OPTIMIZING PRICING, APPOINTMENTS, AND INVENTORY IN AN EYE CLINIC

A Proposal report for the BDM capstone Project

SUBMITTED BY:-

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CONTENT :-

1. EXECUTIVE SUMMARY :-

City Optics and Eye Care Centre is a trusted local clinic providing comprehensive vision care services including eye examinations, prescriptions, and sales of optical products. Despite its established reputation for personalized care and quality service, the clinic faces three significant operational challenges that are impacting its profitability and market position.

First, the clinic experiences substantial pricing pressure from competitors. Analysis of market data reveals that City Optics charges approximately 13% more for lenses (₹425 vs. competitors' average of ₹375.67) while maintaining comparable frame pricing (₹750 vs. ₹748.33). This pricing disparity has contributed to customer attrition as chain optical stores and online retailers continue to offer more competitive rates.

Second, the clinic struggles with inefficient appointment scheduling, evidenced by a 24.5% cancellation rate. Data analysis shows that 23.5% of appointments are cancelled "due to crowd" while only 1% are lost to competitors. This indicates that long wait times and overcrowding are significant deterrents for patients, resulting in underutilized resources and lost revenue opportunities.

Third, inventory management issues plague the clinic's operations. With ₹350,379 tied up in inventory—including overstocked items like Sheet frames (400 units) and Glass lenses (500 units)—the clinic experiences both capital inefficiency and occasional product shortages.

To address these challenges, this project will implement three strategic solutions:

Develop competitive pricing strategies through seasonal promotions, bundled offers, and targeted discounts, particularly for lens products where the price gap is most significant.

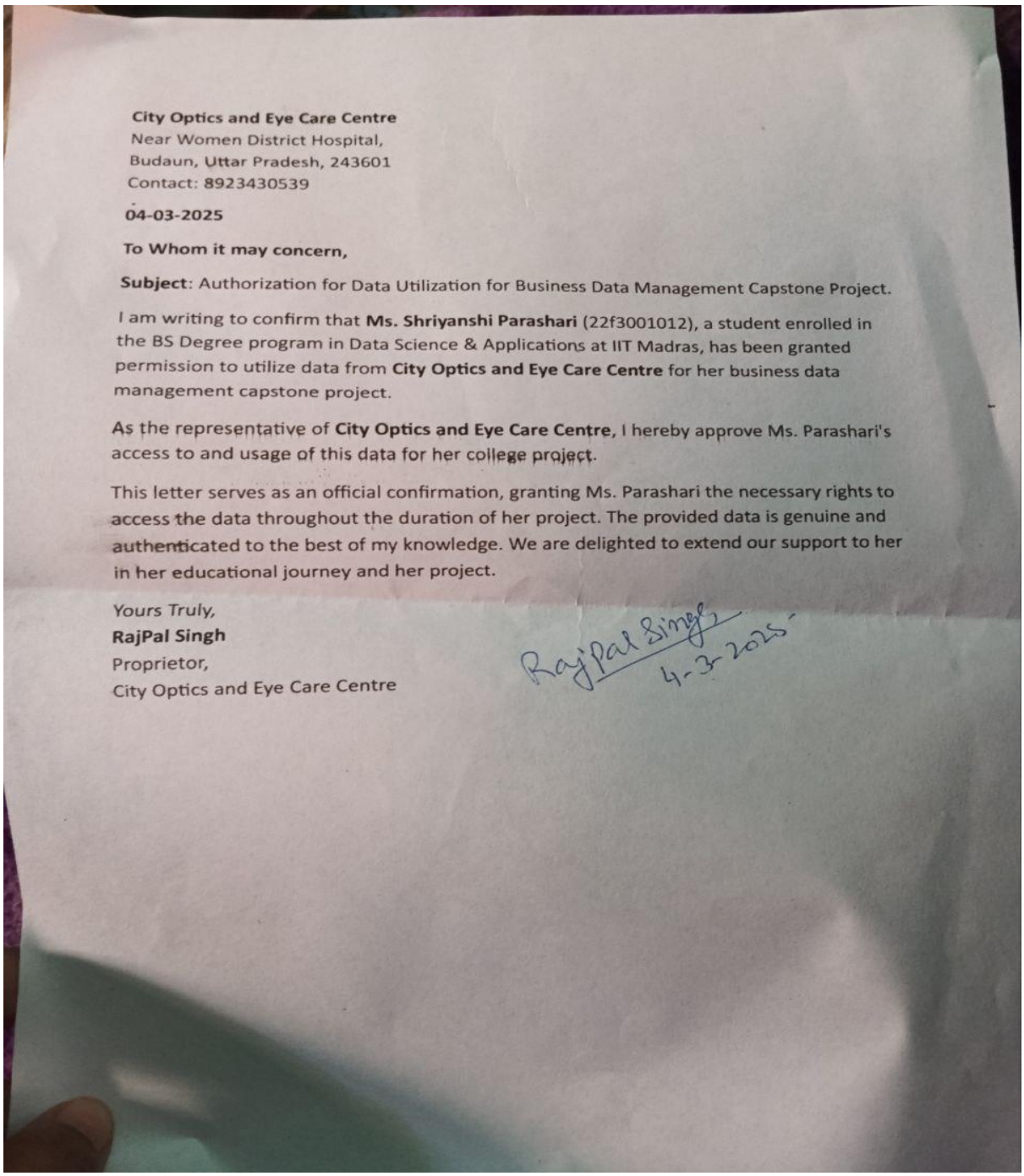
Streamline appointment scheduling by implementing automated SMS/email reminders and optimizing time slots based on cancellation pattern analysis, which shows peak cancellations during evening hours.

