Inventory Management System

Grp_A's Final Project

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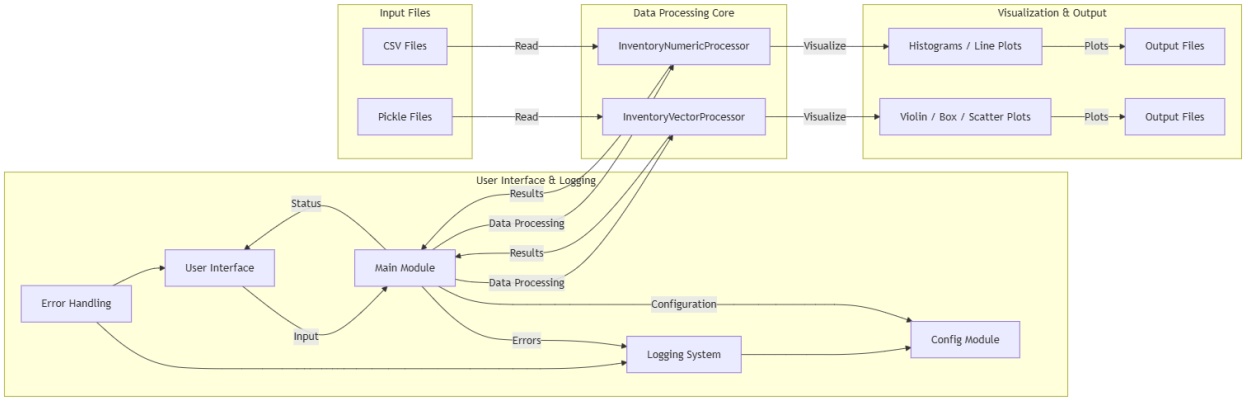
https://github.com/taylfrad/CMPS3400_Grp_A

Project Goal

The goal of this project is to design and implement a comprehensive Inventory Management System capable of processing both numeric and vector-based data. The system emphasizes robust data analysis, intuitive visualizations, and a user-friendly command-line interface. Built using modular and object-oriented design, it supports advanced statistical operations, vector calculations, and multiple input/output formats. Key technical priorities include code quality, performance optimization, and extensibility for future enhancements. This project also aims to strengthen skills in data science, software engineering, and project management while ensuring a polished, functional, and user-centered final product.

