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Data-Driven Transformation: Optimizing Operations and Customer Engagement at XYZ Café

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Mid-Term Submission for the Project on Business Data Management

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Data-Driven Transformation: Optimizing Operations and Customer Engagement at XYZ Café

Executive Summary

The ABC Café business data management midterm submission involves an in-depth analysis of transactional data from July to October 2023, aiming to enhance operational efficiency and customer engagement. Two primary datasets, \`invoice.csv\` and \`office_sales.csv\`, were meticulously studied to extract key insights.

\`invoice.csv\` comprising 1419 entries revealed transaction details like Transaction Date, Product/Item Name, Quantity, and Total Amount. Notably, the dataset reflected transactional specifics, enlightening the operational aspects vital for strategic enhancements. Meanwhile, \`office_sales.csv\` with 290 entries provided coherent transactional details, offering crucial insights into "to-office-specific" sales dynamics.

Descriptive statistics highlighted numerical and categorical data analyses, uncovering popular product categories, customer types, and prevalent payment methods. Advanced analysis techniques including ARIMA time series forecasting, linear regression, and customer type-based clustering were employed to forecast sales trends, approximate daily sales patterns, and unveil distinct preferences across different customer types.

Key findings emphasized successful sales trend capturing by the ARIMA model, distinct preferences showcased by customer type-based clustering, and the capability of linear regression to portray overall sales trends. The next phase (Final Submission) will delve deeper into daily sales analysis, improved forecasting, and comprehensive customer segmentation, promising heightened efficiency and informed decision-making for sustained growth at the café.

Proof of Originality of the Data

Access the evidence substantiating the originality and authenticity of the datasets utilized for the Business Data Management project can be found in this link:

[Link to the evidence]

Data Source Clarification

invoice.csv: Obtained directly from the café owner, these files comprise raw sales data from the POS system, encapsulating transactional records from July 2023 to October 2023.

office_sales.csv: Generated via Tabula from office sales bills PDFs, delineating sales to various offices within the VTC shopping complex during the same period.

Both datasets originate from ABC Café, with `invoice.csv` directly sourced and `office_sales.csv` extracted meticulously from authentic documents.

Confirmation Documentation and Other Evidence

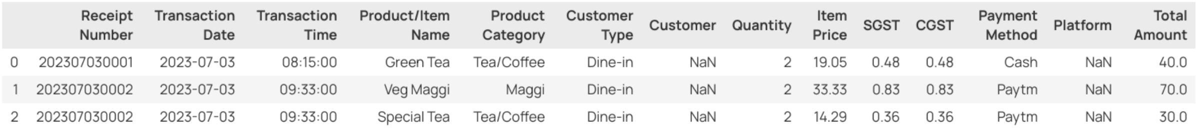
Owner's Declaration: A formal letter from the proprietor asserting cooperation and data provision for this project.

GMeet Recording and Photos of the shop: Supplementary materials encompassing a recorded discussion with [Owner Name], the café owner, along with pictures of the café premises.

Metadata and Descriptive Statistics

Metadata

- **Metadata: *invoice.csv***:



	Receipt Number	Transaction Date	Transaction Time	Product/Item Name	Product Category	Customer Type	Customer	Quantity	Item Price	SGST	CGST	Payment Method	Platform	Total Amount
0	202307030001	2023-07-03	08:15:00	Green Tea	Tea/Coffee	Dine-in	NaN	2	19.05	0.48	0.48	Cash	NaN	40.0
1	202307030002	2023-07-03	09:33:00	Veg Maggi	Maggi	Dine-in	NaN	2	33.33	0.83	0.83	Paytm	NaN	70.0
2	202307030002	2023-07-03	09:33:00	Special Tea	Tea/Coffee	Dine-in	NaN	2	14.29	0.36	0.36	Paytm	NaN	30.0

The dataset `invoice.csv` comprises 1419 entries capturing transactions at ABC Café for the months July 2023 to October 2023. It delineates vital aspects instrumental in optimizing operational efficiency.

1. **Data Composition:**

The dataset encompasses 15 columns revealing transaction details such as *Transaction Date*, *Product/Item Name*, *Quantity*, and *Total Amount*. Notably, the column *Customer* holds null values, as the recording machinery sometimes fails to input this information into the database.

