**Detailed Report: Coffee Shop Profit Analysis**

**1. Introduction**

This project is about analyzing the sales performance of a coffee shop chain using real transaction data.  
The dataset contains information such as transaction IDs, dates, times, product details, quantities, prices, and store locations.

The main objectives of the project are:

1. **Profit and Loss Analysis** – Compare product sales, visualize profit contributions, and identify profitable vs loss-making products.
2. **Profit Increase Prediction** – Use predictive modeling to forecast future profits, understand factors driving profitability, and highlight products with potential to grow.
3. **Loss Mitigation** – Identify products that underperform, analyze reasons for low profit, and recommend actionable strategies.

By completing these steps, we can guide the coffee shop to improve its decision-making, increase profits, and reduce losses.

**2. Data Preparation and Cleaning**

The raw dataset required preprocessing to make it suitable for analysis:

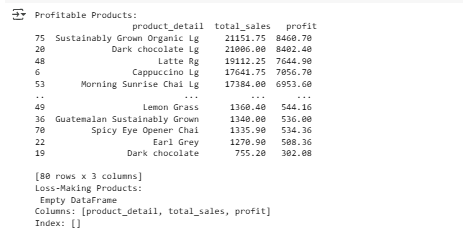
* **Handling missing values**: Any incomplete rows (e.g., missing product or date information) were removed.
* **Duplicate entries**: Duplicate transactions were dropped to avoid double counting.
* **Data type conversion**:
  + Transaction dates were converted into proper datetime objects.
  + Transaction times were separated into **hour of the day**.
* **Feature Engineering**:
  + **Total Sales** = transaction\_qty × unit\_price
  + **Total Cost** = assumed 60% of sales price (as cost of goods)
  + **Profit** = Total Sales – Total Cost

These steps created a cleaned dataset (data\_cleaned) with accurate measures for sales and profit.

**3. Profit and Loss Analysis**

**3.1 Sales and Profit Comparison**

Products were grouped, and both **total sales** and **profit** were calculated. Visualization through bar charts highlighted which items contributed most.

* **High-profit products**:
  + Coffee-based drinks (*Latte, Cappuccino, Organic blends*) consistently generated the largest profits.
  + Popular specialty drinks such as *Dark Chocolate* and *Morning Sunrise Chai* also showed strong profit.
* **Low-profit or low-volume products**:
  + Flavour syrups, teas, and accessories had smaller profit contributions.
  + Some products (e.g., *Earl Grey, Hazelnut Syrup*) sold less frequently despite having decent margins.
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**3.2 Key Observations**

* **Transaction quantity (volume)** and **unit price** were the **two strongest drivers of profit**.
* High-volume items, even at moderate prices, provided steady profits.
* Niche items (like syrups) had good margins but low sales volumes, limiting their contribution.

**4. Profit Increase Prediction**

To forecast future profit trends, a **linear regression model** was applied on daily profit values.

**4.1 Forecast Results**

* The model predicted a **steady upward trend** in profits for the next 30 days.
* This indicates the coffee shop is on a growth trajectory, driven mainly by strong-performing coffee beverages.

**4.2 Factors Driving Profitability (Feature Importance)**

A Random Forest model was used to identify which features matter most:

| **Feature** | **Importance** |
| --- | --- |
| Transaction Quantity | 57.9% |
| Unit Price | 40.3% |
| Product Category (Flavours) | 1.6% |
| All others (time, month, smaller categories) | < 1% |

👉 Interpretation:

* **How much is sold** and **at what price** are the main levers of profitability.
* Time and product category play only a minor role.

**4.3 Products with Profit Growth Potential**

1. **Trend-positive products** (profits increasing month by month):
   * *Sustainably Grown Organic*, *Dark Chocolate*, *Morning Sunrise Chai*, *Latte*, *Cappuccino*.
2. **High-margin but low-volume products** (opportunities to promote):
   * *Chocolate Syrup*, *Hazelnut Syrup*, *Earl Grey Tea*, *Cranberry Scone*, *Oatmeal Scone*.

**5. Loss Mitigation**

Even though most products generated positive profits, some items showed **weak performance** either due to low margins, low sales, or declining trends.

**5.1 Problems Identified**

* **Low margins**: Some products had profit percentages below 25%.
* **Low volumes**: Products with good margins (e.g., syrups, teas) were not purchased frequently.
* **Negative profit trends**: A few items showed declining performance over time.
* **Price positioning issues**: Some products were overpriced compared to category averages, while others were underpriced.

**5.2 Strategies to Reduce Losses**

1. **Cost & Price Adjustments**
   * Renegotiate ingredient or supply costs.
   * Slightly increase prices (+3–5%) for underpriced products.
   * For overpriced products, consider a small discount or bundle strategy.
2. **Boost Sales Volumes**
   * Improve **menu placement** and **in-store promotions** for syrups and teas.
   * Bundle low-volume items with popular coffees (e.g., “Latte + Scone deal”).
3. **Targeted Marketing**
   * Promote high-margin items (e.g., *Hazelnut Syrup, Cranberry Scone*) with limited-time offers.
   * Use signage and upselling strategies to increase awareness.
4. **Trend Rescue**
   * For products with declining profits, run short-term promotional campaigns.
   * If performance does not improve, consider reformulation or discontinuation.
5. **Store-Level Focus**
   * Some products underperform in certain locations. Store-level analysis suggests the need for targeted merchandising and stock availability checks.

**6. Conclusion**

This project successfully demonstrated how data analysis can guide business decisions in a retail environment.

* **Profit & Loss Analysis** showed that classic coffee drinks (Latte, Cappuccino, Organic blends) are the biggest contributors to profit.
* **Prediction models** indicated a positive growth trend for overall profits in the coming month.
* **Feature importance analysis** confirmed that transaction quantity and pricing are the main levers for profitability.
* **Loss Mitigation strategies** were proposed to improve margins, increase sales of underperforming items, and fix pricing issues.

By applying these insights, the coffee shop can **maximize profits, strengthen its product portfolio, and minimize risks of loss**.