NAAN MUDHALVAN PROJECT

Project Title: Product Sales Analysis Using Machine learning

Phase 3: Development Part 1

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Data Cleaning and Analysis Report:

Introduction

This report presents an analysis of the dataset from "statsfinal.csv" after performing data cleaning and processing. The dataset was loaded using Python, and various data cleaning steps were applied to prepare it for analysis.

Coding part:

```
# Data Loading

import pandas as pd

data = pd.read_csv("statsfinal.csv")
```

Data Cleaning:

Missing Values

The initial step involves identifying and handling missing values in the dataset. Fortunately, there were no missing values present.

Coding part:

```
# Missing Values

missing_values = data.isnull().sum()

print(missing_values)

print("There are no missing values")
```

Duplicates

Duplicate rows were removed to ensure data integrity.

Coding part

```
# Duplicates
data.drop_duplicates(inplace=True)
```

Data Formatting:

The 'Date' column was split into separate columns for 'Day,' 'Month,' and 'Year' to facilitate further analysis.

Coding part

```
# Data Formatting
data['Day'] = data['Date'].apply(lambda x: x.split('-')[0])
data['Month'] = data['Date'].apply(lambda x: x.split('-')[1])
data['Year'] = data['Date'].apply(lambda x: x.split('-')[2])
```

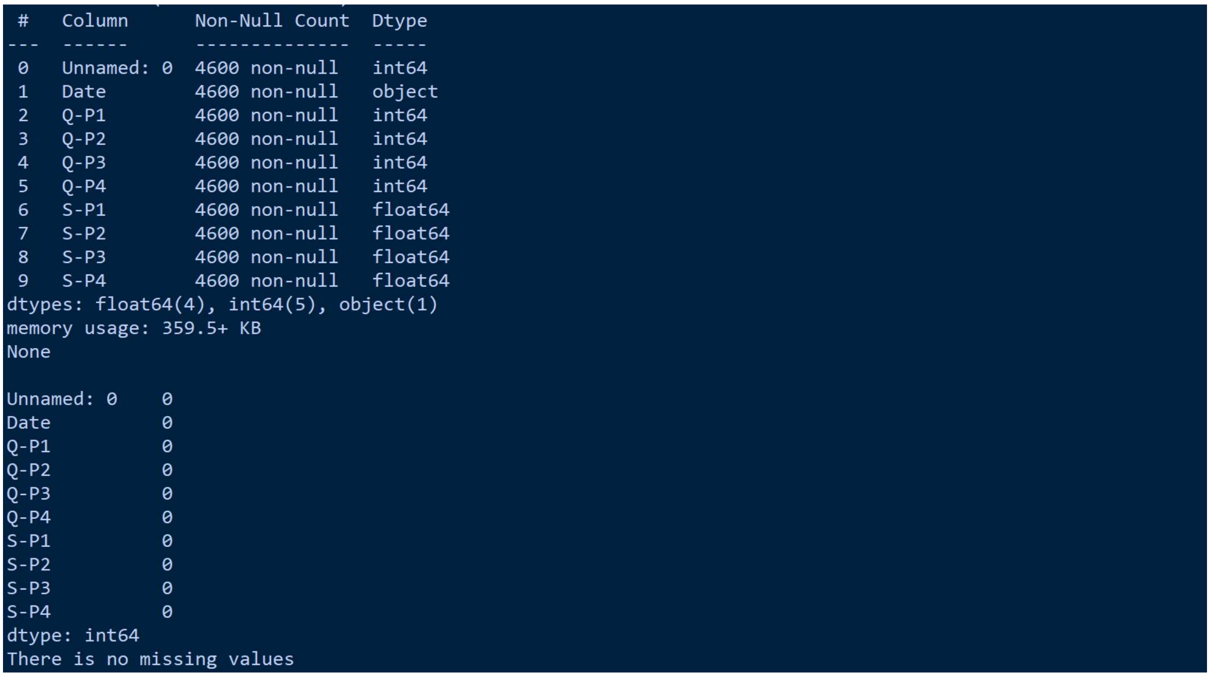
Data Reduction

Rows corresponding to the years 2010 and 2023 were removed due to insufficient data. Additionally, incorrect dates such as '31-9-20XX' and '31-11-20XX' were identified and removed.