The absence of entries in the *Customer* column signifies transactions where customer identification wasn't recorded, limiting insights into specific consumer behaviour or preferences.

Additionally, the *Platform* column, populated only for transactions categorized under *Online* in *Customer Type*, elucidates the external platforms (*Zomato* or *Swiggy*) through which online orders were placed.

2. **Data Integrity & Anomalies:**

Anomalies in this dataset include null entries in the *Customer* column, affecting the comprehensiveness of customer-centric analysis.

Wide-ranging values in *Quantity* (ranging from 1 to 120) and *Total Amount* (ranging from 10 to 3600) hint at potential outliers or diverse order sizes, warranting further scrutiny for data consistency and outlier detection.

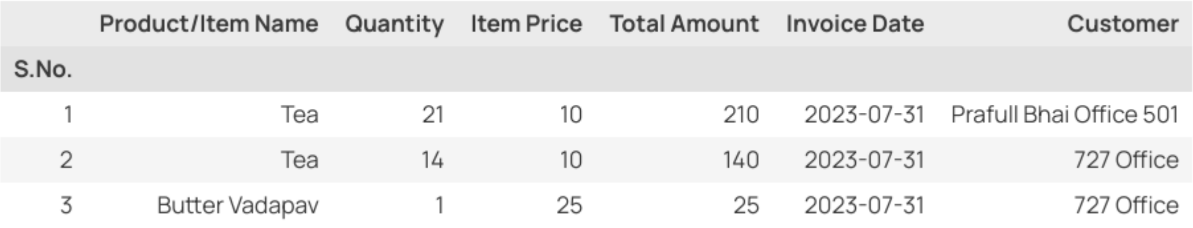
- **Metadata: office_sales.csv**

The *'office_sales.csv'* dataset, comprising 290 entries, portrays sales to office clientele, derived from scanned bills in PDF format using Tabula.

1. **Data Source & Composition:**

This dataset encapsulates key transactional details like *Product/Item Name*, *Quantity*, *Item Price*, and *Total Amount*, crucial for understanding sales dynamics to office customers.

The extraction process from PDF bills via Tabula ensures the representation of sales data from various office transactions, contributing to the understanding of office-specific product preferences and purchase patterns.



	Product/Item Name	Quantity	Item Price	Total Amount	Invoice Date	Customer
S.No.						
1	Tea	21	10	210	2023-07-31	Prafull Bhai Office 501
2	Tea	14	10	140	2023-07-31	727 Office
3	Butter Vadapav	1	25	25	2023-07-31	727 Office

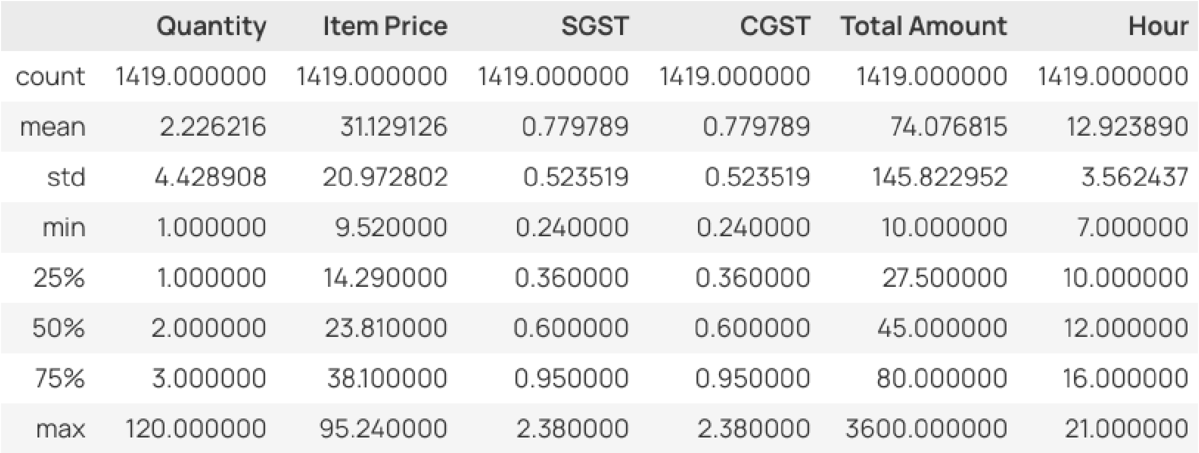
2. **Data Characteristics:**

The dataset exhibits a consistent structure without missing values, ensuring reliability in analysing office sales trends.

