**1. Execution Instructions**

* Install dependencies:

```pip install pandas numpy fredapi```

* Open the Jupyter notebook and run all cells.
* To refresh data any time, re-run the last cell calling refresh\_and\_merge().

**2. Project Overview**

* **Synthetic Sales Data**: Generates 52 weeks of synthetic sales for 50 products with seasonality and discounts.
* **Economic Data**: FRED API Integration
  + fredapi client: Fetch GASREGW (weekly gas prices) and CPIAUCSL (monthly CPI) series.
  + Resampling: Convert both to weekly (Sunday) bins: mean for gas, forward fill for CPI.
* **Merge**: Joins sales and economic tables on week start date.
* **Checks**: Validates missing values, sales outliers, and merge alignment.
* **Alerts**: Logs errors.
* **Output**: Save merged DataFrame to CSV: merged\_data.csv

**3. Assumptions**

* Data covers one calendar year (52 weeks).
* Region is fixed to "USA".
* Seasonality modelled by simple sine wave (±30%).
* Discount Distribution - 70 % full‑price weeks, 20 % at 10 %, 10 % at 20 %
* CPI forward‑filled to weekly values.