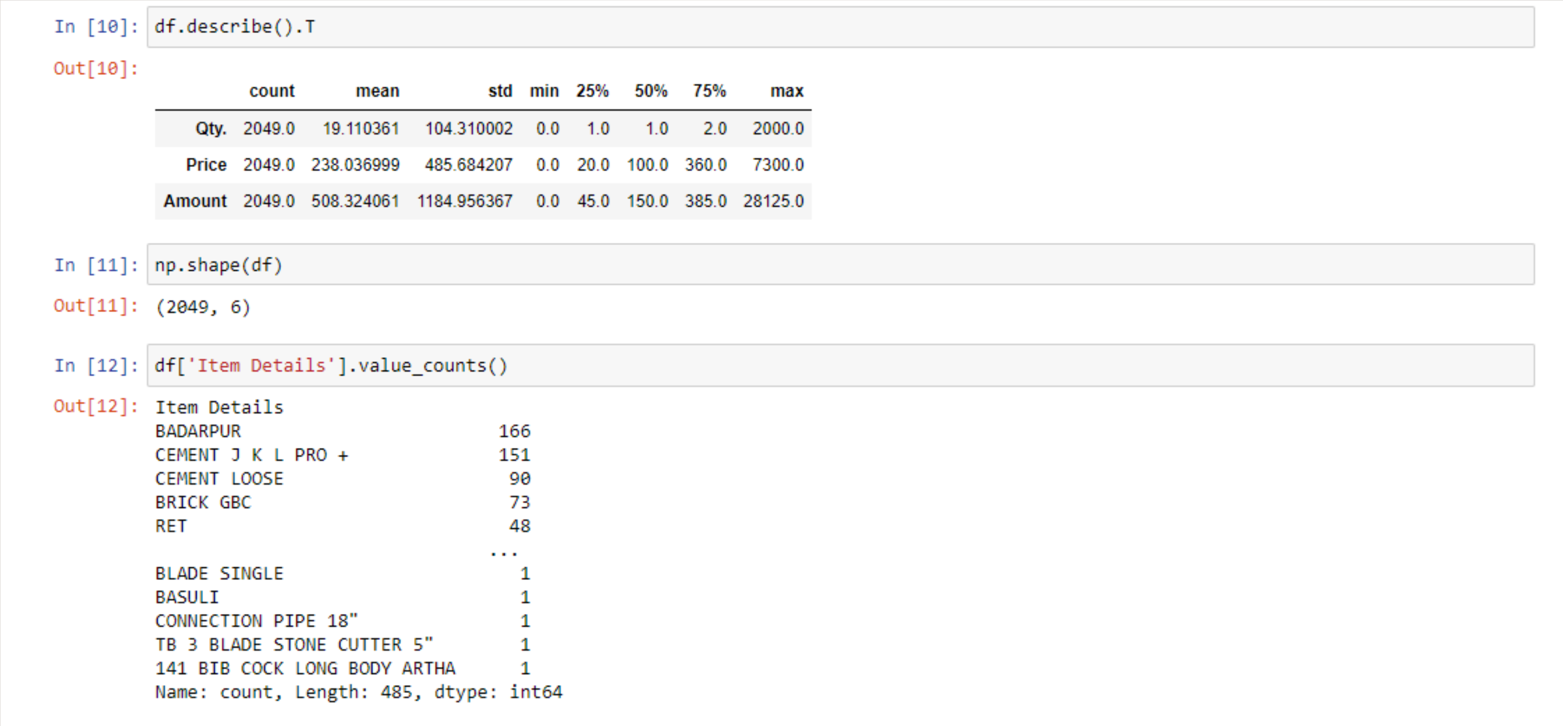
Out[6]:
```
Date            0
Item Details    5
Qty.            5
Unit            5
Price           5
Amount          5
dtype: int64
```

DATA CLEANING



```
In [6]:  #handling missing values
         df.isnull().sum()

Out[6]:  Date            0
         Item Details    5
         Qty.            5
         Unit            5
         Price           5
         Amount          5
         dtype: int64

In [7]:  df.dropna(inplace=True)

In [8]:  df.isnull().sum()

Out[8]:  Date            0
         Item Details    0
         Qty.            0
         Unit            0
         Price           0
         Amount          0
         dtype: int64
```

DATA ANALYSIS



In [10]:

```
df.describe().T
```

Out[10]:

	count	mean	std	min	25%	50%	75%	max
Qty.	2049.0	19.110361	104.310002	0.0	1.0	1.0	2.0	2000.0
Price	2049.0	238.036999	485.684207	0.0	20.0	100.0	360.0	7300.0
Amount	2049.0	508.324061	1184.956367	0.0	45.0	150.0	385.0	28125.0

In [11]:

```
np.shape(df)
```

Out[11]:

```
(2049, 6)
```

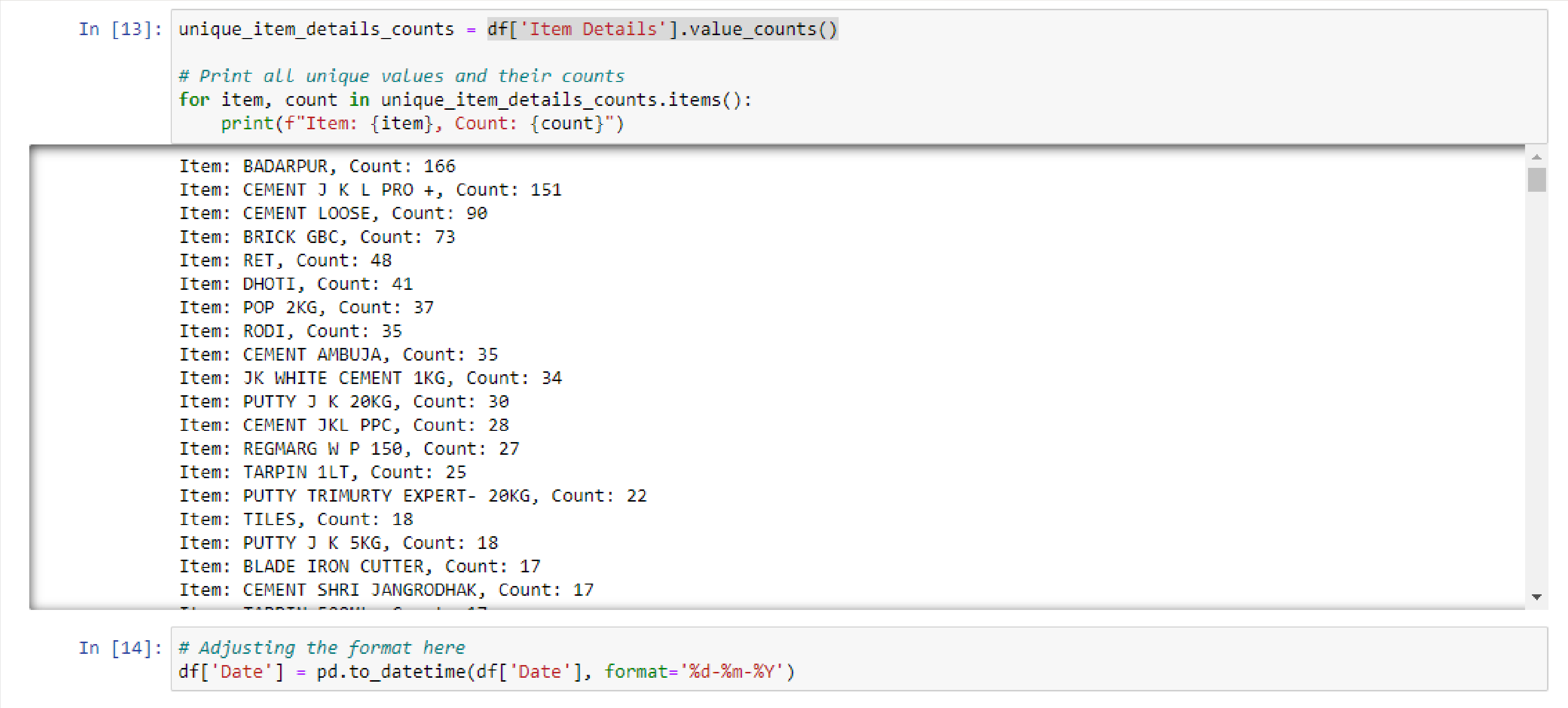
In [12]:

```
df['Item Details'].value_counts()
```

Out[12]:

```
Item Details
BADARPUR                         166
CEMENT J K L PRO +               151
CEMENT LOOSE                      90
BRICK GBC                         73
RET                               48
                                ... 
BLADE SINGLE                       1
BASULI                             1
CONNECTION PIPE 18"                1
TB 3 BLADE STONE CUTTER 5"         1
141 BIB COCK LONG BODY ARTHA       1
Name: count, Length: 485, dtype: int64
```