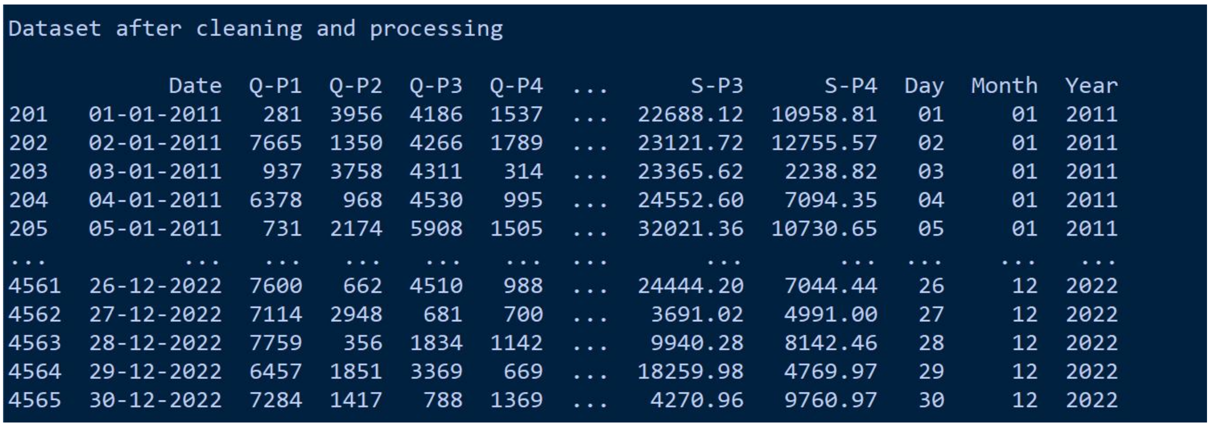
Coding part:

```
# Data Reduction

data_reduced = data.query("Year != '2010' and Year != '2023'")

remove_date = []

for i in range(11, 23):

 remove_date.append('31-9-20' + str(i))

remove_date.append('31-11-20' + str(i))

data_reduced =
data_reduced[~data_reduced['Date'].isin(remove_date)]
```

Outputs of the above code snippet:-



```
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   Unnamed: 0  4600 non-null   int64
 1   Date        4600 non-null   object
 2   Q-P1        4600 non-null   int64
 3   Q-P2        4600 non-null   int64
 4   Q-P3        4600 non-null   int64
 5   Q-P4        4600 non-null   int64
 6   S-P1        4600 non-null   float64
 7   S-P2        4600 non-null   float64
 8   S-P3        4600 non-null   float64
 9   S-P4        4600 non-null   float64
dtypes: float64(4), int64(5), object(1)
memory usage: 359.5+ KB
None

Unnamed: 0    0
Date          0
Q-P1          0
Q-P2          0
Q-P3          0
Q-P4          0
S-P1          0
S-P2          0
S-P3          0
S-P4          0
dtype: int64
There is no missing values
```



```
Dataset after cleaning and processing

            Date  Q-P1  Q-P2  Q-P3  Q-P4  ...       S-P3      S-P4  Day  Month  Year
201   01-01-2011   281  3956  4186  1537  ...   22688.12  10958.81   01     01  2011
202   02-01-2011  7665  1350  4266  1789  ...   23121.72  12755.57   02     01  2011
203   03-01-2011   937  3758  4311   314  ...   23365.62   2238.82   03     01  2011
204   04-01-2011  6378   968  4530   995  ...   24552.60   7094.35   04     01  2011
205   05-01-2011   731  2174  5908  1505  ...   32021.36  10730.65   05     01  2011
...          ...   ...   ...   ...   ...  ...        ...       ...  ...    ...   ...
4561  26-12-2022  7600   662  4510   988  ...   24444.20   7044.44   26     12  2022
4562  27-12-2022  7114  2948   681   700  ...    3691.02   4991.00   27     12  2022
4563  28-12-2022  7759   356  1834  1142  ...    9940.28   8142.46   28     12  2022
4564  29-12-2022  6457  1851  3369   669  ...   18259.98   4769.97   29     12  2022
4565  30-12-2022  7284  1417   788  1369  ...    4270.96   9760.97   30     12  2022
```