Notably, the range in *Quantity* (from 1 to 219) might require outlier identification to maintain dataset consistency and accuracy in subsequent analyses.

Descriptive Statistics

- **Numerical Data Analysis**



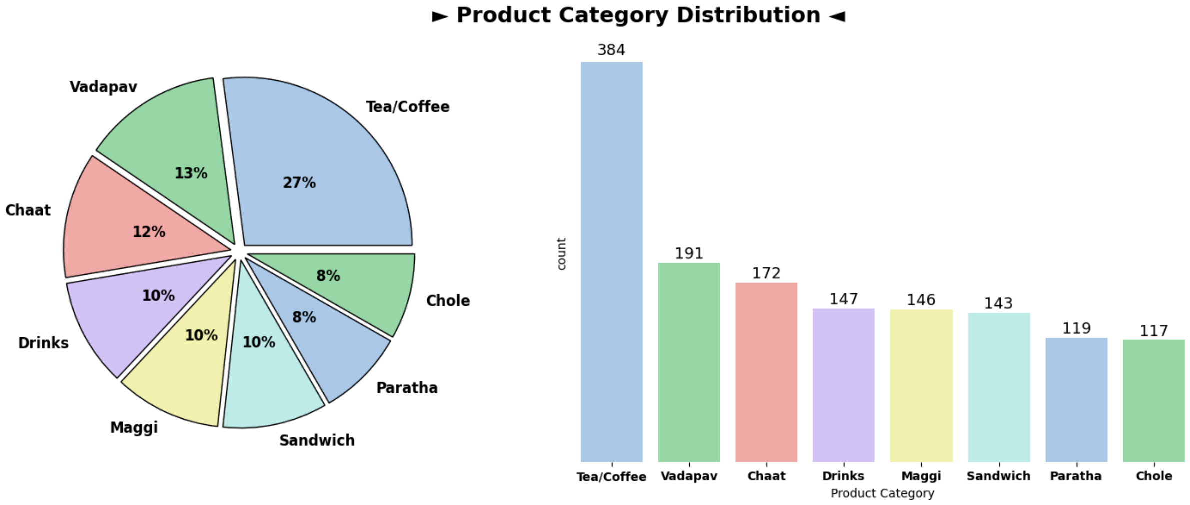
	Quantity	Item Price	SGST	CGST	Total Amount	Hour
count	1419.000000	1419.000000	1419.000000	1419.000000	1419.000000	1419.000000
mean	2.226216	31.129126	0.779789	0.779789	74.076815	12.923890
std	4.428908	20.972802	0.523519	0.523519	145.822952	3.562437
min	1.000000	9.520000	0.240000	0.240000	10.000000	7.000000
25%	1.000000	14.290000	0.360000	0.360000	27.500000	10.000000
50%	2.000000	23.810000	0.600000	0.600000	45.000000	12.000000
75%	3.000000	38.100000	0.950000	0.950000	80.000000	16.000000
max	120.000000	95.240000	2.380000	2.380000	3600.000000	21.000000

Quantity, Item Price, Total Amount: The invoice dataset consists of 1419 entries. The mean quantity sold per transaction is approximately 2.23, with a standard deviation of around 4.43. The mean item price is approximately Rs. 31.13, ranging from Rs. 9.52 to

Rs. 95.24. The mean total amount per transaction is about Rs. 74.08, with a considerable range from Rs. 10 to Rs. 3600.