DATA ANALYSIS

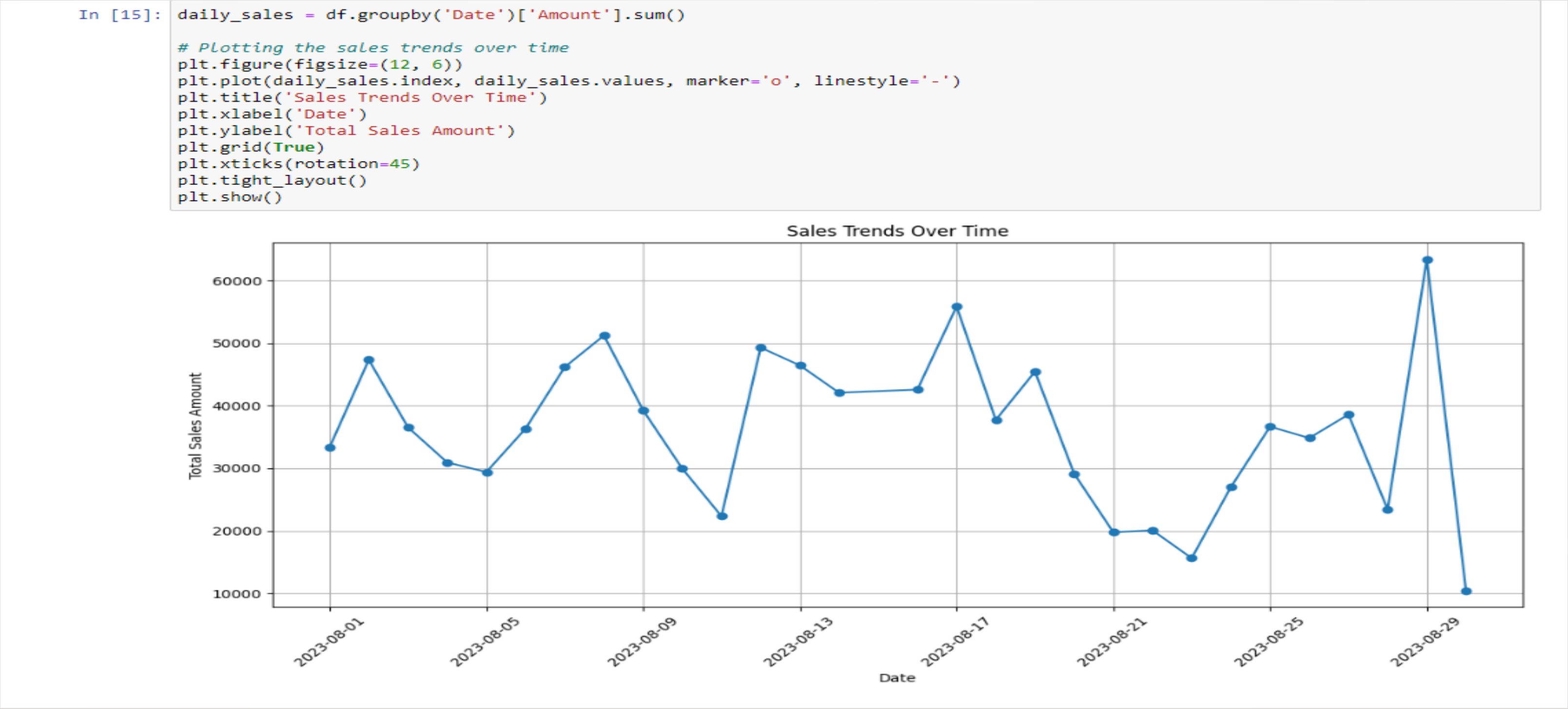


```
In [13]: unique_item_details_counts = df['Item Details'].value_counts()

         # Print all unique values and their counts
         for item, count in unique_item_details_counts.items():
             print(f"Item: {item}, Count: {count}")
```

```
Item: BADARPUR, Count: 166
Item: CEMENT J K L PRO +, Count: 151
Item: CEMENT LOOSE, Count: 90
Item: BRICK GBC, Count: 73
Item: RET, Count: 48
Item: DHOTI, Count: 41
Item: POP 2KG, Count: 37
Item: RODI, Count: 35
Item: CEMENT AMBUJA, Count: 35
Item: JK WHITE CEMENT 1KG, Count: 34
Item: PUTTY J K 20KG, Count: 30
Item: CEMENT JKL PPC, Count: 28
Item: REGMARG W P 150, Count: 27
Item: TARPIN 1LT, Count: 25
Item: PUTTY TRIMURTY EXPERT- 20KG, Count: 22
Item: TILES, Count: 18
Item: PUTTY J K 5KG, Count: 18
Item: BLADE IRON CUTTER, Count: 17
Item: CEMENT SHRI JANGRODHAK, Count: 17
```

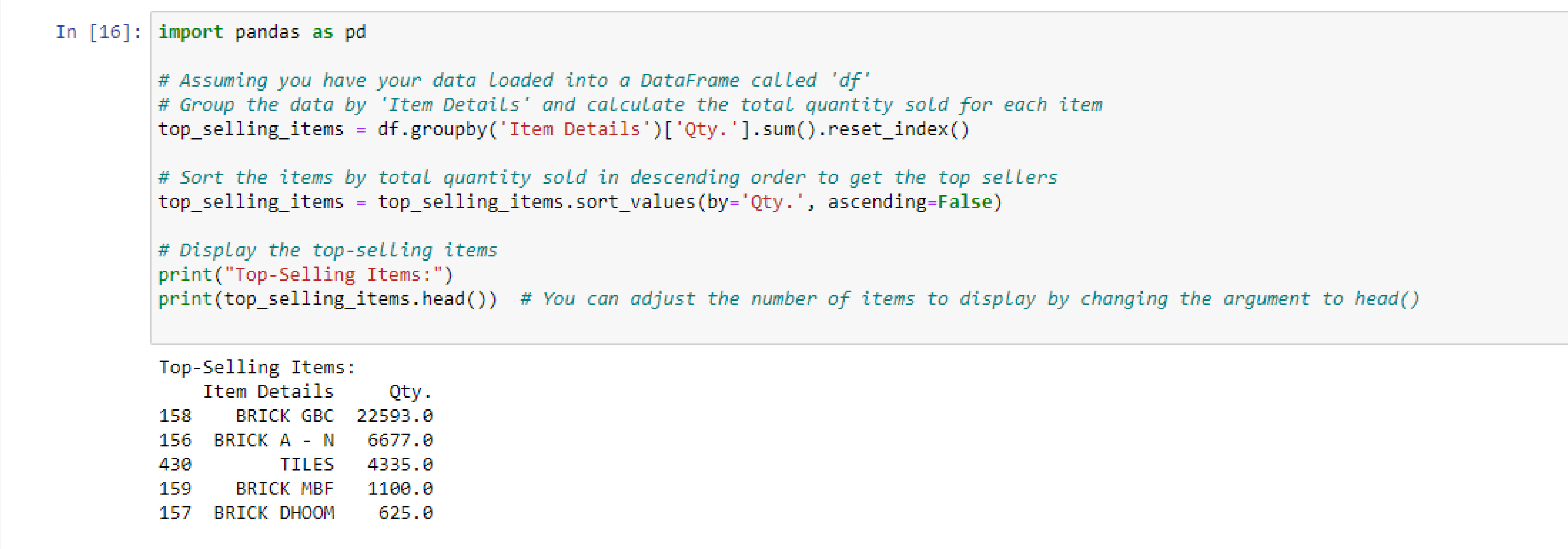
```
In [14]: # Adjusting the format here
         df['Date'] = pd.to_datetime(df['Date'], format='%d-%m-%Y')
```

SALES TRENDS OVER TIME



```
In [15]: daily_sales = df.groupby('Date')['Amount'].sum()

         # Plotting the sales trends over time
         plt.figure(figsize=(12, 6))
         plt.plot(daily_sales.index, daily_sales.values, marker='o', linestyle='-')
         plt.title('Sales Trends Over Time')
         plt.xlabel('Date')
         plt.ylabel('Total Sales Amount')
         plt.grid(True)
         plt.xticks(rotation=45)
         plt.tight_layout()
         plt.show()
```

TOP 5 MOST SELLING ITEMS BY QUANTITY

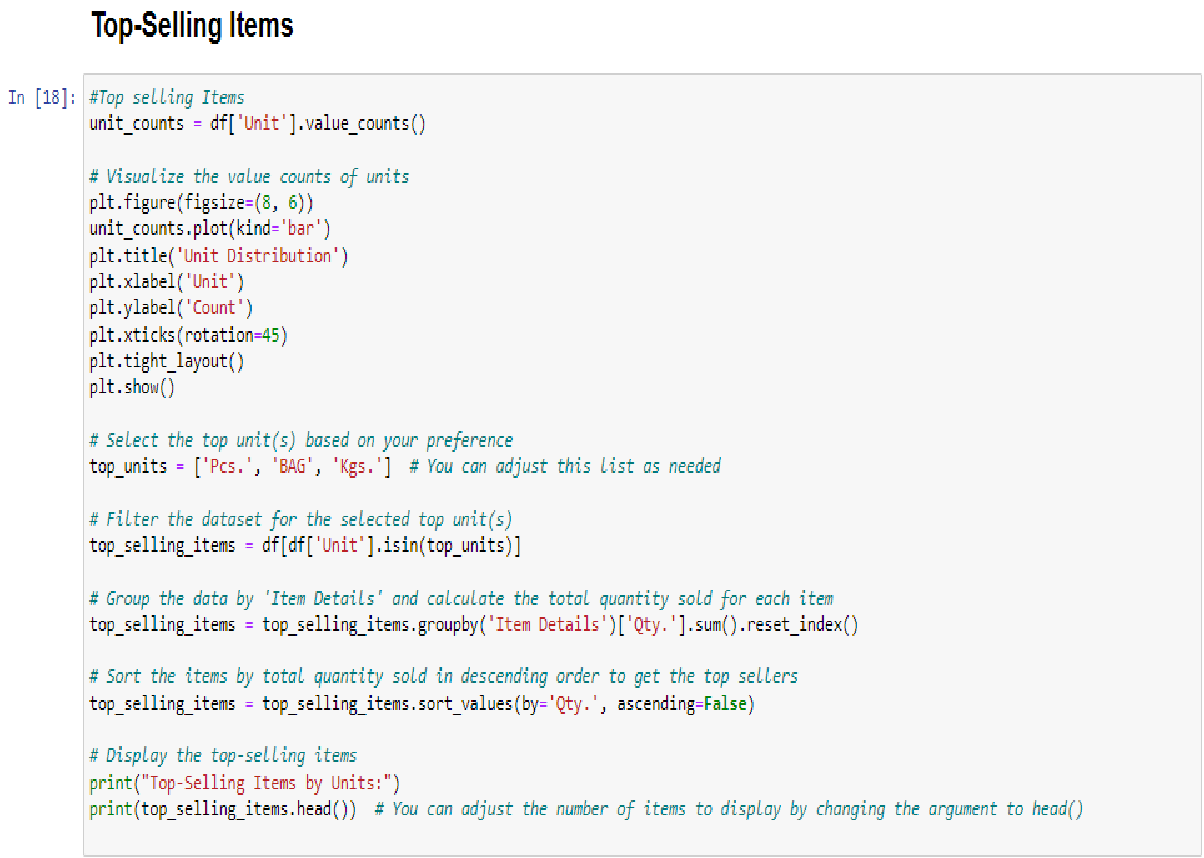


In [16]:

```
import pandas as pd

# Assuming you have your data loaded into a DataFrame called 'df'
# Group the data by 'Item Details' and calculate the total quantity sold for each item
top_selling_items = df.groupby('Item Details')['Qty.'].sum().reset_index()

# Sort the items by total quantity sold in descending order to get the top sellers
top_selling_items = top_selling_items.sort_values(by='Qty.', ascending=False)

# Display the top-selling items
print("Top-Selling Items:")
print(top_selling_items.head())  # You can adjust the number of items to display by changing the argument to head()
```