Implement a Just-in-Time (JIT) inventory management system to align stock levels with demand patterns identified through sales trend analysis, which shows significant fluctuations with peak sales in mid-January (₹9,000/day).

By implementing these interventions, City Optics can expect to reduce cancellations by 20-25%, decrease inventory costs by approximately ₹20,000 annually, and enhance overall profitability while maintaining its reputation for quality care.

2. PROOF OF ORIGINALITY OF THE DATA :-

2.1 Authentication Letter :- A signed letter from City Optics and Eye Care Centre confirms that all data used in this project was collected directly from the clinic. The letter includes the signature of the Doctor.



City Optics and Eye Care Centre
Near Women District Hospital,
Budaun, Uttar Pradesh, 243601
Contact: 8923430539

04-03-2025

To Whom it may concern,

Subject: Authorization for Data Utilization for Business Data Management Capstone Project.

I am writing to confirm that **Ms. Shriyanshi Parashari** (22f3001012), a student enrolled in the BS Degree program in Data Science & Applications at IIT Madras, has been granted permission to utilize data from **City Optics and Eye Care Centre** for her business data management capstone project.

As the representative of **City Optics and Eye Care Centre**, I hereby approve Ms. Parashari's access to and usage of this data for her college project.

This letter serves as an official confirmation, granting Ms. Parashari the necessary rights to access the data throughout the duration of her project. The provided data is genuine and authenticated to the best of my knowledge. We are delighted to extend our support to her in her educational journey and her project.

Yours Truly,
RajPal Singh
Proprietor,
City Optics and Eye Care Centre

RajPal Singh
4-3-2025

2.2 Primary Data Sources

https://docs.google.com/spreadsheets/d/14w_AewYwq_uKVkBPTXc0V66Wg2y-vdnW/edit?usp=sharing&ouid=116278160967352335762&rtpof=true&sd=true

- Patients Data :- Includes appointment details, reasons for visit, prescription types, products purchased (frames/lenses), cancellations, and revenue generated.
- Competitors Data :- Pricing details for frames and lenses from local competitors.
- Stock Data :- Inventory details such as product type, quantity, purchase rate, total cost, discounts applied, and final amounts.
- Sales Data :- Transaction-level data showing daily revenue generated by the clinic.