Plot function

Coding Part:

```
def plot_bar_chart(df, columns, stri, str1, val):

# Aggregate sales for each product by year, by sum or mean

if val == 'sum':

        sales_by_year = df.groupby('Year')[columns].sum().reset_index()

        elif val == 'mean':

         sales_by_year =
        df.groupby('Year')[columns].mean().reset_index()


           # Melt the data to make it easier to plot

           sales_by_year_melted = pd.melt(sales_by_year,
        id_vars='Year', value_vars=columns, var_name='Product',
        value_name='Sales')


           # Create a bar chart

           plt.figure(figsize=(20,4))
```

```
    sns.barplot(data=sales_by_year_melted, x='Year', y='Sales',
hue='Product') #,palette="cividis")
    plt.xlabel('Year')
    plt.ylabel(stri)
    plt.title(f'{stri} by {str1}')
    plt.xticks(rotation=45)
    plt.show()
```

Data Analysis:

Total Unit Sales by Year

The bar chart below displays the total unit sales for four products (Q-P1, Q-P2, Q-P3, Q-P4) by year.

Coding part:

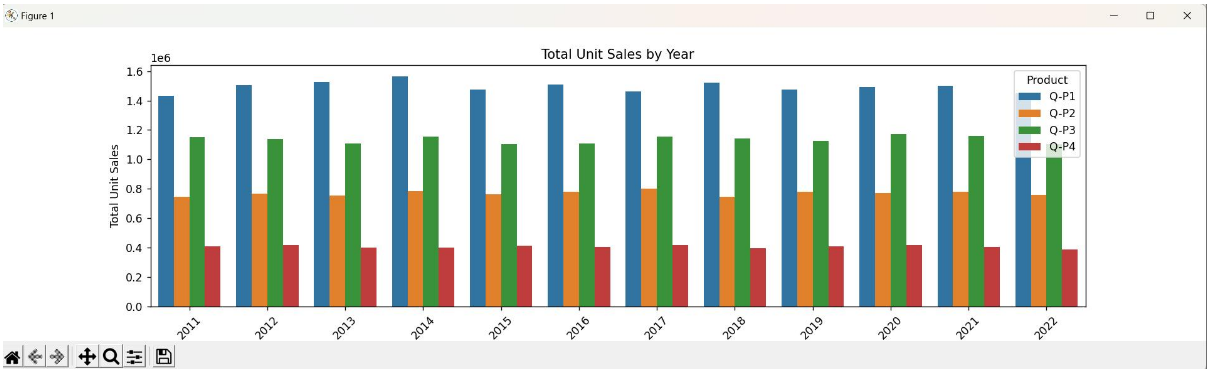
```
 plot_bar_chart(data_reduced, ['Q-P1', 'Q-P2', 'Q-P3', 'Q-P4'],'Total Unit Sales',
'Year', 'sum')
```

Insights:

Total unit sales have been relatively consistent from 2011 to 2022.

Product Q-P2 consistently leads in total unit sales.

Output:



Mean Unit Sales by Year

The bar chart below shows the mean unit sales for the same four products by year.

Coding part:

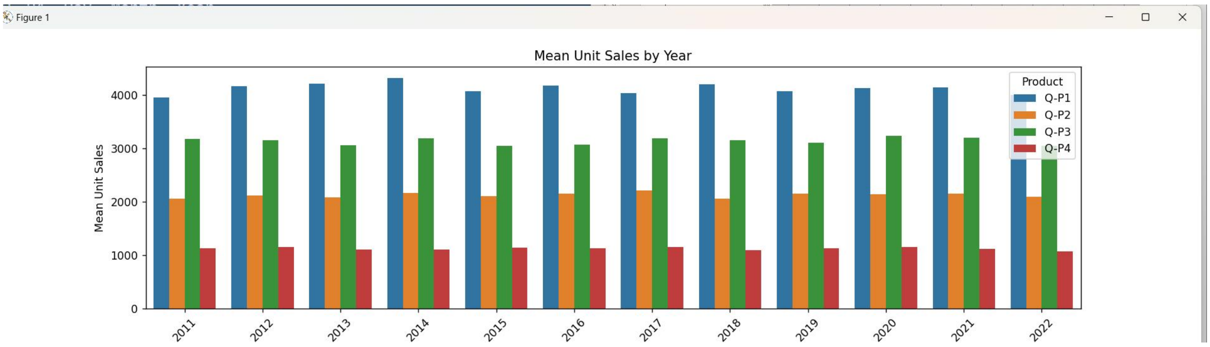
```
plot_bar_chart(data_reduced, ['Q-P1', 'Q-P2', 'Q-P3', 'Q-P4'],'Mean Unit Sales', 'Year', 'mean')
```

Insights:

The mean unit sales for all products show a gradual increase over the years.