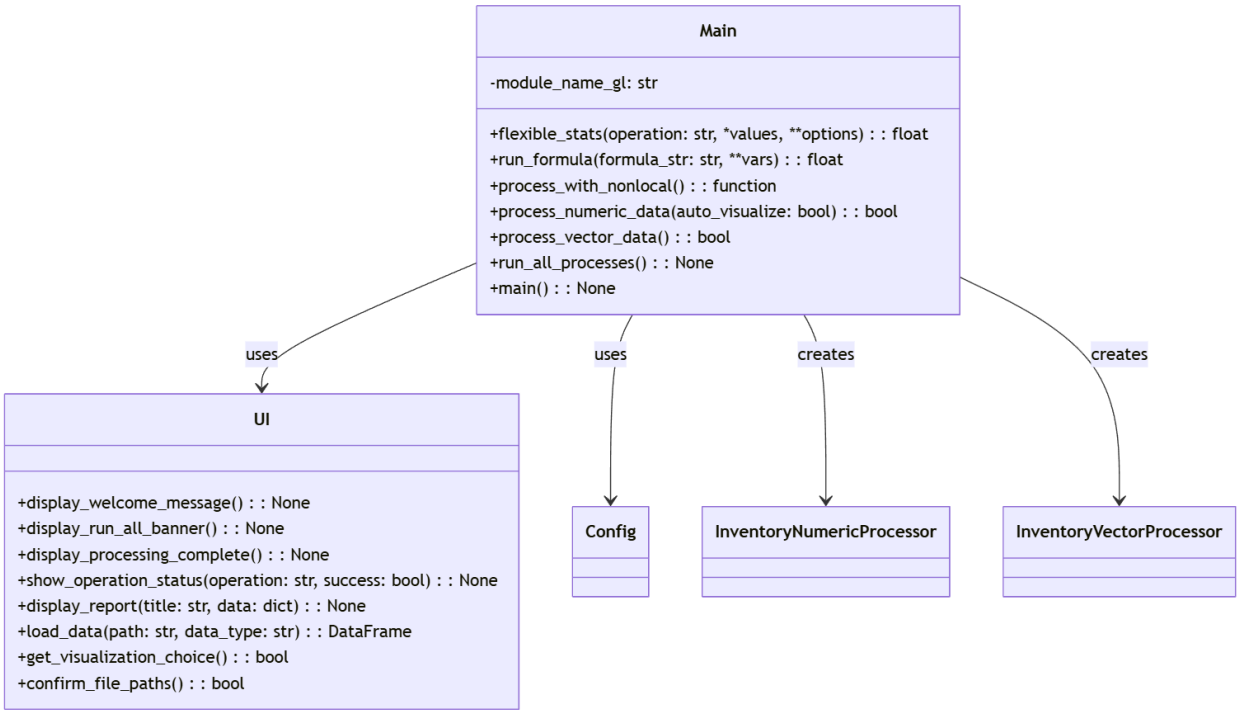
- **Primary Objectives**
- **Data Processing & Analysis**
    - Implement a robust framework for processing large-scale inventory data in both numeric and vector formats.
    - Utilize efficient data structures and algorithms for optimized performance.
    - Provide comprehensive statistical tools and support for advanced vector operations.
- **Visualization & Reporting**
    - Deliver intuitive, clear visual representations using various plot types (e.g., histograms, line plots, violin plots, scatter plots).
    - Generate detailed, well-formatted reports with support for exporting results in multiple formats (CSV, TXT, image files).
    - Ensure visualizations and outputs are both informative and user-friendly.
- **User Experience**
    - Build a clean, responsive command-line interface with clear navigation.
    - Implement informative error messages and real-time status updates.
    - Maintain seamless integration between modules for consistent data flow and operation.