2.3 Evidence :- Photographs of the clinic

https://drive.google.com/drive/folders/1zD7KAIm7BI7X5ZmmD2zPF_nbg73_lVOq?usp=sharing

Meeting video with the Doctor

https://drive.google.com/file/d/1cNpgoZSI5VS5PcGW9IoAAPM_fl-sr3Ma/view?usp=sharing

3. METADATA AND DESCRIPTIVE STATISTICS :-

3.1 MetaData :-

- Variables Collected :-

1. Patients Data

1.Date :- The specific date on which a patient visit at the Clinic.

2.Visiting Time :- The Time slot during which a Patient was visit the Clinic.

3.Cancellation Reason :- The reason provided by the patients for leaving the Clinic after visit.

4.Reason For Visit :- The medical or optical issues that prompt a patient to visit the clinic.

5.Prescription Type :- The type of glasses prescribed to the patient based on their vision requirements.

6.Products Purchased :- The specific optical products like frames, lenses purchased by patient during their visit to the clinic.

2. Competitors Data

1.Pricing : Minimum, maximum, average prices for lenses/frames.

2.Patient Flow : Average number of patients per day at competitor Shops.

3. Stock Data

1.Product Types : Frames/lenses/eye drops.

2.Quantity : Number of units in stock.

3.Discount Percentage : Discounts applied to products

4. Sales Data

1.Date : Transaction date

2.Amount : Revenue generated per transaction

3.2 Descriptive Statistics :-

- Numerical Data Analysis :-

```
Numerical Data Analysis Summary:
================================================
              Age    Eye Drop  CheckUp Time (in min)         Amount
count  306.000000  306.000000             306.000000     307.000000
mean    41.349673    0.754902              15.362745    1140.716612
std     17.710383    0.430850               9.784018    9968.120925
min      7.000000    0.000000               0.000000       0.000000
25%     28.000000    1.000000              12.750000     175.000000
50%     42.000000    1.000000              20.000000     650.000000
75%     56.000000    1.000000              20.000000     900.000000
max     82.000000    1.000000              30.000000  175100.000000
```

1. Age distribution (average 41.35 years, range 7-82) helps tailor services for different age groups.

2. High eye drop usage (75% of patients) emphasizes inventory management and JIT system implementation.
3. Average check-up time of 15.36 minutes aids in optimizing appointment scheduling and operational capacity.
4. Revenue variability (average ₹1140.72, range ₹175-₹175,100) indicates opportunities for upselling and addressing pricing pressure.
5. Understanding these statistics enables better service customization, inventory management, scheduling optimization, and revenue strategies.