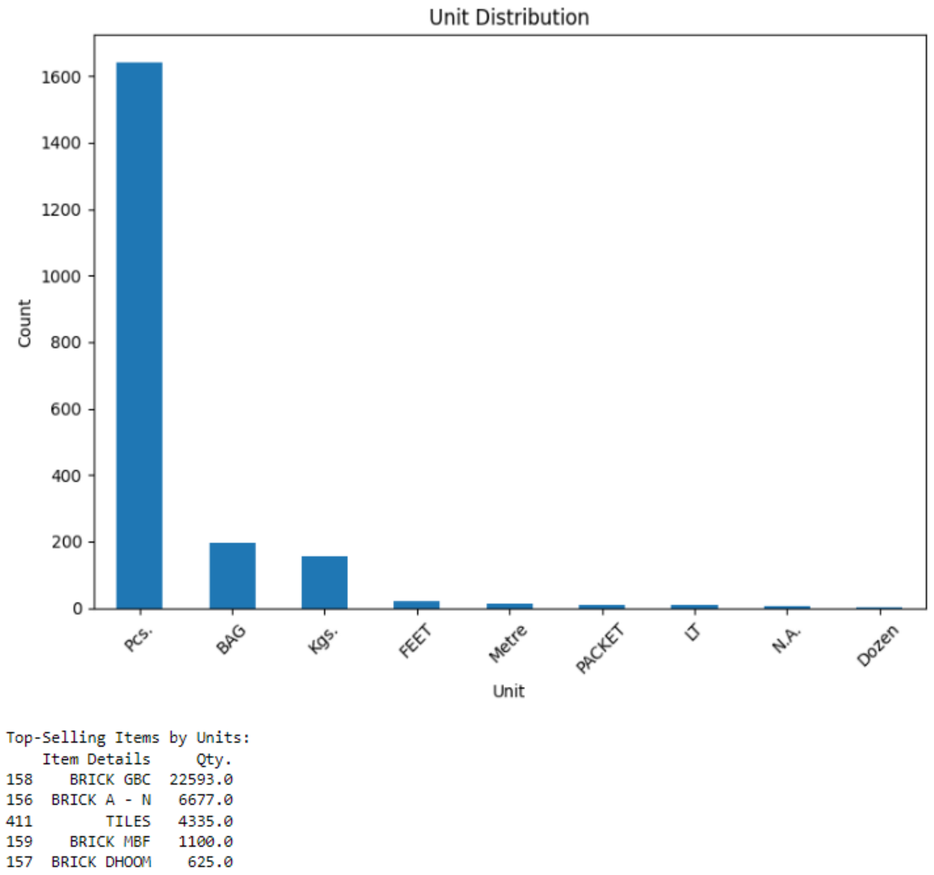
```
Top-Selling Items:
    Item Details     Qty.
158    BRICK GBC  22593.0
156  BRICK A - N   6677.0
430        TILES   4335.0
159    BRICK MBF   1100.0
157  BRICK DHOOM    625.0
```

TOP SELLING ITEMS BY UNITS



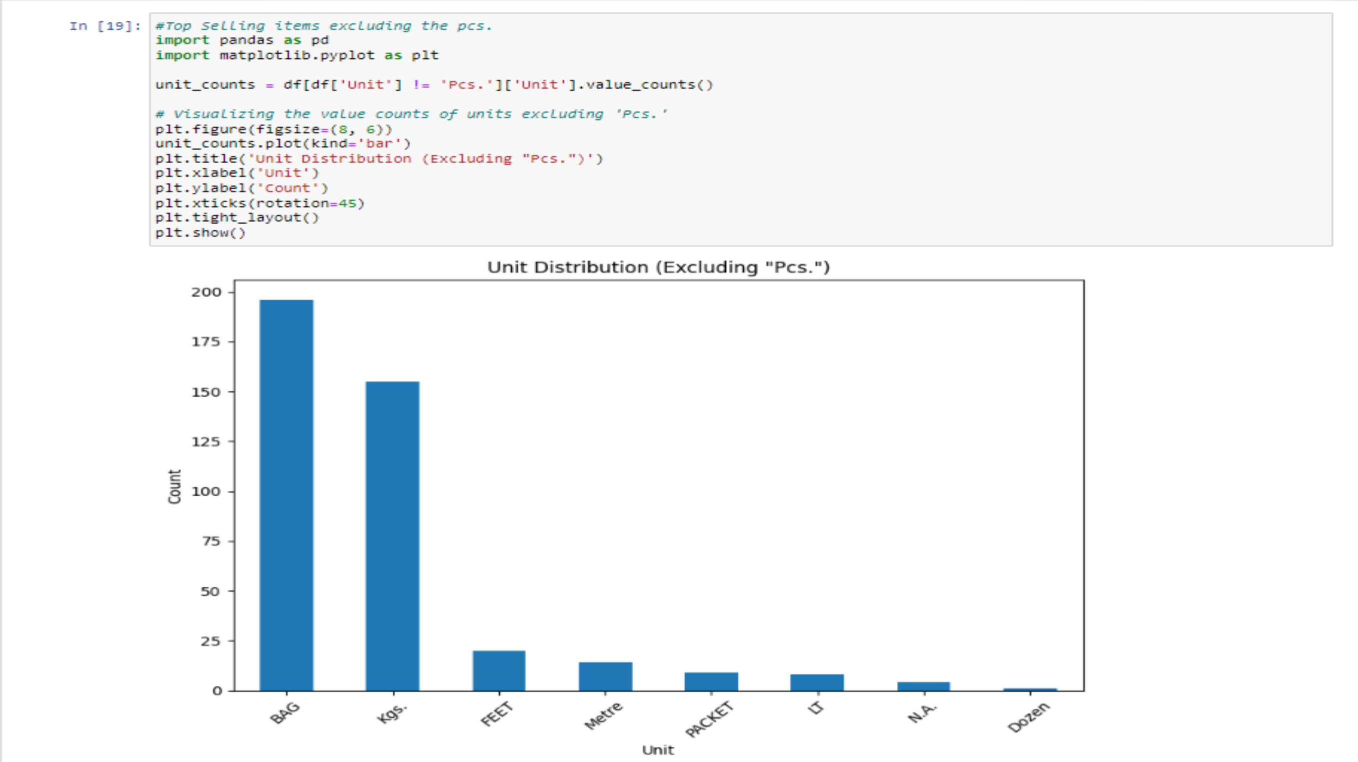
Top-Selling Items

```
In [18]: #Top selling Items
         unit_counts = df['Unit'].value_counts()

         # Visualize the value counts of units
         plt.figure(figsize=(8, 6))
         unit_counts.plot(kind='bar')
         plt.title('Unit Distribution')
         plt.xlabel('Unit')
         plt.ylabel('Count')
         plt.xticks(rotation=45)
         plt.tight_layout()
         plt.show()

         # Select the top unit(s) based on your preference
         top_units = ['Pcs.', 'BAG', 'Kgs.']  # You can adjust this list as needed

         # Filter the dataset for the selected top unit(s)
         top_selling_items = df[df['Unit'].isin(top_units)]

         # Group the data by 'Item Details' and calculate the total quantity sold for each item
         top_selling_items = top_selling_items.groupby('Item Details')['Qty.'].sum().reset_index()

         # Sort the items by total quantity sold in descending order to get the top sellers
         top_selling_items = top_selling_items.sort_values(by='Qty.', ascending=False)

         # Display the top-selling items
         print("Top-Selling Items by Units:")
         print(top_selling_items.head())  # You can adjust the number of items to display by changing the argument to head()
```



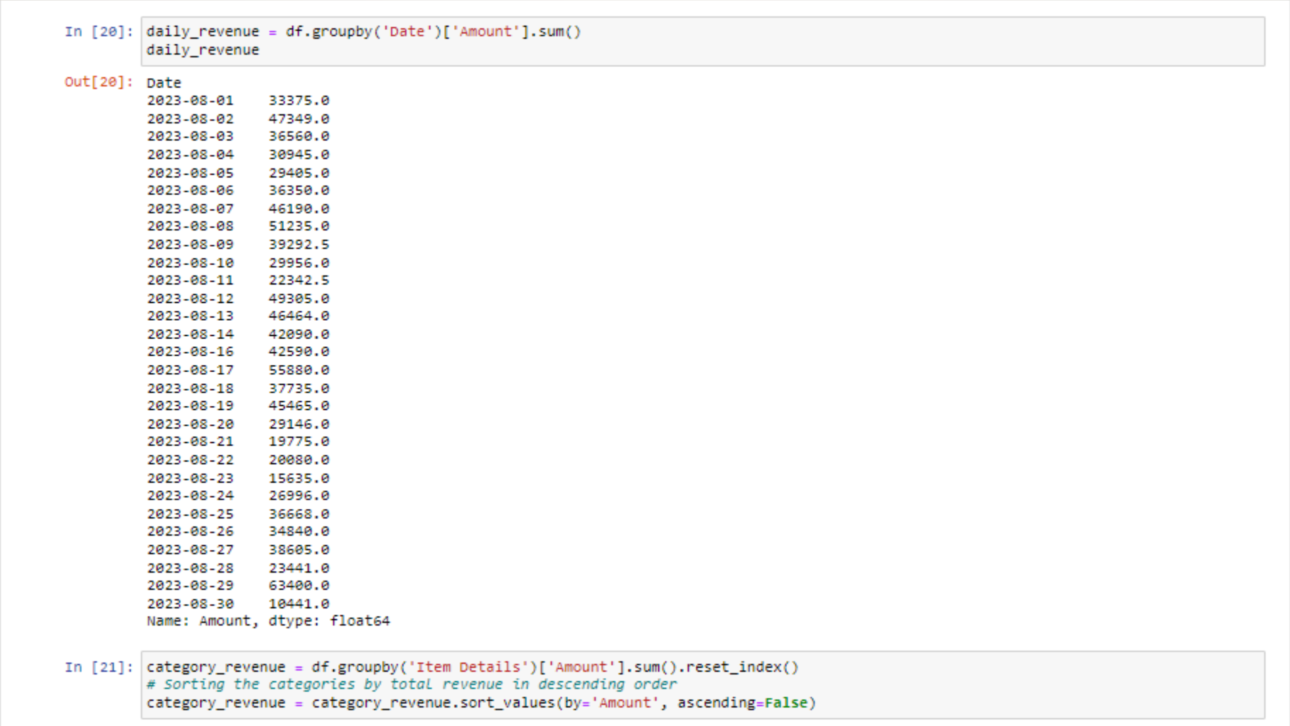
```
Top-Selling Items by Units:
    Item Details      Qty.
158    BRICK GBC  22593.0
156  BRICK A - N   6677.0
411        TILES   4335.0
159    BRICK MBF   1100.0
157  BRICK DHOOM    625.0
```

TOP SELLING ITEMS EXCLUDING “PCS.”