Module Communication Flow Diagram

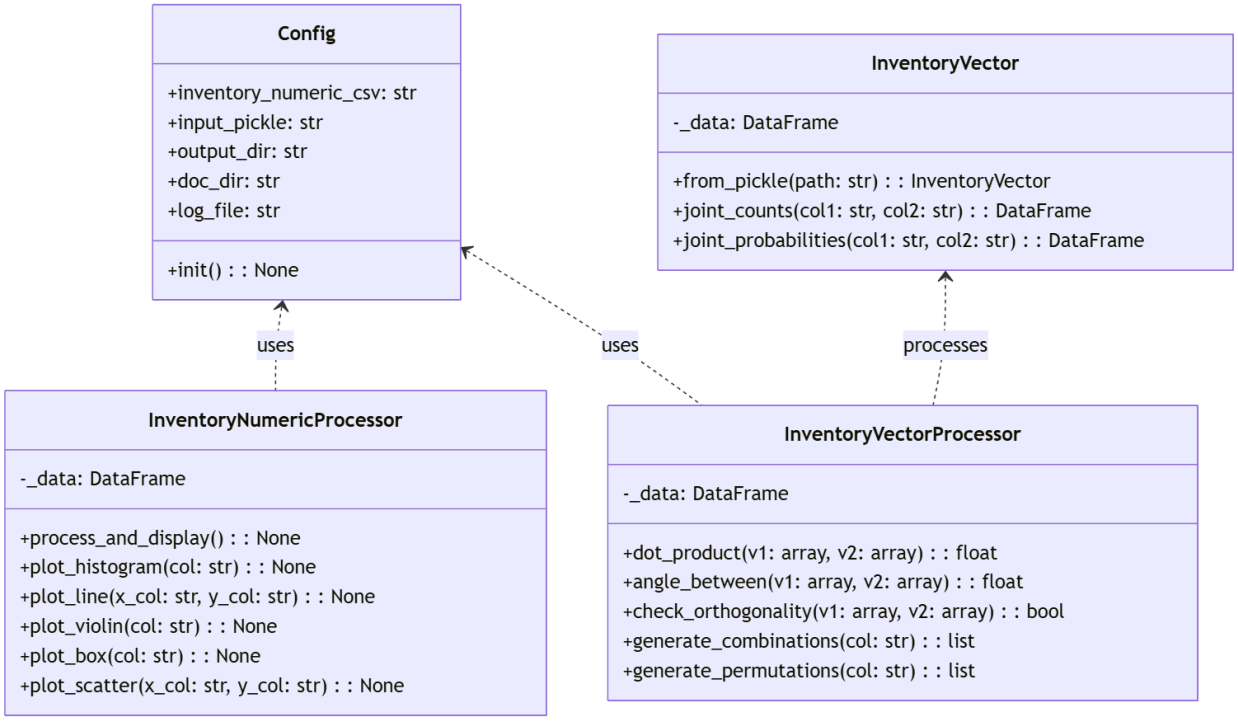


Class Diagrams

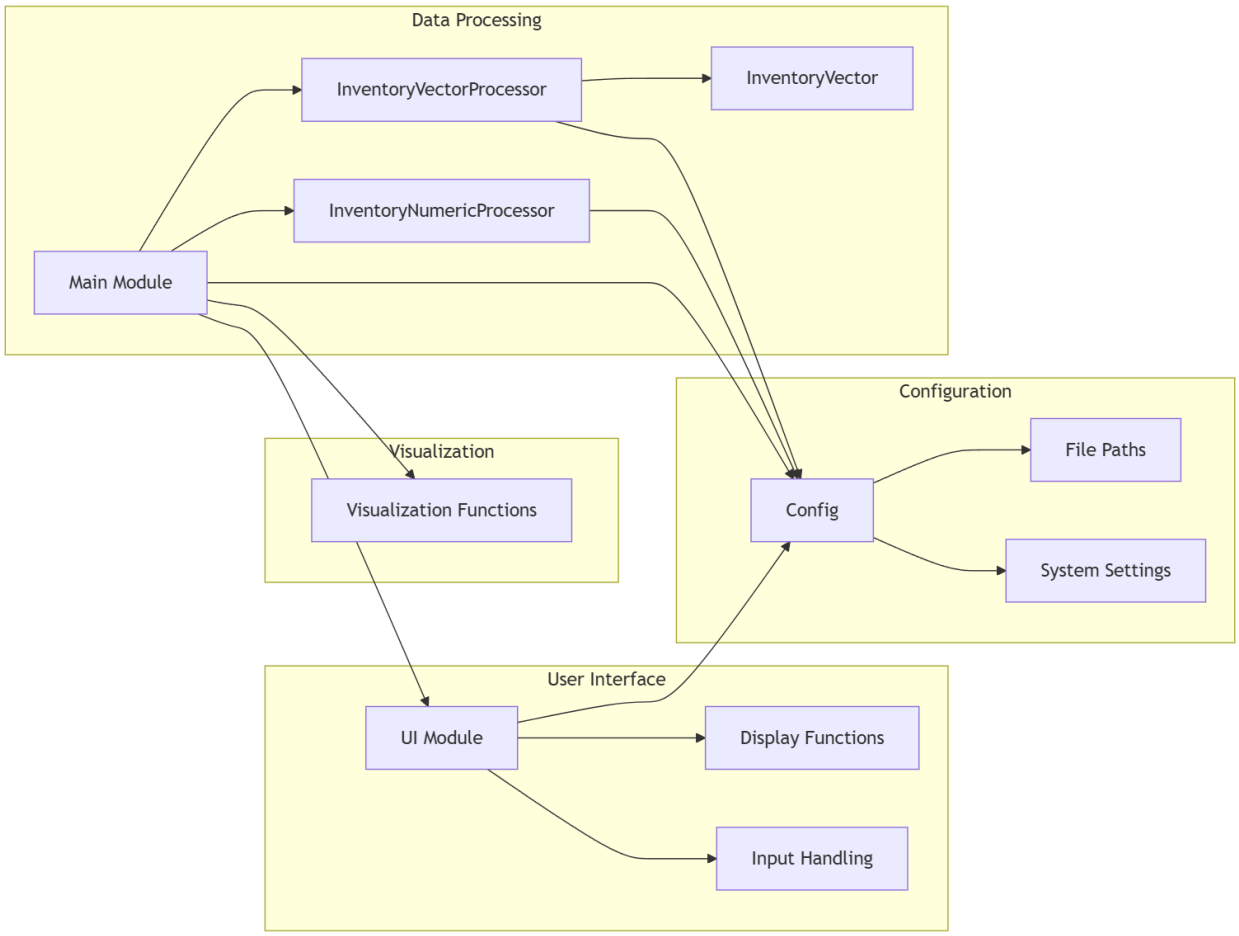
Main Execution and User Interface Workflow:



Inventory Data Processing Architecture: Core Components



System Architecture Overview: Class Relationships and Dependencies



Project Manual

Input Data Format

The system accepts two types of input files located in the `Input/` directory:

1. Numerical Inventory Data (`sample_data.csv`)

- **Format**: Comma-Separated Values (.csv)
- **Required Columns**:
    - `ProductID` (int): Unique identifier for the item
    - `Price` (float): Price of each item
    - `Stock` (int): Current quantity in stock
    - `ReorderLevel` (int): Threshold to determine if an item is below reorder level

Example:

```
Unset
ProductID,Price,Stock,ReorderLevel
101,12.99,32,49
102,19.99,78,50
...
```

2. Vector/Probability Data (`vector_data.pkl`)

- **Format**: Pickle (.pkl)
- **Contents**: A serialized Pandas DataFrame containing:
    - Categorical attributes (e.g., `Category`, `Region`)
    - Numeric vectors (e.g., feature embeddings, coordinate vectors)

Output Data Format

All output is saved in the `Output/` directory and includes:

1. Reports (.csv)

- Results from numerical analysis and probability computations
- Common file names include:
    - `numeric_report.csv`
    - `probability_table.csv`
    - `vector_results.csv`

2. Visualizations (.jpg)

- All graphs and plots are saved as high-quality `.jpg` files
- Naming format:
    - `plot_histogram_Price.jpg`
    - `plot_violin_Stock.jpg`
    - `plot_scatter_VectorA_vs_VectorB.jpg`

User Manual

To run the program:

1. **Open a terminal or command prompt**
2. Navigate to the project folder

3. Run the main program:

```python
python main.py
```

Main Menu Options:

- 1 – Process Numerical Data
- 2 – Process Vector Data
- 3 – Run All
- 4 – Exit

What it does:

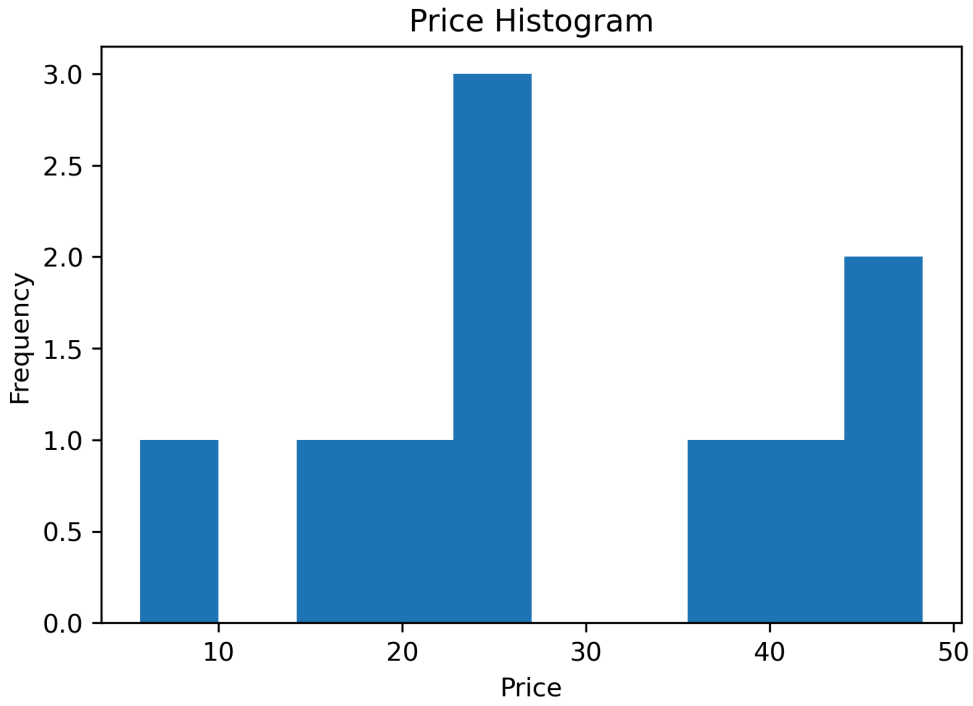
- Prompts for visualization export (Y/N)
- Summarizes statistics in terminal
- Generates and saves plots and reports to `Output/`
- Logs errors and operations to `Output/logfile.txt`

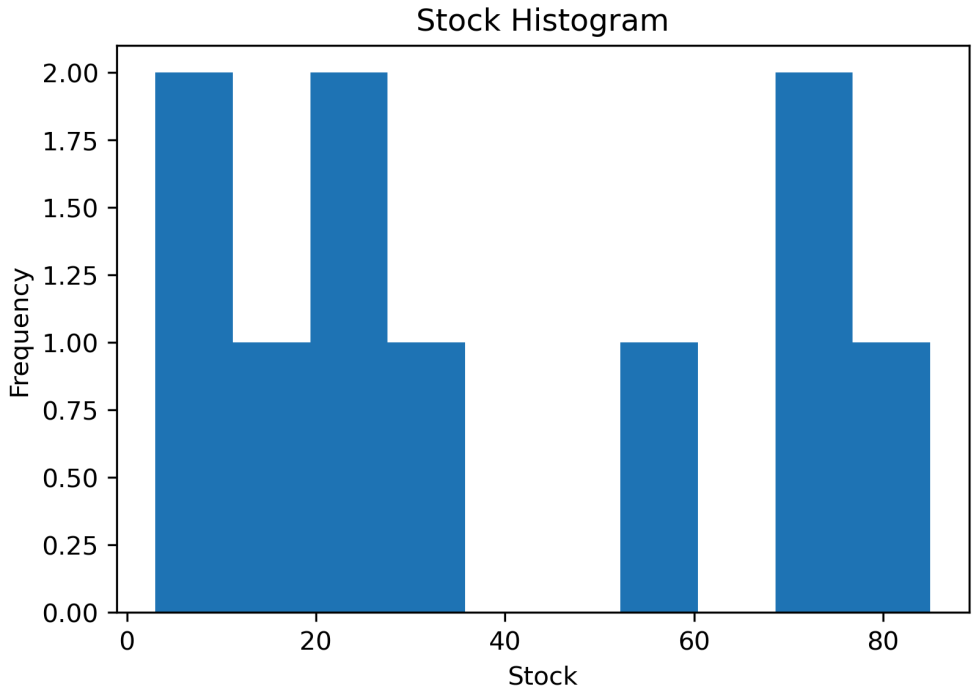
Sample Output:

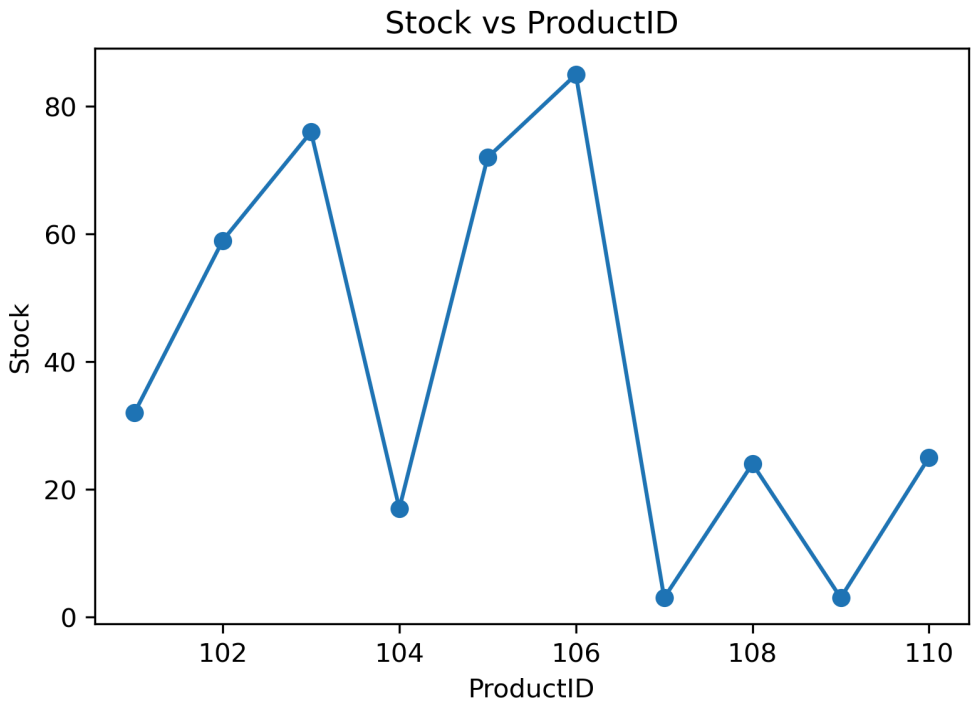
```
------------------------------------------------------------
             NUMERICAL INVENTORY REPORT
------------------------------------------------------------
Total Stock: 396
```

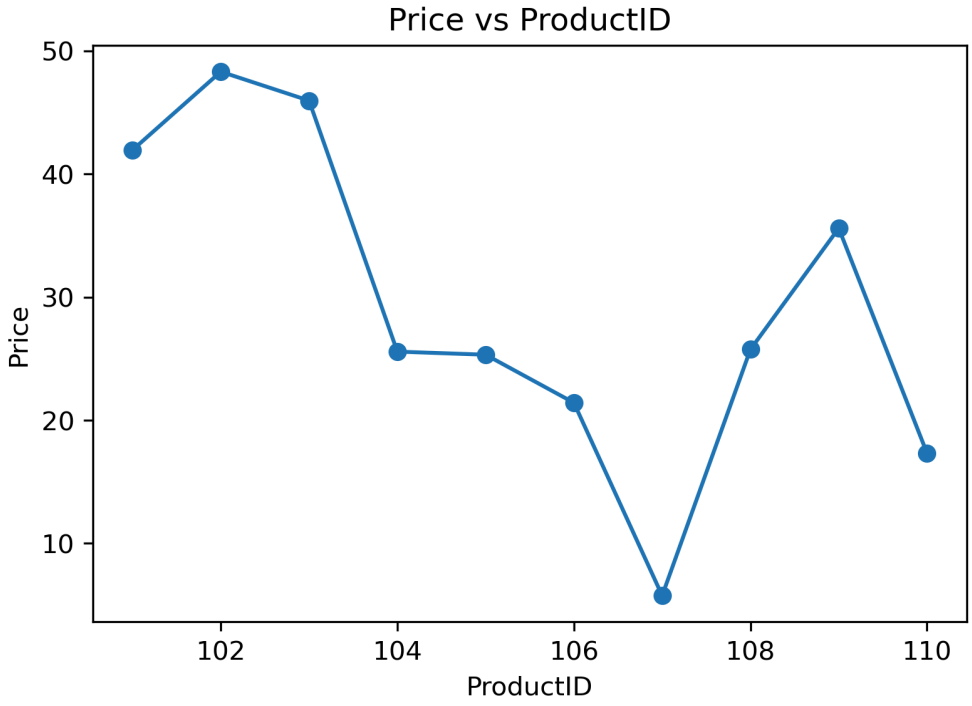
```
Average Price: 29.29
Items Below Reorder: 6
...
```