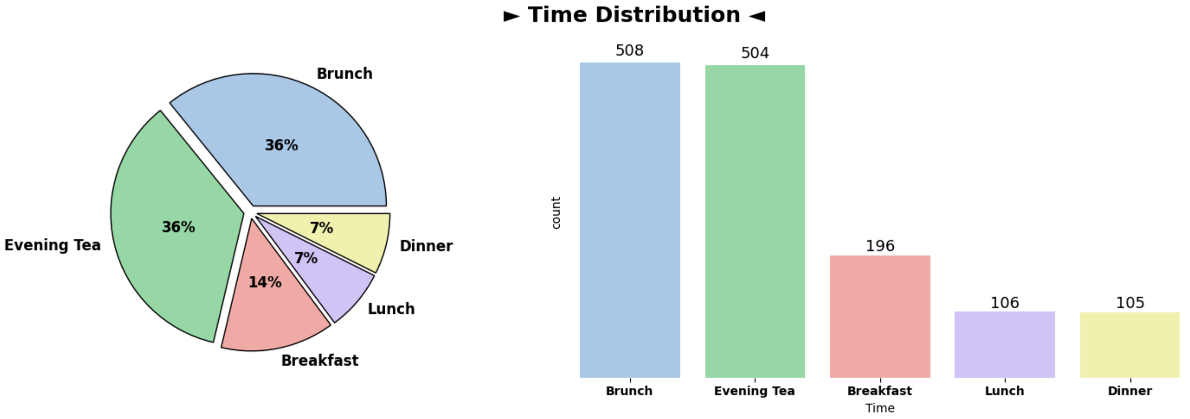
Significance of Statistics: The statistical measures, including mean, median, and range, unveil insights crucial for operational decisions. They reveal sales' typical volume, pricing distribution, and transaction sizes, aiding precise inventory management, pricing strategies, and identification of influential outlier transactions impacting overall revenue.

- **Categorical Data Analysis**

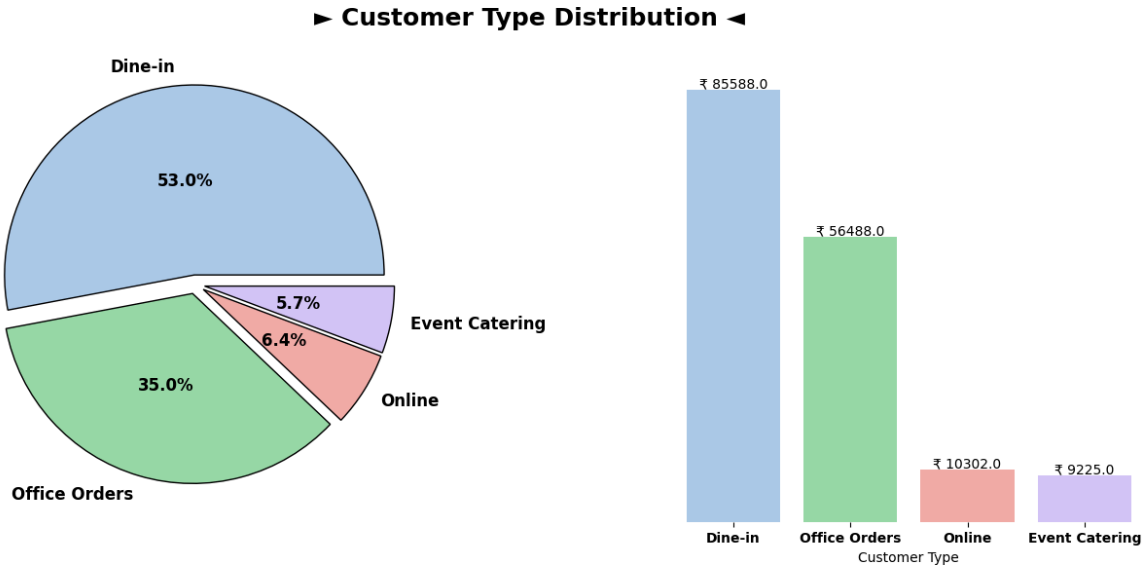


Product Category: Tea/Coffee, Vadapav, and Chaat appear to be popular categories, indicating potential high-demand items.

Time Distribution: Most transactions occur during Brunch and Evening Tea Time, with a relatively smaller proportion taking place during Breakfast, Lunch, and Dinner.