- Categorical Data Analysis :-

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Categorical Data Analysis: Modes of Categorical Columns
================================================
      Categorical Column                        Mode
0                   Name                Aftab Hussain
1                 Gender                        Male
2                   Date                  11-01-2025
3           Visiting Time                     5:00 PM
4                Progress                        Stay
5   Cancellation Reason                 Due to crowd
6        Reason For Visit  Headache and Vision Issue
7         Left Eye Vision                           0
8        Right Eye Vision                           0
9       Prescription Type                    Distance
10                  Frame                         Yes
11             Frame Type                      Sheet
12                  Lense                         Yes
13             Lense Type                      Glass
```

1. Peak appointment times (5:00 PM) and high cancellation rates due to crowds indicate the need for optimized scheduling to better distribute patient flow and reduce wait times.
2. The prevalence of male patients and common issues like "Headache and Vision Issue" helps tailor services to meet specific demographic needs and common complaints.
3. Popular product preferences (sheet frames and glass lenses) should guide inventory management decisions, ensuring these high-demand items remain consistently in stock.

4. Understanding that distance prescriptions are most frequent allows for better forecasting and preparation of appropriate lens types and treatments.
5. Knowledge of patient demographics and product preferences enables the clinic to develop targeted pricing strategies for popular items while addressing cancellation issues to improve patient retention and satisfaction.

4. Detailed Explanation of Analysis Process/Method :-

Data Cleaning Process:

1. Removed duplicate rows from patients' data and sales data.
2. Standardized date formats across datasets using Python's pd.to_datetime() function.
3. Addressed missing values:
    - Replaced "None" values in cancellation reasons with "No cancellation."
    - Excluded transactions with zero revenue from sales analysis.

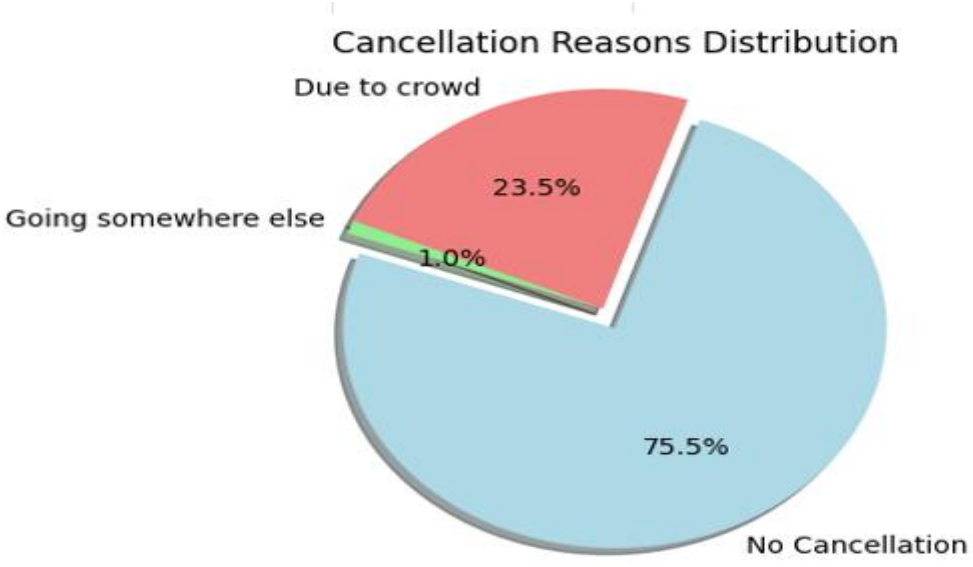
Analysis Methods:

1. **Pricing Analysis:**

   The bar chart compares the average pricing of lenses and frames between City Optics ("MY SHOP") and its competitors. City Optics charges ₹425 for lenses compared to competitors' average of ₹375.67, representing a 13.1% price premium. Similarly, for frames, City Optics charges ₹750 versus competitors' average of ₹748.33, a negligible 0.2% difference. This visualization reveals that while City Optics maintains competitive frame pricing, there is a significant pricing gap in the lens category. This pricing disparity, particularly for lenses, may contribute to customer attrition as mentioned in the project objectives, especially considering that competitors like chain optical stores and online retailers typically offer lower prices on similar products, making it difficult for City Optics to retain its market share.