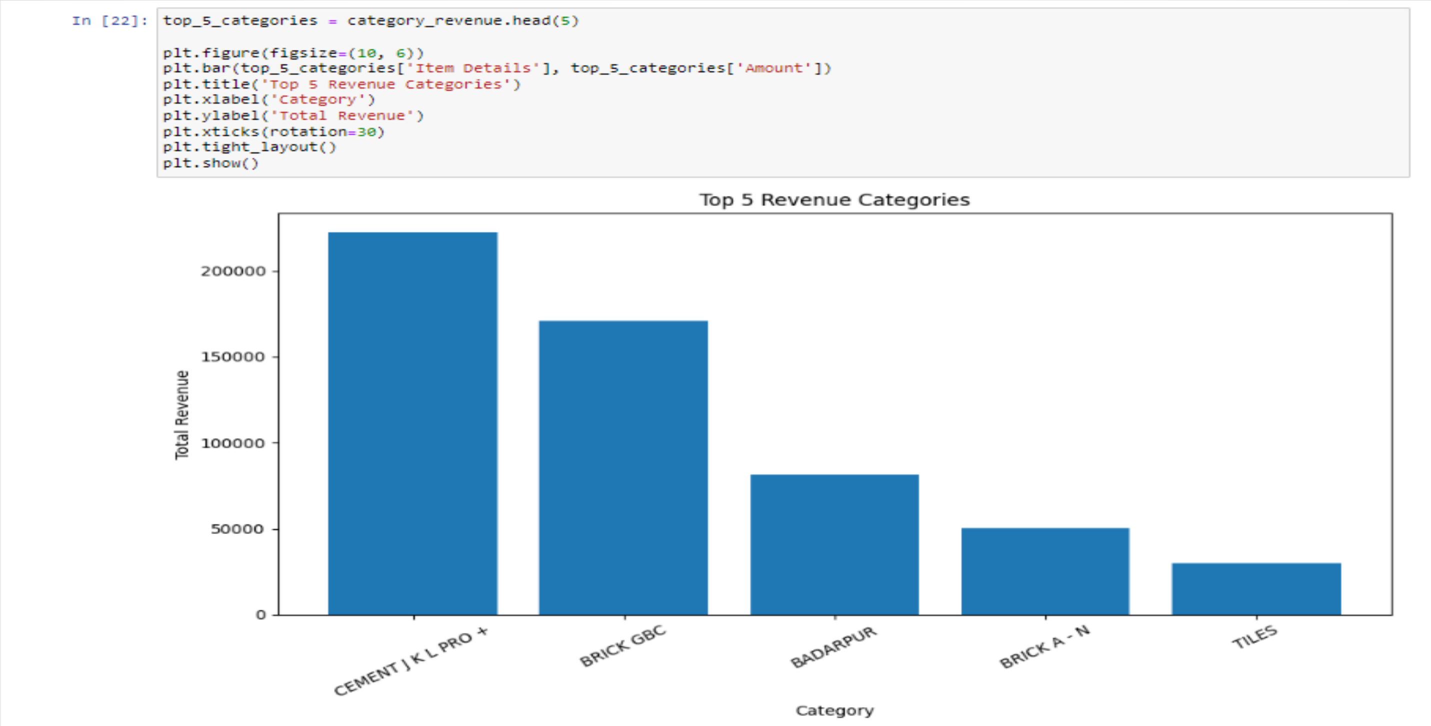
```
In [19]: #Top selling items excluding the pcs.
         import pandas as pd
         import matplotlib.pyplot as plt

         unit_counts = df[df['Unit'] != 'Pcs.']['Unit'].value_counts()

         # Visualizing the value counts of units excluding 'Pcs.'
         plt.figure(figsize=(8, 6))
         unit_counts.plot(kind='bar')
         plt.title('Unit Distribution (Excluding "Pcs.")')
         plt.xlabel('Unit')
         plt.ylabel('Count')
         plt.xticks(rotation=45)
         plt.tight_layout()
         plt.show()
```

REVENUE ANALYSIS



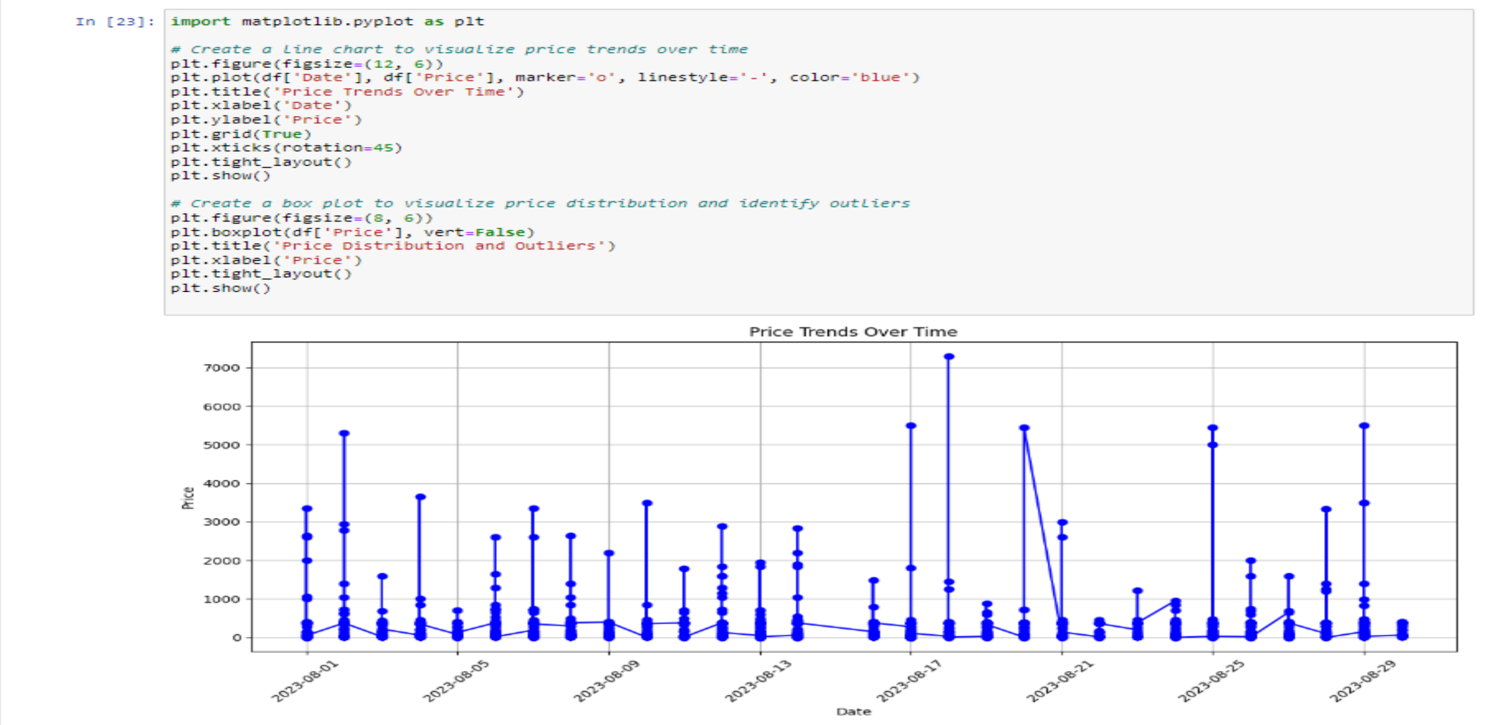
```
In [20]: daily_revenue = df.groupby('Date')['Amount'].sum()
         daily_revenue

Out[20]: Date
         2023-08-01    33375.0
         2023-08-02    47349.0
         2023-08-03    36560.0
         2023-08-04    30945.0
         2023-08-05    29405.0
         2023-08-06    36350.0
         2023-08-07    46190.0
         2023-08-08    51235.0
         2023-08-09    39292.5
         2023-08-10    29956.0
         2023-08-11    22342.5
         2023-08-12    49305.0
         2023-08-13    46464.0
         2023-08-14    42090.0
         2023-08-16    42590.0
         2023-08-17    55880.0
         2023-08-18    37735.0
         2023-08-19    45465.0
         2023-08-20    29146.0
         2023-08-21    19775.0
         2023-08-22    20080.0
         2023-08-23    15635.0
         2023-08-24    26996.0
         2023-08-25    36668.0
         2023-08-26    34840.0
         2023-08-27    38605.0
         2023-08-28    23441.0
         2023-08-29    63400.0
         2023-08-30    10441.0
         Name: Amount, dtype: float64

In [21]: category_revenue = df.groupby('Item Details')['Amount'].sum().reset_index()
         # Sorting the categories by total revenue in descending order
         category_revenue = category_revenue.sort_values(by='Amount', ascending=False)
```

VISUALIZING REVENUE BY TOP 5 REVENUE CATEGORIES



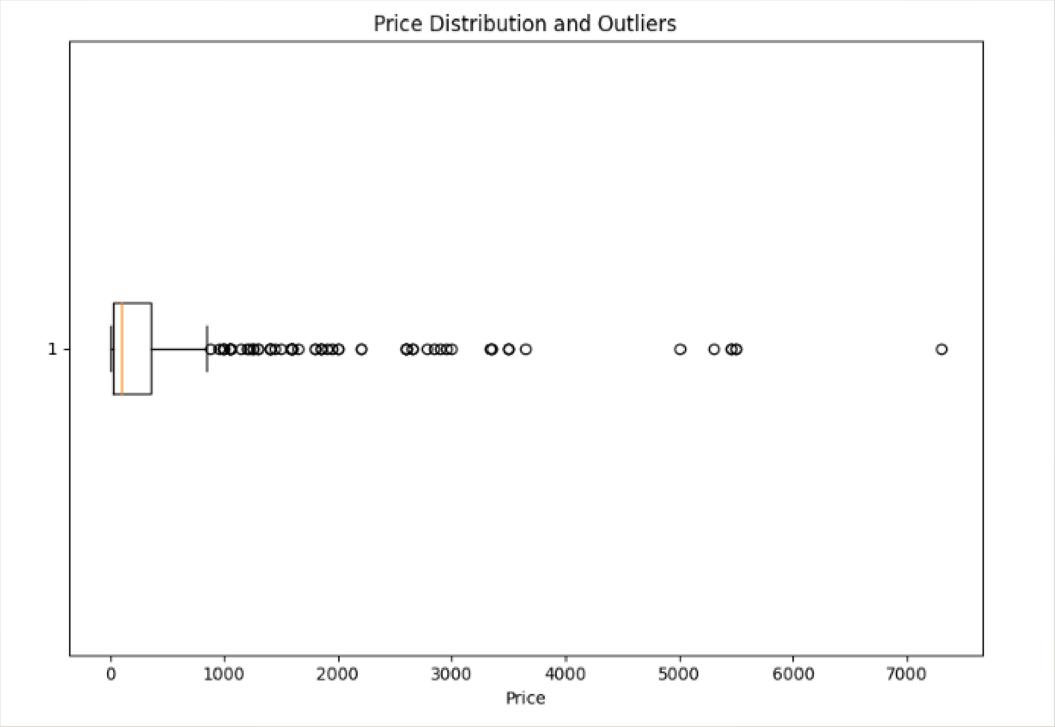
```
In [22]: top_5_categories = category_revenue.head(5)

         plt.figure(figsize=(10, 6))
         plt.bar(top_5_categories['Item Details'], top_5_categories['Amount'])
         plt.title('Top 5 Revenue Categories')
         plt.xlabel('Category')
         plt.ylabel('Total Revenue')
         plt.xticks(rotation=30)
         plt.tight_layout()
         plt.show()
```