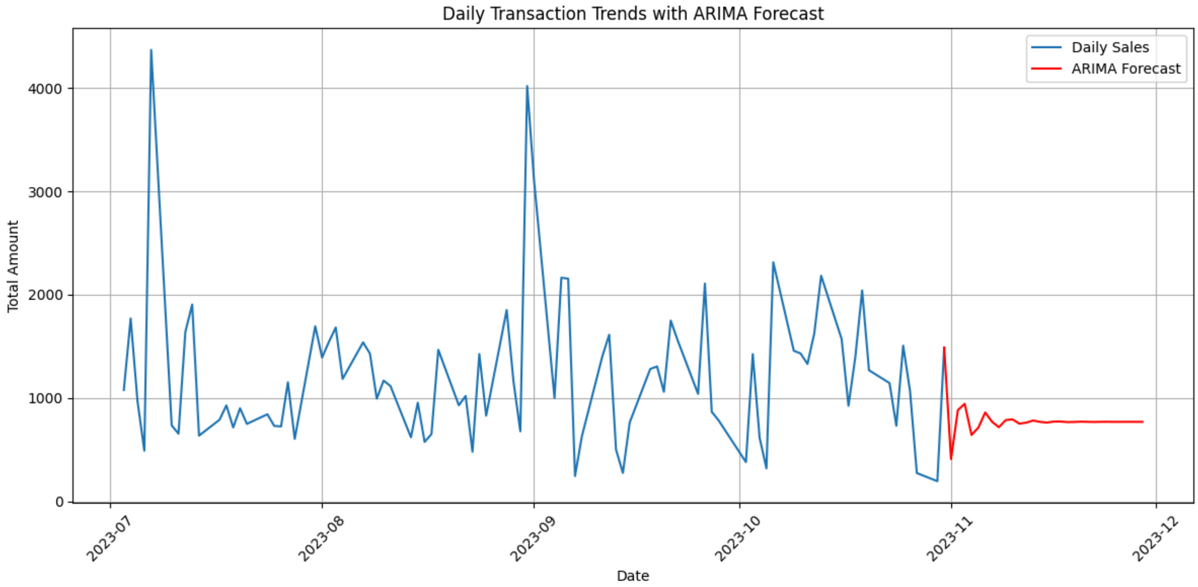
Customer Type: The Majority of transactions are from Dine-in customers and Office Orders, with a smaller portion from Online and Event Catering.



Payment Method: Cash, Paytm, GPay, and PhonePay are commonly used, while Credit Card, and Debit Card constitute a smaller portion.

Detailed Explanation of Analysis Process/Method

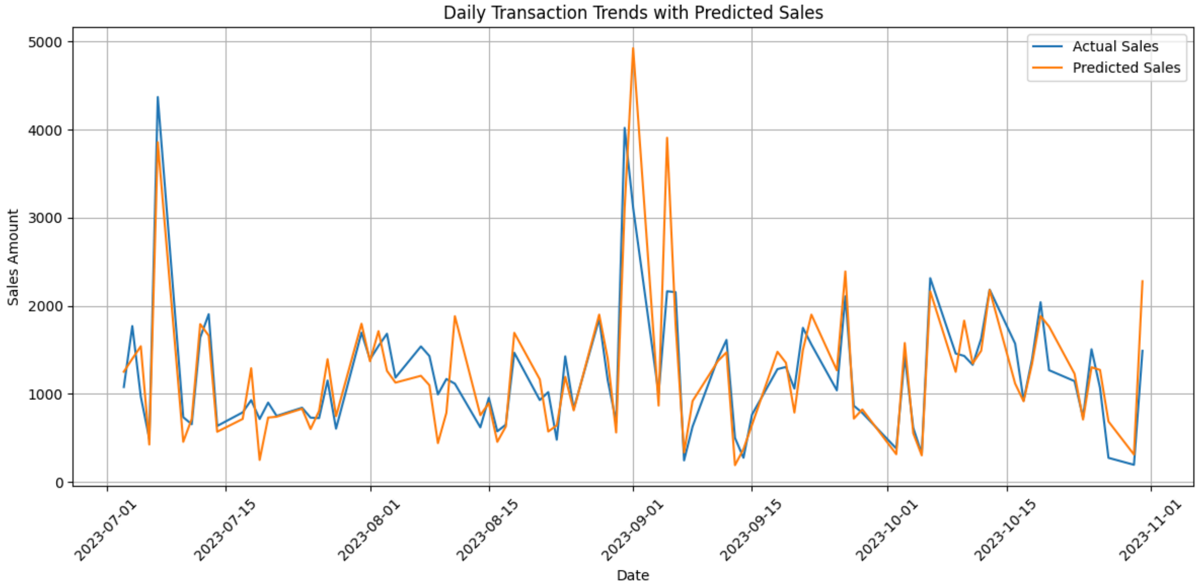
1. Sales Forecasting through ARIMA Time Series Analysis



