

## Code Overview

1. **Data Loading and Preparation:** The code loads the Superstore Sales Dataset, converts the Order Date to a datetime format, and sets it as the index. This prepares the data for time series analysis.
2. **Sub-category Analysis:** It loops through each unique sub-category to analyze sales trends individually, allowing for a granular view of sales patterns by product type.
3. **Time Series Decomposition:** For each sub-category, the code performs seasonal decomposition, splitting monthly sales into:
  - **Seasonal Component:** Shows regular, repeating patterns or expected fluctuations across months.
  - **Residual Component:** Indicates deviations from expected sales trends, helping detect anomalies.
4. **Moving Average:** The code adds a moving average as a benchmark to smooth fluctuations and highlight overall trends in sales, providing a comparison baseline for seasonal and residual components.
5. **Visualization:** Each sub-category's seasonal, residual, and moving average values are plotted on a chart, offering a visual analysis of trends, deviations, and benchmarks across time.
6. **Data Comparison:** The code prints out the values for seasonal, residual, and moving average components for each month. This allows for direct comparison and helps identify where sales meet, exceed, or fall short of expected benchmarks.

## Insights Provided

1. **Sales Benchmarking:** By comparing actual sales against the moving average and seasonal expectations, the code shows if monthly sales meet, exceed, or fall short of expectations.
2. **Anomaly Detection:** Large deviations in the residual component highlight anomalies—months where sales are unexpectedly high or low. This insight helps pinpoint months for further investigation, such as unplanned factors or operational issues.
3. **Seasonal Trends:** Seasonal components indicate regular peaks or troughs across months, showing when sales typically increase or decrease. This insight helps businesses plan inventory, marketing, and staffing needs accordingly.

4. **Performance Analysis:** By comparing residual and seasonal trends, the business can evaluate its performance against expected benchmarks, especially during high-sales months, to assess if sales goals are being met.

This code equips the business with a clear view of monthly sales trends, helping them make data-driven decisions to optimize sales strategies, resource allocation, and performance evaluation.