PRIZE TRENDS OVER TIME

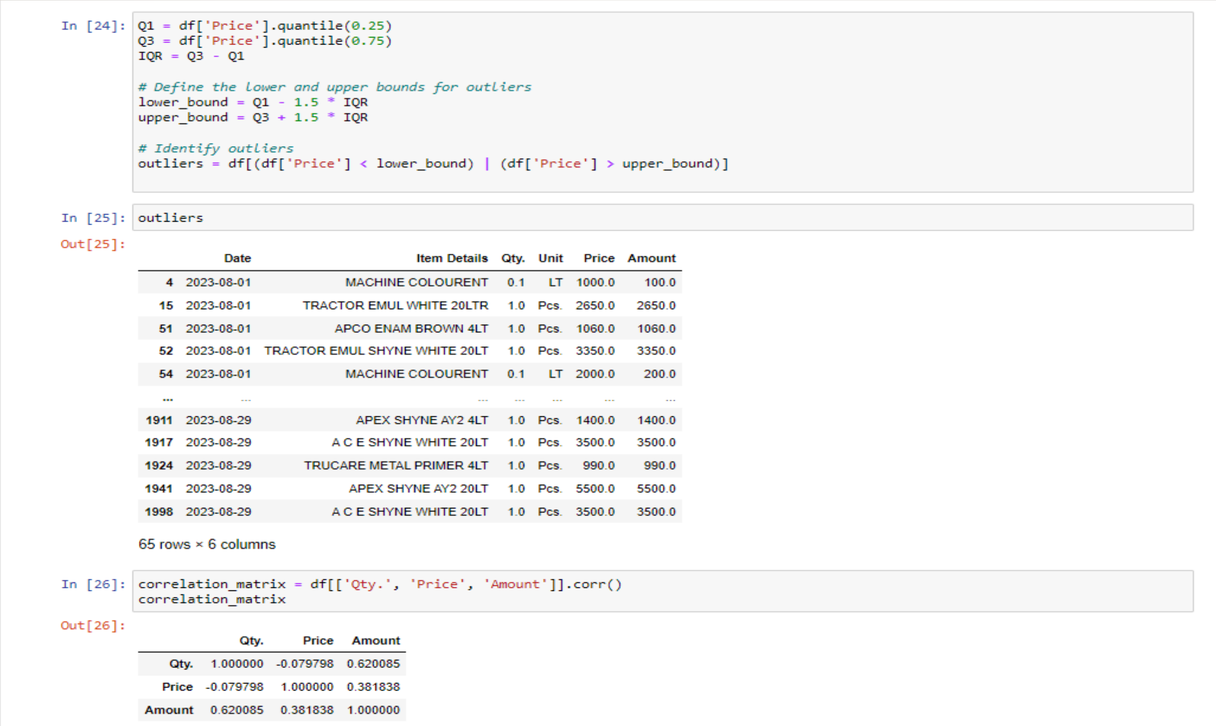


```
In [23]: import matplotlib.pyplot as plt

         # Create a line chart to visualize price trends over time
         plt.figure(figsize=(12, 6))
         plt.plot(df['Date'], df['Price'], marker='o', linestyle='-', color='blue')
         plt.title('Price Trends Over Time')
         plt.xlabel('Date')
         plt.ylabel('Price')
         plt.grid(True)
         plt.xticks(rotation=45)
         plt.tight_layout()
         plt.show()

         # Create a box plot to visualize price distribution and identify outliers
         plt.figure(figsize=(8, 6))
         plt.boxplot(df['Price'], vert=False)
         plt.title('Price Distribution and Outliers')
         plt.xlabel('Price')
         plt.tight_layout()
         plt.show()
```

PRICE DISTRIBUTION AND OUTLIERS



OUTLIERS



In [24]:

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

# Define the lower and upper bounds for outliers
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

# Identify outliers
outliers = df[(df['Price'] < lower_bound) | (df['Price'] > upper_bound)]
```

In [25]:

```
outliers
```

Out[25]:

	Date	Item Details	Qty.	Unit	Price	Amount
4	2023-08-01	MACHINE COLOURENT	0.1	LT	1000.0	100.0
15	2023-08-01	TRACTOR EMUL WHITE 20LTR	1.0	Pcs.	2650.0	2650.0
51	2023-08-01	APCO ENAM BROWN 4LT	1.0	Pcs.	1060.0	1060.0
52	2023-08-01	TRACTOR EMUL SHYNE WHITE 20LT	1.0	Pcs.	3350.0	3350.0
54	2023-08-01	MACHINE COLOURENT	0.1	LT	2000.0	200.0
...	...	...	...	...	...	...
1911	2023-08-29	APEX SHYNE AY2 4LT	1.0	Pcs.	1400.0	1400.0
1917	2023-08-29	A C E SHYNE WHITE 20LT	1.0	Pcs.	3500.0	3500.0
1924	2023-08-29	TRUCARE METAL PRIMER 4LT	1.0	Pcs.	990.0	990.0
1941	2023-08-29	APEX SHYNE AY2 20LT	1.0	Pcs.	5500.0	5500.0
1998	2023-08-29	A C E SHYNE WHITE 20LT	1.0	Pcs.	3500.0	3500.0

65 rows × 6 columns

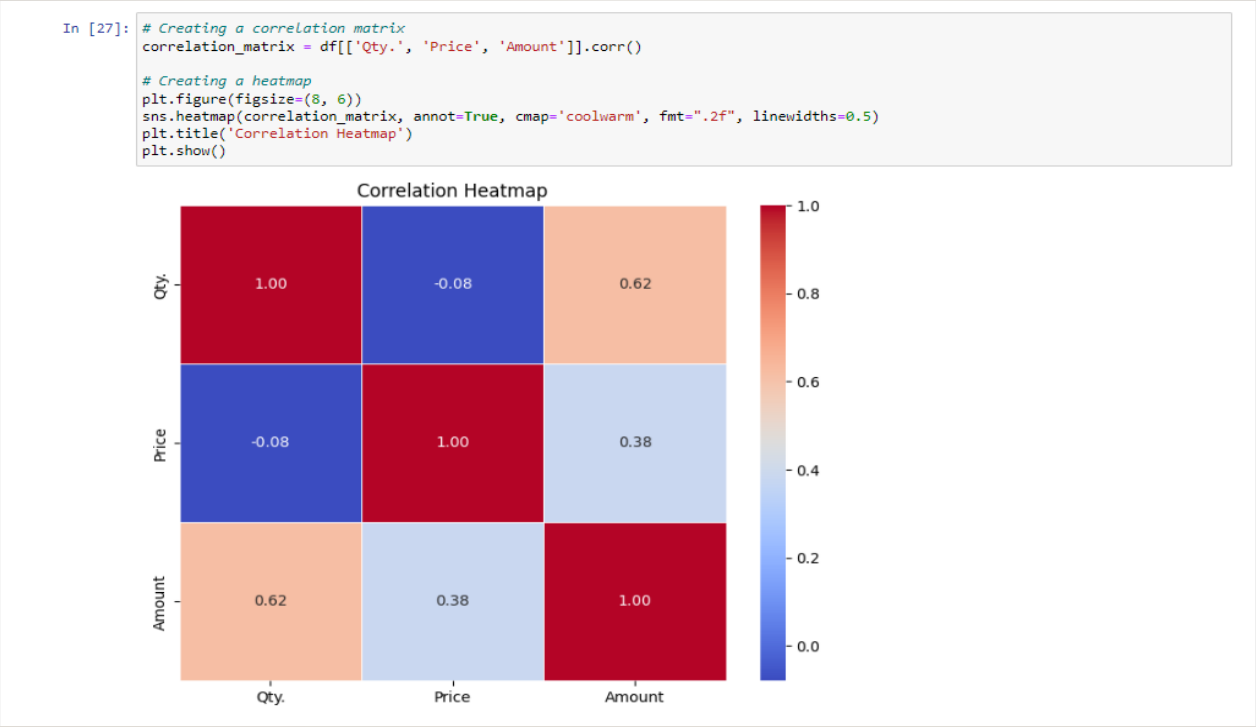
In [26]:

```
correlation_matrix = df[['Qty.', 'Price', 'Amount']].corr()
correlation_matrix
```

Out[26]:

	Qty.	Price	Amount
Qty.	1.000000	-0.079798	0.620085
Price	-0.079798	1.000000	0.381838
Amount	0.620085	0.381838	1.000000

CORRELATION HEATMAP



```
In [27]: # Creating a correlation matrix
         correlation_matrix = df[['Qty.', 'Price', 'Amount']].corr()