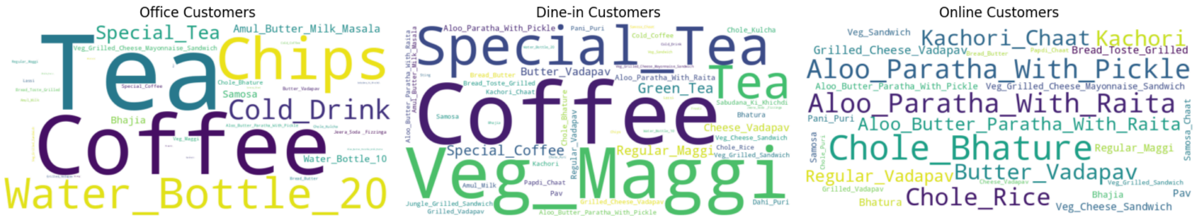
Utilizing the ARIMA (AutoRegressive Integrated Moving Average) model with parameter values (p, d, q) of (3, 1, 0) via the *auto_arima* function from the *pmdarima* package, an insightful sales forecast was generated. This model effectively captured the prevailing trend in sales data, showcasing its potential in forecasting future sales patterns. The plotted forecast, juxtaposed with existing trends, demonstrates the model's ability to analyse sequential transactional data, providing valuable insights for ABC Café in [City] to optimize inventory management and operational strategies.

2. Linear Regression Analysis: Total Sales Prediction Based on Time and Customer Type

Despite an R-squared score of -0.52, the Linear Regression model, utilizing *"Hour"* and *"Customer Type"* as independent variables and *"Total Amount"* as the dependent variable, provided a meaningful portrayal of the overall daily sales trends. The visual representation of predicted versus actual sales through a line plot indicates the model's capability to approximate the general sales patterns throughout the day, considering different customer types. Although the R-squared score may suggest some variance from the actual data, the model offers insights into the cumulative sales trends, serving as a valuable tool for sales estimation at ABC Café in [City].



3. Customer Type-based Popular Product Analysis



WordCloud representing Popular Items among different Customer Types

Utilizing clustering techniques, a customer type-centric analysis unveils distinct preferences at Raj Gopal Khauram’s Café. Among “Office Orders”, “Tea” emerges as the favoured choice, resonating with the professional ambiance. Conversely, “Coffee” dominates the preferences for “Dine-in,” reflecting the café's ambiance and the inclination for a leisurely experience. Surprisingly, “Chole Bhature” stands out as the top pick for “Online” orders, emphasizing convenience and perhaps regional culinary allure. The word cloud plot visually encapsulates these preferences, showcasing the prominent items for each customer type, vital for tailored marketing and menu enhancement strategies.

Results and Findings

Through comprehensive analyses encompassing ARIMA Time Series Forecasting, Linear Regression, and Customer Type-Based Clustering, several critical insights have surfaced. The ARIMA model successfully captured sales trends, aiding in forecasting future sales patterns. However, the Linear Regression model, while showcasing general daily sales trends, exhibited limited correlation with the Total Amount (R-squared score: -0.52). Meanwhile, Customer Type-Based Clustering unveiled distinct preferences: “Tea” for “Office Orders,” “Coffee” for “Dine-in,” and “Chole Bhature” for “Online” transactions.

Moving forward, the final submission will entail a more detailed examination. This involves deeper daily sales and performance analyses, refining demand forecasting by considering hourly variations for various items, and enhancing the Regression Analysis through improved variable selection and feature engineering. Additionally, a comprehensive customer segmentation analysis will be conducted, aiming to discern purchase patterns and timings across “Office Orders,” “Dine-in,” and “Online” customer types.

These deeper analyses will promise heightened preparedness for mitigating losses and augmenting efficiency at ABC Café. Resulting enhanced insights into sales trends, demand forecasts, and customer preferences will facilitate strategic decision-making, enabling proactive measures to optimize operations and foster sustained growth.