Product Q-P4 has the highest mean unit sales in recent years.

Output:



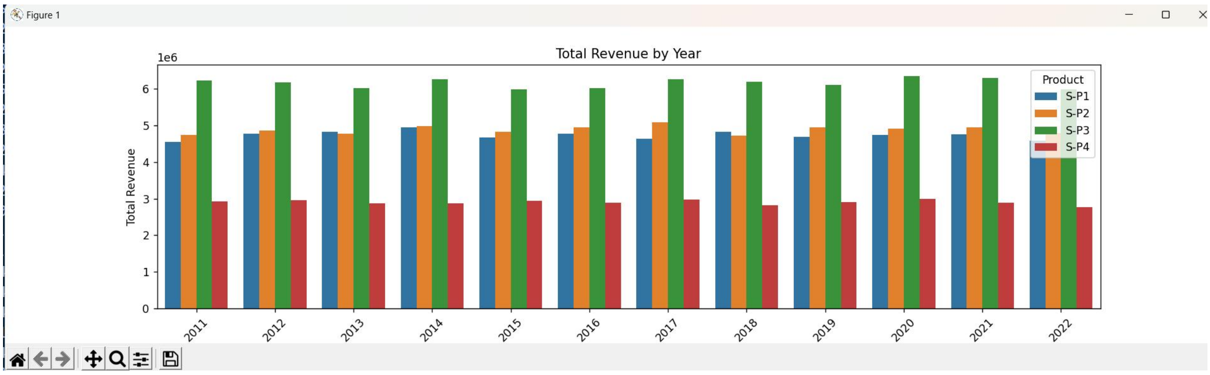
Total Revenue by Year

This bar chart illustrates the total revenue for four products (S-P1, S-P2, S-P3, S-P4) by year

Coding part:

```
plot_bar_chart(data_reduced, ['S-P1', 'S-P2', 'S-P3', 'S-P4'], 'Total Revenue', 'Year', 'sum')
```

Output:



Mean Revenue by Year

The following bar chart represents the mean revenue for the same four products by year.

Coding part:

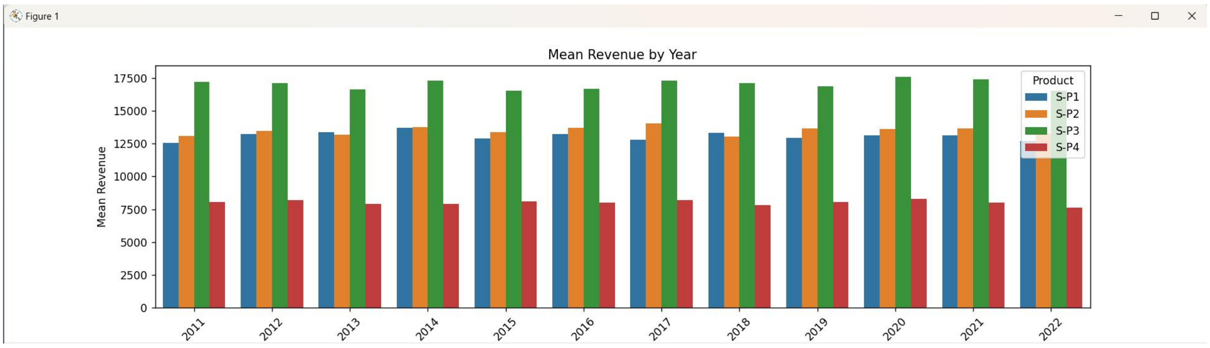
```
plot_bar_chart(data_reduced, ['S-P1', 'S-P2', 'S-P3', 'S-P4'], 'Mean Revenue', 'Year', 'mean')
```

Insights:

The mean revenue for all products increases gradually over the years.

Product S-P2 shows the highest mean revenue.

Output:



Conclusion

The data cleaning and analysis of the dataset from "statsfinal.csv" have provided valuable insights into unit sales and revenue trends over the years. The dataset is now well-prepared for further in-depth analysis or machine learning tasks.