         # Creating a heatmap
         plt.figure(figsize=(8, 6))
         sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f", linewidths=0.5)
         plt.title('Correlation Heatmap')
         plt.show()
```

CORRELATION HEAT MAP ANALYSIS

1) Qty. vs. Price

- The correlation between 'Qty.' and 'Price' is approximately -0.079798, which indicates a weak negative correlation. This suggests that there's a slight tendency for the quantity sold ('Qty.') and the price of the item ('Price') to move in opposite directions, but the correlation is not strong.

2) Qty. vs. Amount

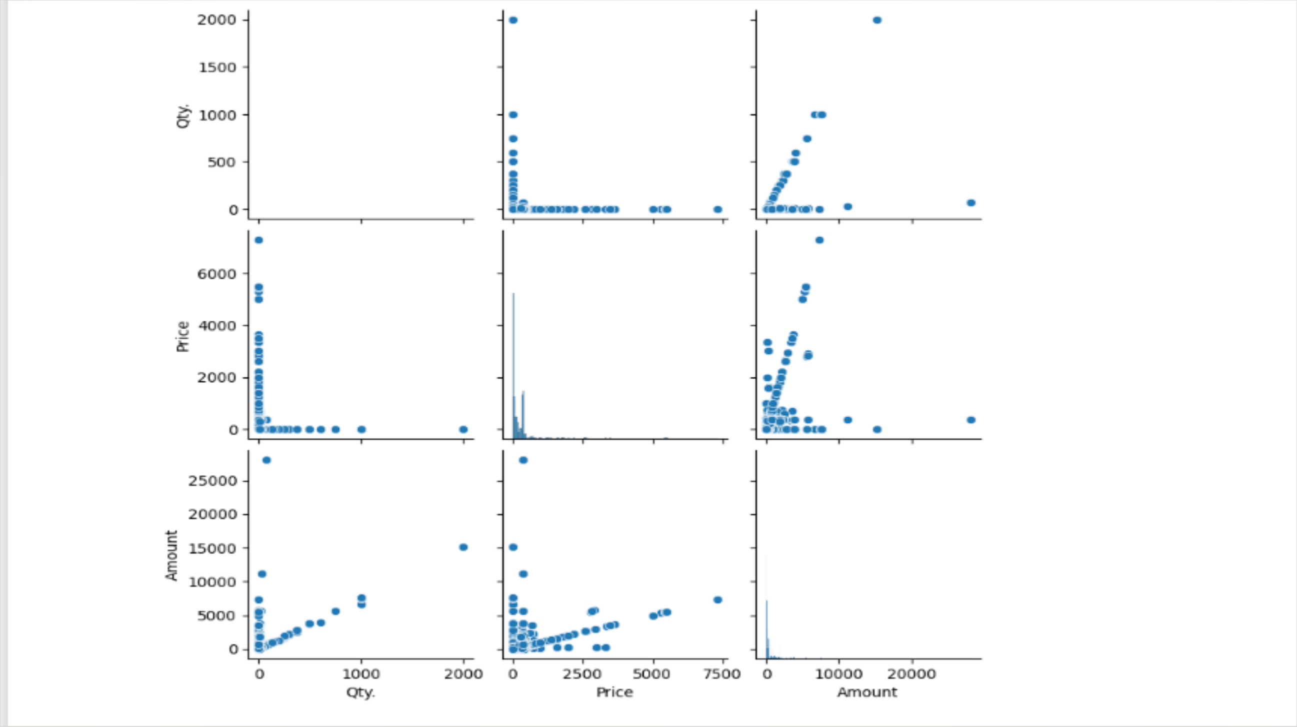
- The correlation between 'Qty.' and 'Amount' is approximately 0.620085, which indicates a moderate positive correlation. This means that there is a moderate tendency for the quantity sold ('Qty.') and the total sales amount ('Amount') to move together, with an increase in quantity sold associated with an increase in the total sales amount.

3) Price vs. Amount

- The correlation between 'Price' and 'Amount' is approximately 0.381838, indicating a moderate positive correlation. This means that there is a moderate tendency for the price of the item ('Price') and the total sales amount ('Amount') to move together, with an increase in price associated with an increase in the total sales amount.

These correlation coefficients provide insights into the relationships between the variables in the data.

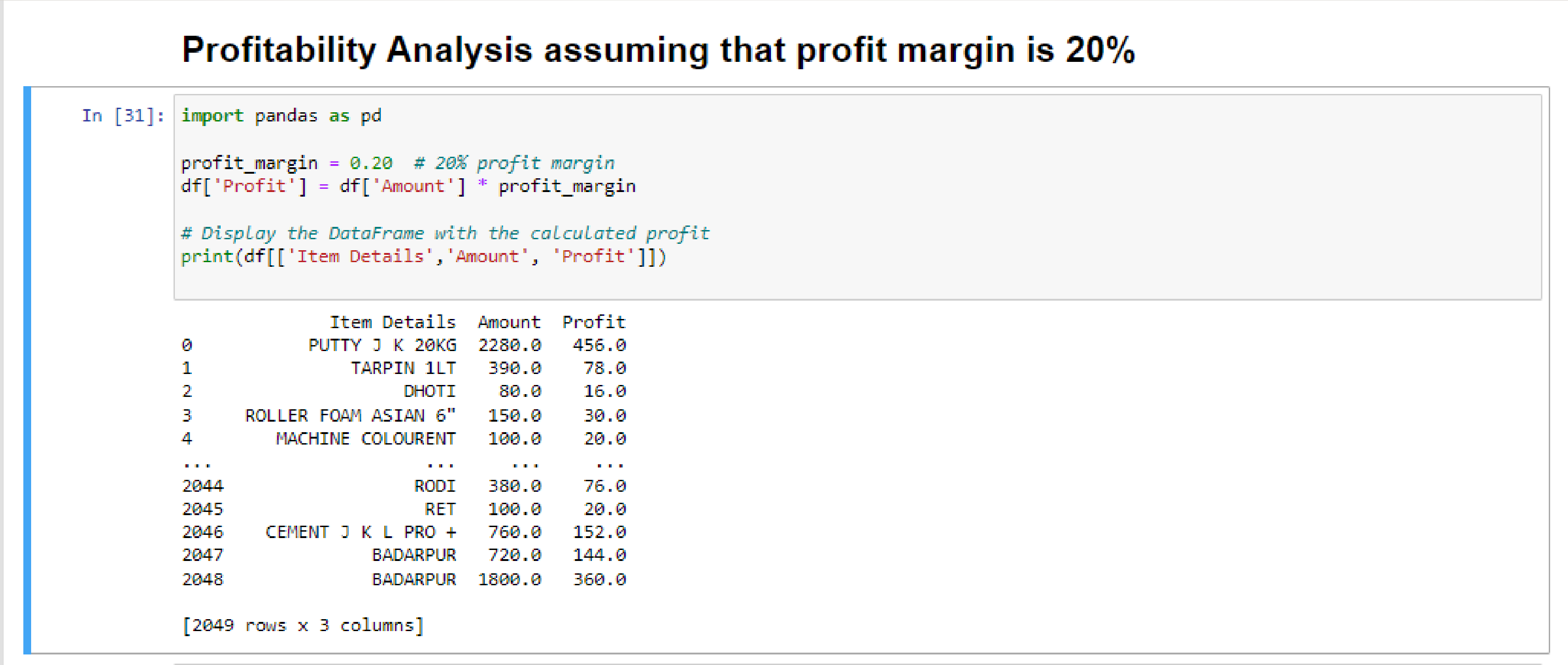
VISUALISING USING SCATTER MATRIX



PROFITABILITY ANALYSIS

- The primary objective was to assess the profitability of each item in our inventory, assuming a 20% profit margin. This analysis is crucial for making informed decisions regarding pricing, product management, and overall business strategy.
- Methodology:
  - Profit Margin: We calculated the profit for each item by applying a 20% profit margin to the 'Amount' column in our dataset. The profit margin represents the portion of revenue that contributes to profit after covering costs.

RESULTS



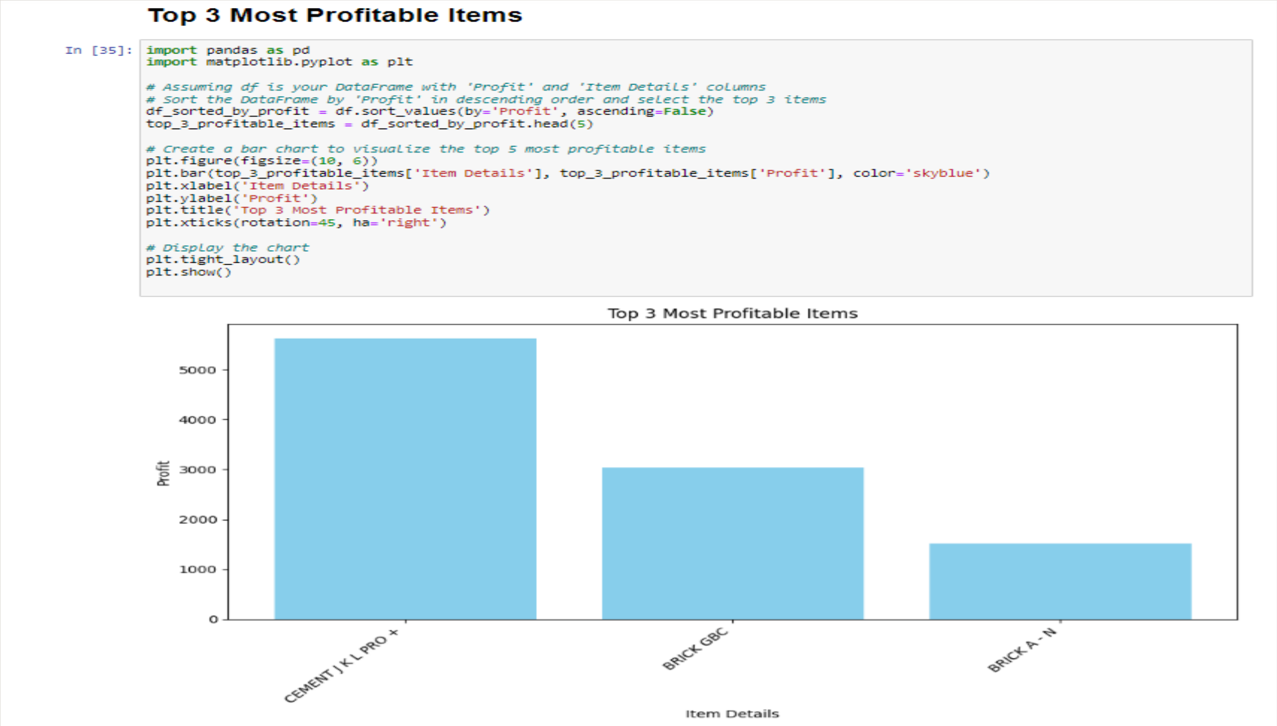
Profitability Analysis assuming that profit margin is 20%

In [31]:

```
import pandas as pd

profit_margin = 0.20  # 20% profit margin
df['Profit'] = df['Amount'] * profit_margin

# Display the DataFrame with the calculated profit
print(df[['Item Details','Amount', 'Profit']])
```

```
               Item Details  Amount  Profit
0             PUTTY J K 20KG  2280.0   456.0
1                 TARPIN 1LT   390.0    78.0
2                      DHOTI    80.0    16.0
3         ROLLER FOAM ASIAN 6"   150.0    30.0
4          MACHINE COLOURENT   100.0    20.0
...                      ...     ...     ...
2044                    RODI   380.0    76.0
2045                     RET   100.0    20.0
2046        CEMENT J K L PRO +   760.0   152.0
2047                BADARPUR   720.0   144.0
2048                BADARPUR  1800.0   360.0

[2049 rows x 3 columns]
```

TOP 3 MOST PROFITABLE ITEMS



Top 3 Most Profitable Items

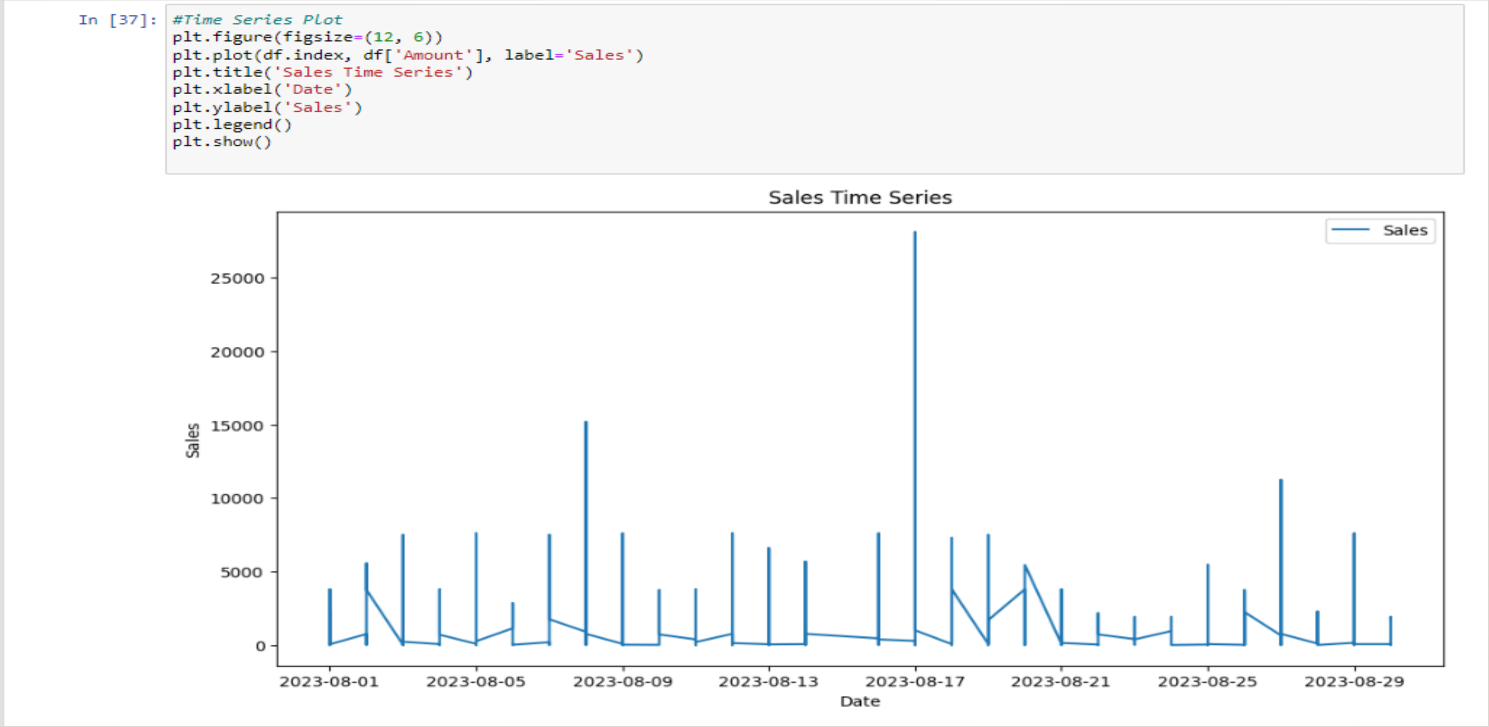
In [35]:

```python
import pandas as pd
import matplotlib.pyplot as plt

# Assuming df is your DataFrame with 'Profit' and 'Item Details' columns
# Sort the DataFrame by 'Profit' in descending order and select the top 3 items
df_sorted_by_profit = df.sort_values(by='Profit', ascending=False)
top_3_profitable_items = df_sorted_by_profit.head(5)

# Create a bar chart to visualize the top 5 most profitable items
plt.figure(figsize=(10, 6))
plt.bar(top_3_profitable_items['Item Details'], top_3_profitable_items['Profit'], color='skyblue')
plt.xlabel('Item Details')
plt.ylabel('Profit')
plt.title('Top 3 Most Profitable Items')
plt.xticks(rotation=45, ha='right')

# Display the chart
plt.tight_layout()
plt.show()
```

KEY INSIGHTS

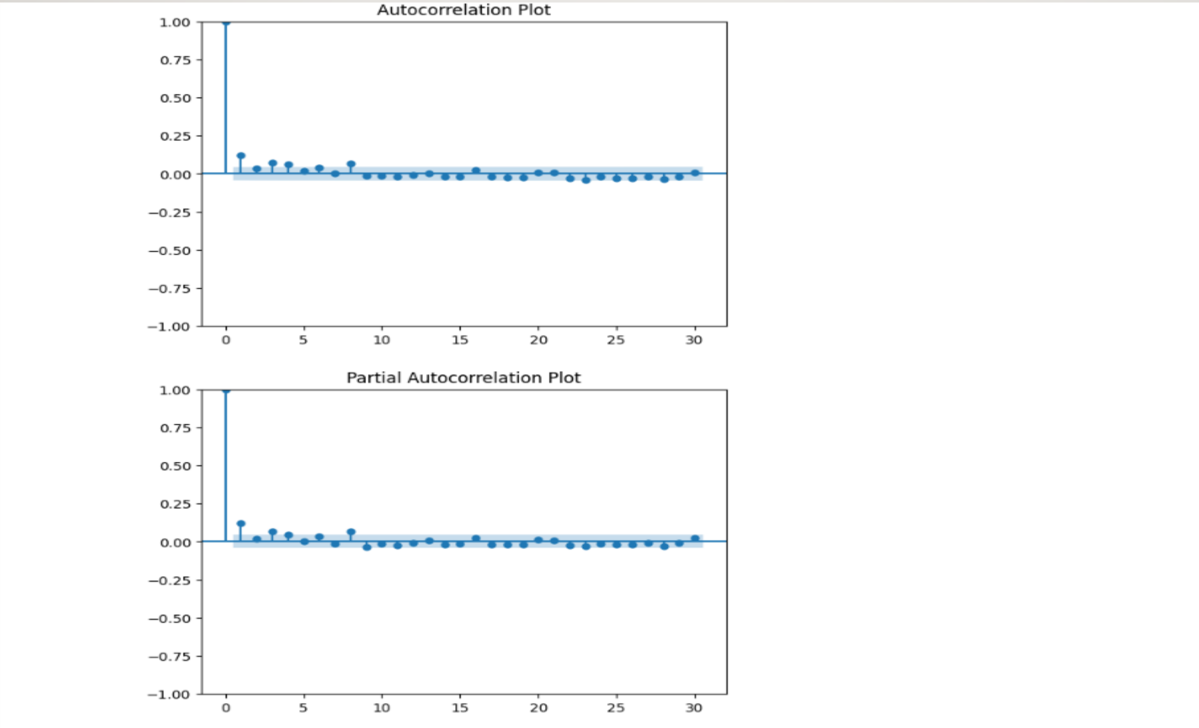
- With this profitability analysis, we are better equipped to make informed decisions regarding pricing strategies, product promotions, and inventory management. We can identify products with higher profit margins and focus our efforts accordingly.
- The profitability analysis has provided valuable insights into the financial performance of the products. It serves as a foundation for data-driven decision-making, enabling and optimizing the pricing strategies and enhance overall profitability. Moving forward, we will continue to monitor and analyze profitability to adapt to changing market conditions and business objectives.

TIME-SERIES PLOT



```
In [37]: #Time Series Plot
         plt.figure(figsize=(12, 6))
         plt.plot(df.index, df['Amount'], label='Sales')
         plt.title('Sales Time Series')
         plt.xlabel('Date')
         plt.ylabel('Sales')
         plt.legend()
         plt.show()
```

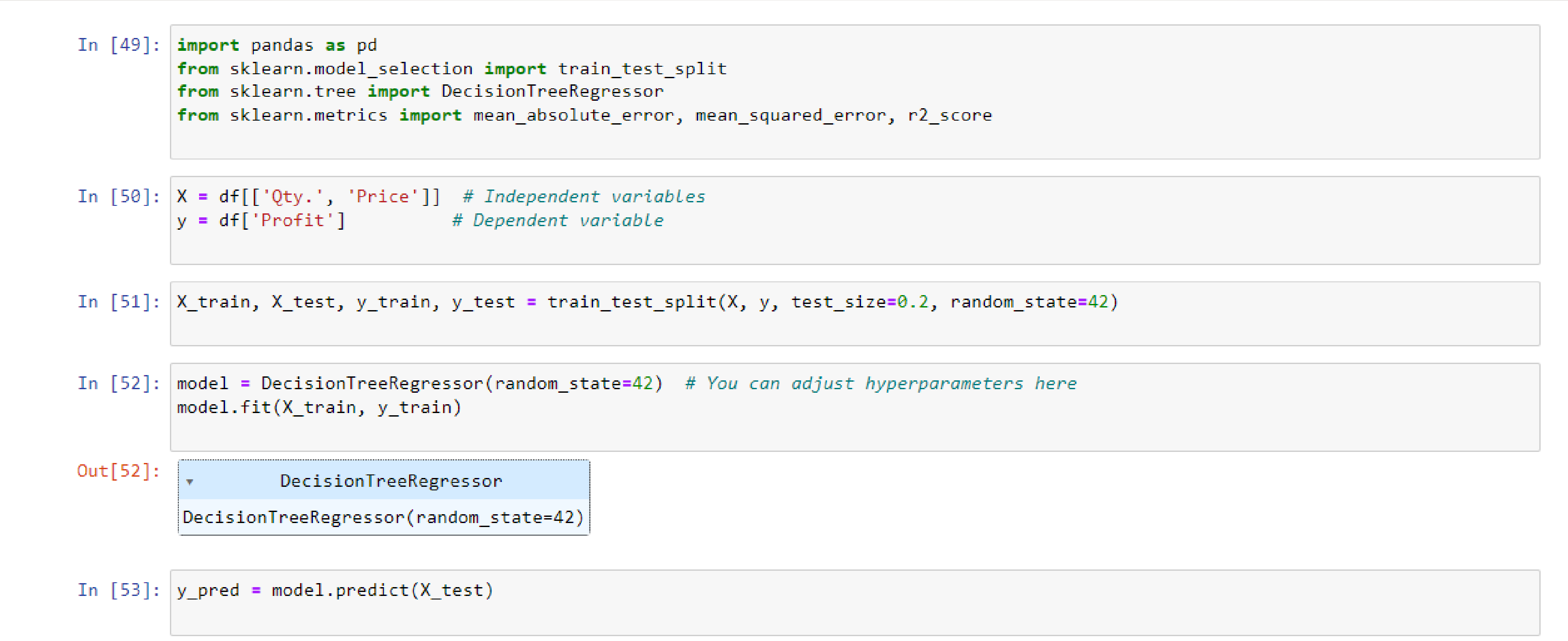
AUTOCORRELATIONS PLOTS



REGRESSION ANALYSIS

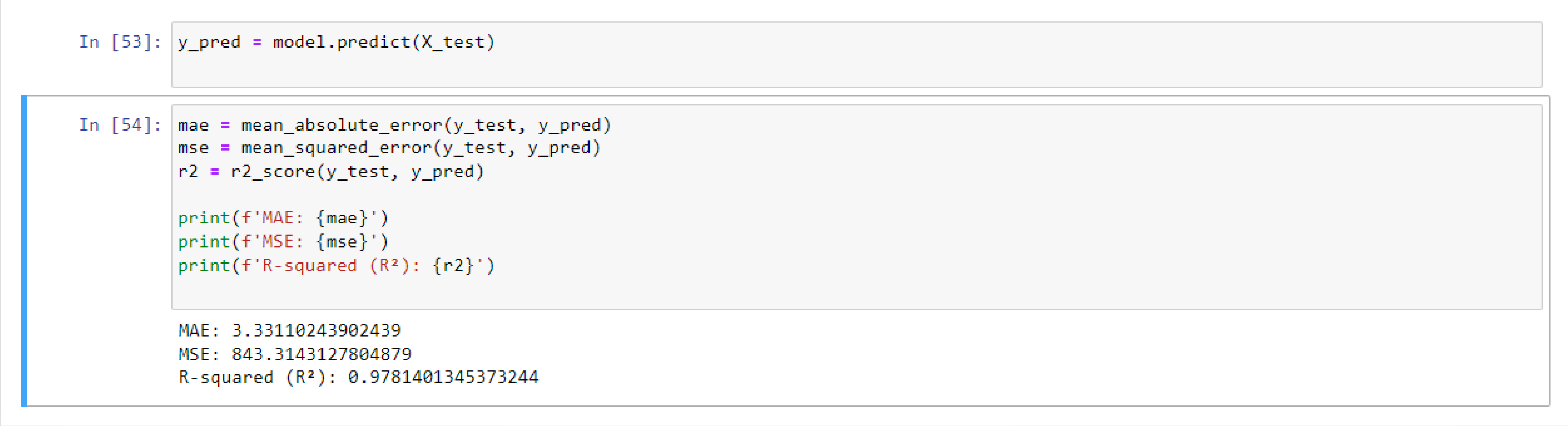
- Model Used: Decision Tree Regression model.
  - Decision Tree Regression is a supervised machine learning technique used for predicting a continuous target variable based on one or more input features. It is a versatile and interpretable model that builds a tree-like structure to make predictions.
- Advantages:
  - **Interpretability**: Decision Trees are easy to interpret and explain. You can visualize the tree structure and understand the decision-making process.
  - **Nonlinearity**: Decision Trees can capture nonlinear relationships between features and the target variable, making them suitable for complex datasets.
  - **Handling Multicollinearity**: Decision Trees can handle multicollinearity (correlations between independent variables) effectively.

IMPLEMENTING THE MODEL