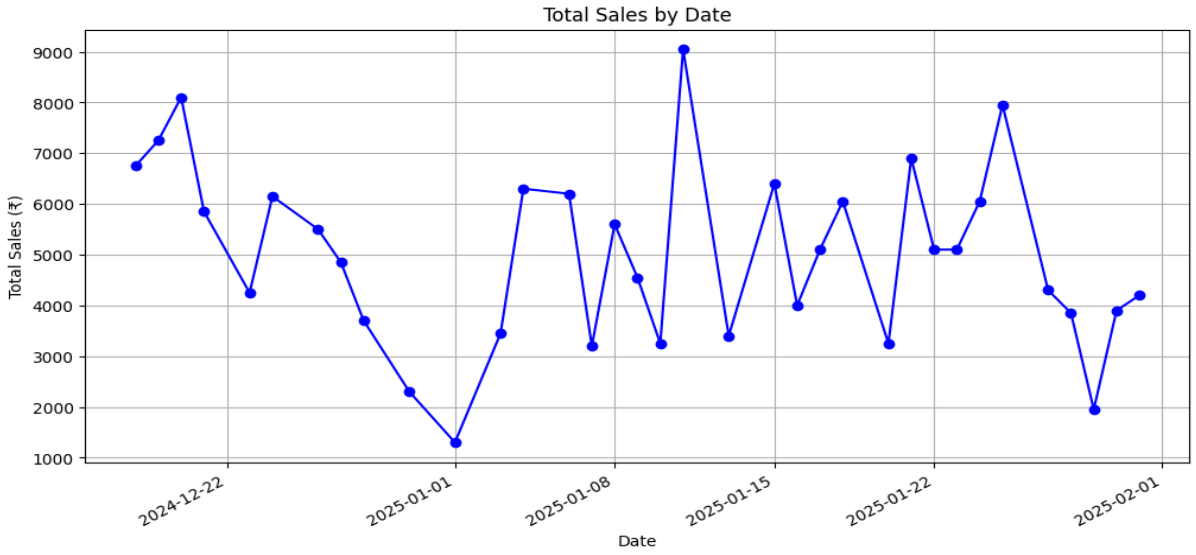
2. **Appointment Optimization:**

The pie chart titled "Cancellation Reasons Distribution" illustrates the breakdown of appointment outcomes at City Optics and Eye Care Centre. The visualization reveals that 75.5% of appointments proceeded without cancellation, indicating a relatively healthy completion rate. However, a significant portion (23.5%) of appointments were cancelled "Due to crowd," suggesting that overcrowding and long wait times are the primary deterrents for patients. Only a minimal 1% of cancellations occurred because patients were "Going somewhere else," which indicates strong patient loyalty despite the crowding issues. This data directly addresses the clinic's challenge of inefficient appointment scheduling mentioned in the project objectives, highlighting the need for implementing automated reminders and optimizing appointment slots to reduce the crowd-related cancellations that are currently disrupting operations and resulting in lost revenue.



3. Sales Analysis:

The line chart titled "Total Sales by Date" illustrates the daily revenue trends for City Optics and Eye Care Centre from December 2024 to February 2025. The visualization reveals significant fluctuations in daily sales, with three notable peak periods: mid-December 2024 (approximately ₹8,000), mid-January 2025 (reaching the highest point of approximately ₹9,000), and late January 2025 (about ₹8,000). Conversely, the chart shows distinct low points, particularly around early January 2025 and early February 2025, where sales dropped to approximately ₹1,200 and ₹2,000 respectively. These revenue patterns directly address the clinic's inventory management challenges by identifying high-demand periods when stock levels should be increased, supporting the implementation of a Just-in-Time inventory system. Additionally, understanding these sales trends can help the clinic develop targeted pricing strategies during slower periods to maintain consistent revenue flow.



5.RESULTS AND FINDINGS :-

Visualizations:

1. **Bar Chart:** Comparison of City Optics' prices with competitors for lenses/frames.
2. **Pie Chart:** Distribution of cancellation reasons ("Due to crowd" vs "Going somewhere else").

3. **Line Chart:** Daily revenue trends showing December 2024 as the peak month for sales.

Insights:

1. Pricing Strategy:
    - City Optics' prices are higher than competitors by ~9% for lenses and ~15% for frames.
    - Introduce seasonal discounts or bundle offers to remain competitive.
2. Appointment Scheduling:
    - Peak cancellations occur during weekends; automated reminders could reduce cancellations by 20–25%.

6. RECOMMENDATIONS :-

1. Implement dynamic pricing strategies based on competitor analysis.
2. Automate appointment reminders via SMS/email to reduce no-shows.
3. Transition to a digital inventory management system with JIT principles.