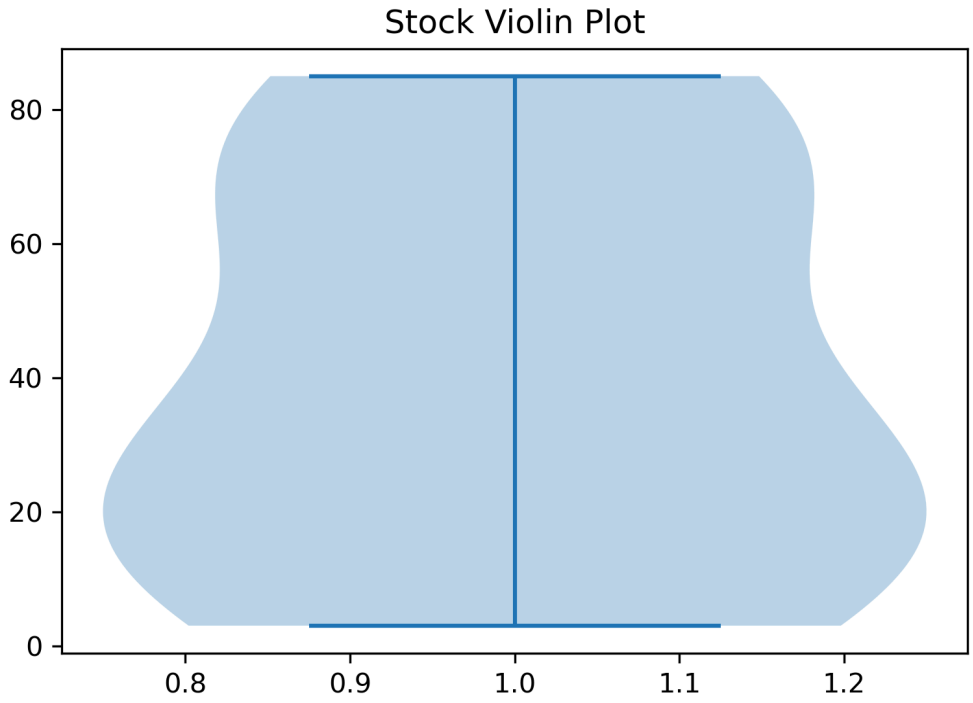
Plots

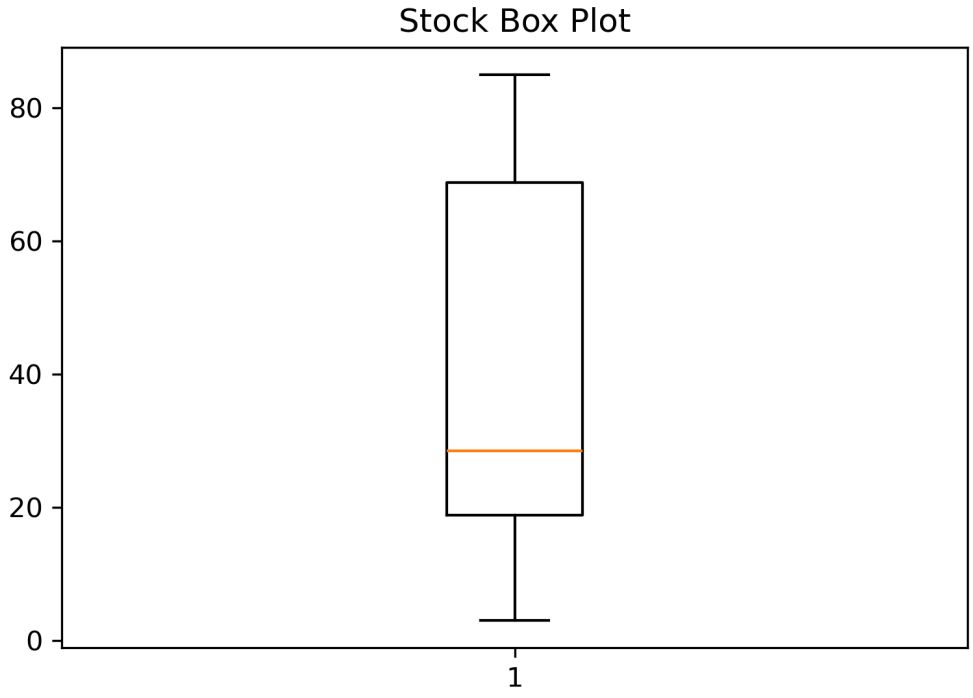

Price Histogram
Frequency
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10
20
30
40
50
Price

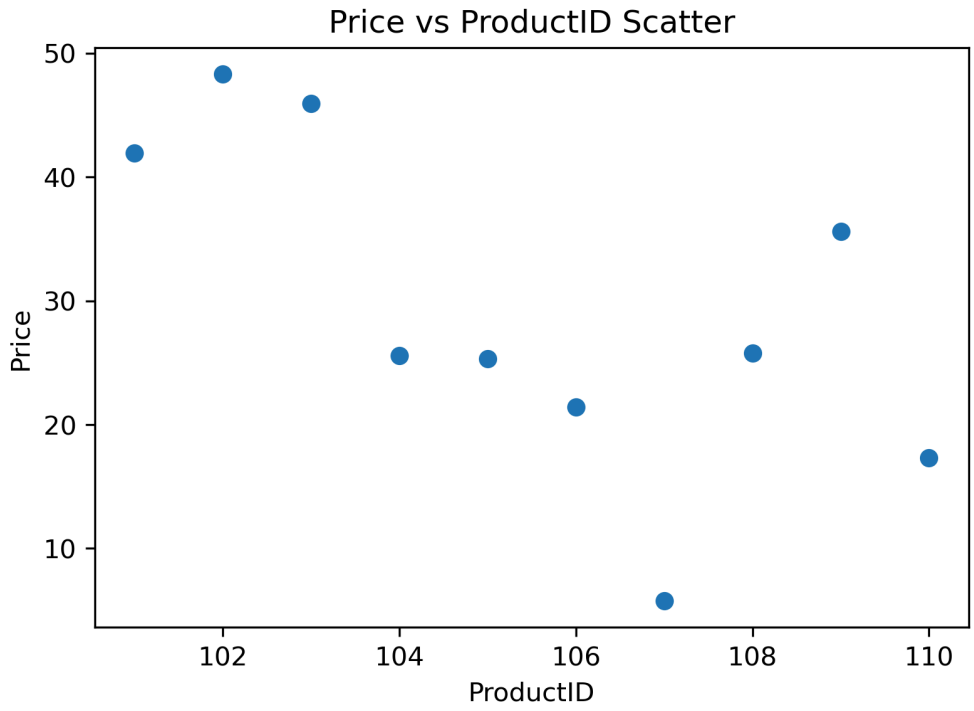

Stock Histogram
Frequency
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
20
40
60
80
Stock


Stock vs ProductID
Stock
ProductID
0
20
40
60
80
102
104
106
108
110


Price vs ProductID
Price
ProductID
10
20
30
40
50
102
104
106
108
110


Stock Violin Plot
80
60
40
20
0
0.8
0.9
1.0
1.1
1.2


Stock Box Plot
80
60
40
20
0
1


Price vs ProductID Scatter
50
40
30
20
10
Price
102
104
106
108
110
ProductID