```
In [49]: import pandas as pd
         from sklearn.model_selection import train_test_split
         from sklearn.tree import DecisionTreeRegressor
         from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

In [50]: X = df[['Qty.', 'Price']]  # Independent variables
         y = df['Profit']          # Dependent variable

In [51]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

In [52]: model = DecisionTreeRegressor(random_state=42)  # You can adjust hyperparameters here
         model.fit(X_train, y_train)

Out[52]: ▾         DecisionTreeRegressor
         DecisionTreeRegressor(random_state=42)

In [53]: y_pred = model.predict(X_test)
```

PREDICTIONS



```
In [53]: y_pred = model.predict(X_test)
```

```
In [54]: mae = mean_absolute_error(y_test, y_pred)
         mse = mean_squared_error(y_test, y_pred)
         r2 = r2_score(y_test, y_pred)

         print(f'MAE: {mae}')
         print(f'MSE: {mse}')
         print(f'R-squared (R²): {r2}')
```

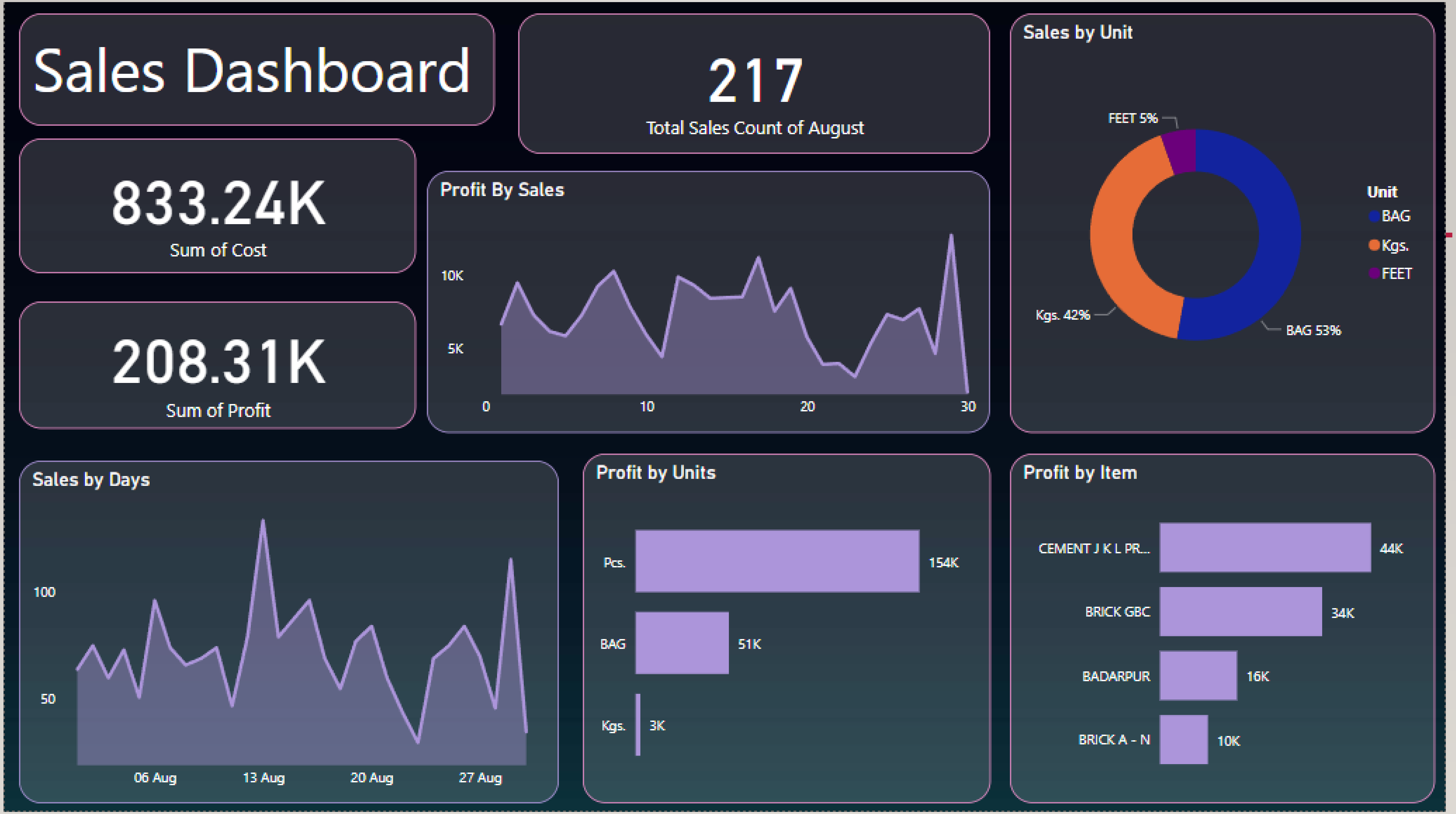
```
MAE: 3.33110243902439
MSE: 843.3143127804879
R-squared (R²): 0.9781401345373244
```

CONCLUSION

- Decision Tree Regression model achieved impressive results, as indicated by the low MAE, MSE, and high R-squared values. This suggests that the model effectively captures the relationships between the quantity, price, and profit, making it a suitable choice for predicting profit based on these features.

CREATING DASHBOARD

- Creating a dashboard is an essential step in presenting and visualizing the insights and results of your data analysis or reporting. Dashboards provide a clear and concise way to convey complex information to your audience. Here's a description of how to create a dashboard
- Dashboard Tool Used: PowerBI



Sales Dashboard

217

Total Sales Count of August

833.24K

Sum of Cost

208.31K

Sum of Profit

Profit By Sales

Sales by Unit

Sales by Days

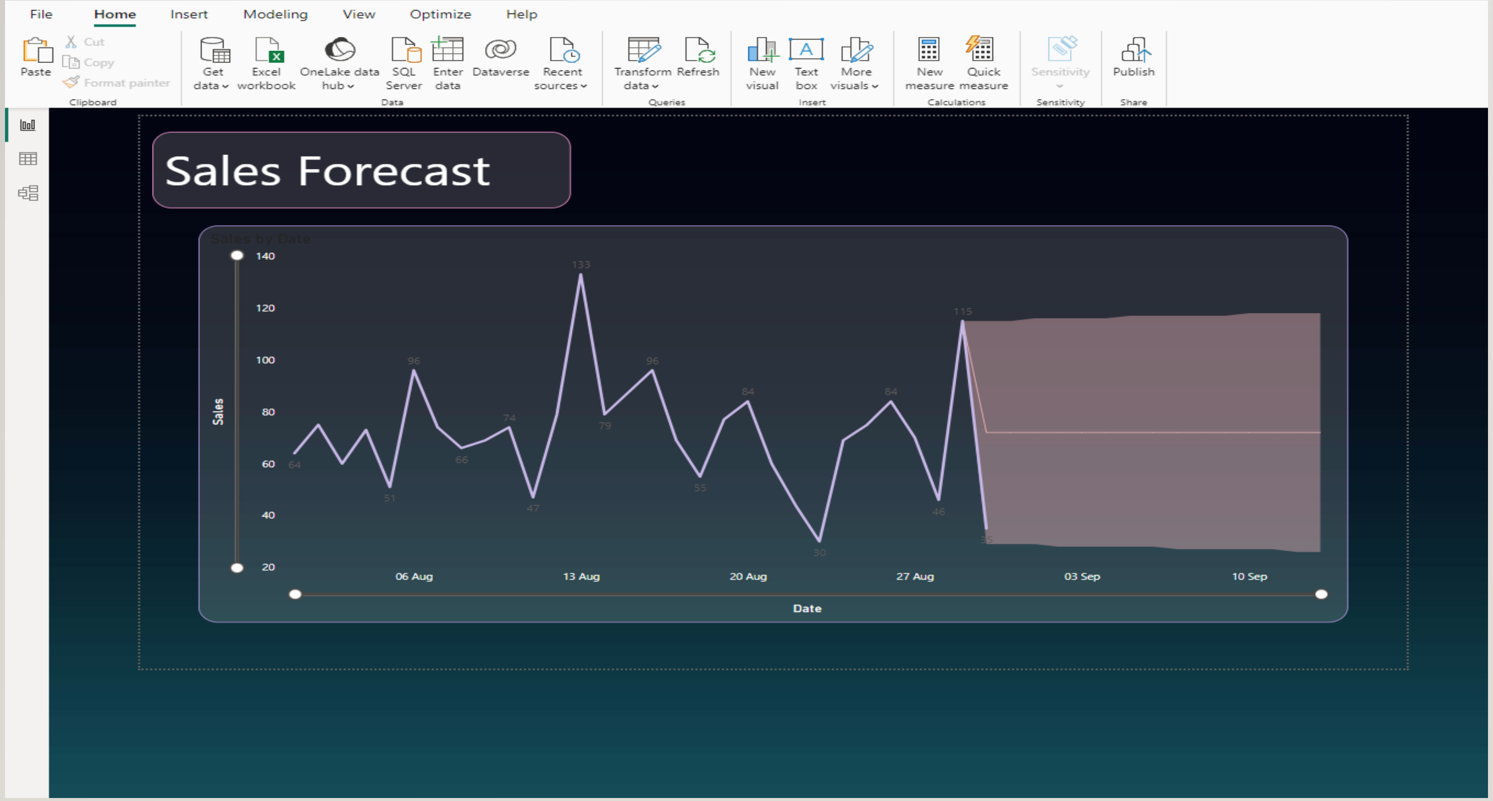
Profit by Units

Profit by Item

FORECASTING THE SALES OF NEXT MONTH

- In the ongoing quest to harness the power of data-driven decision-making, I have achieved a significant milestone by successfully predicting the sales values for the next 15 days using Power BI. This accomplishment reflects commitment to leveraging the data analytics to optimize operations, improve inventory management, and drive profitability.

FORECASTING



THANKYOU