

# Inventory Analytics & Forecasting Report

## 1. Project Overview

This report summarizes the end-to-end processing of sales, purchases, inventory, SKU classification, EOQ computation, reorder points, forecasting using ARIMA, and automated inventory alerts.

## 2. Data Sources

- SalesFINAL12312016.csv (1,048,575 rows)
- PurchasesFINAL12312016.csv (2,372,474 rows)
- 2017PurchasePricesDec.csv (12,261 rows)
- BegInvFINAL12312016.csv (206,529 rows)
- EndInvFINAL12312016.csv (224,489 rows)
- InvoicePurchases12312016.csv (5,543 rows)

## 3. Data Cleaning & Enrichment

- Standardized date fields and validated ranges (Jan–Feb 2016)
- Added derived columns such as revenue, avg\_price, and daily aggregates
- Extracted 7,658 unique SKUs and 79 stores
- Saved key intermediate outputs (monthly revenue, SKU aggregates)

## 4. ABC Classification

SKUs were ranked by cumulative revenue contribution:

- Class A: Top ~10% SKUs contributing ~70–80% of revenue
- Class B: Next ~20% contributing ~15–20%
- Class C: Remaining long-tail SKUs

This classification guides forecasting priority and stock policy.

## 5. EOQ (Economic Order Quantity)

EOQ was calculated using:

$$EOQ = \sqrt{(2 * D * S) / H}$$

Where:

- D = Annual demand units
- S = Ordering cost (assumed 200)
- H = Holding cost (20% of unit cost)

EOQ helps reduce total logistics cost by balancing order frequency and carrying cost.

## 6. Reorder Point (ROP)

$$ROP = (avg\_daily\_demand * lead\_time\_days) + safety\_stock$$

$$Safety\ Stock = z * std\_daily\_demand * \sqrt{lead\_time\_days}$$

Lead time defaulted to 7 days due to incomplete PO fields.

## 7. Forecasting Using ARIMA

ARIMA was selected instead of Prophet due to:

- Data covers only 2 months ( $\approx 60$  days) which is too short for Prophet's seasonal components.
- ARIMA performs better with short, non-seasonal, high volatility retail demand.
- Prophet requires stable yearly and weekly seasonality patterns; those were absent.
- ARIMA (p,d,q) was auto-selected via AIC minimization and produced stable forecasts for top 50 SKUs.

## 8. Forecast Output

SKU-level forecasts were generated and saved as:

- sku\_forecasts\_arima.csv

Simulation example for SKU 4261:

- Stockouts = 0
- Average inventory = 10,895 units

## 9. Inventory Alerts

Generated alerts for SKUs where  $\text{on\_hand} < \text{ROP}$ .

- alerts\_below\_rop.csv (193,111 rows)

These alerts can integrate into dashboards or automated notifications for procurement.

## 10. Summary

The pipeline successfully:

- Cleaned and integrated multi-source data
- Classified SKUs using ABC analysis
- Computed EOQ and reorder points
- Generated SKU-level ARIMA forecasts
- Produced inventory risk alerts
- Exported all results to /content/outputs

The system is designed to scale into production as a modular inventory intelligence engine.