Group Coursework Submission Form

Specialist Masters Programme

Please list all names of group members: (Surname, first name) 1. Rawat, Nikhil 2. Sheng, Yuhong 3. Wang, Yiwei	4. Wen, Hongbo **GROUP NUMBER:** **1**
MSc in: Business Analytics	
Module Code: SMM641	
Module Title: Revenue Management and Pricing	
Lecturer: Dr Oben Ceryan	**Submission Date: 15 Dec 2023**

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1. Context background: Assume a London-based fashion rental company

This report is going to provide a price optimisation and revenue maximisation strategy for a London-based fashion rental enterprise tailored to individuals in search of designer dresses for special events. The rental durations are flexible, offering choices between 4-day and 8-day rental periods, each characterised by standard and premium service (including delivery and laundry services) tiers. The business is dedicated to offering a curated selection of fashionable attire, catering to customers attending events, weddings, parties, and various social gatherings.

1.1. Industry analysis: UK fashion rental market

Fashion rental, considered as circular economy or sharing economy, attracts great attention due to its eco-friendly nature and the trend that consumers are more willing to rent instead of purchase. According to *The Wall Street Journal*, females prefer to rent clothes because of the prosperity of the sharing economy (Safdar and Kapner, 2017). The global online clothing rental market grew at a 10.76% compound annual growth rate (CAGR) between 2019 and 2023 (Research and Market, 2019) and is expected to achieve a market size of $1.83 billion by 2028 (Daniel, 2019). According to a study, the UK fashion rental market has a potential value of £923 million, with an anticipated boom over the next five years (Banks-Walker and Graddon, 2023).

1.2. Comparative analysis

Prominent figures in the fashion rental sector include Selfridges Rental, HURR, By Rotation, and My Wardrobe HQ. These companies aim to provide customers with the option to rent fashion items through their digital platforms. Upon investigating major industry participants, it was noted that the fashion rental business commonly adopts a short-term rental model (typically 4-day and 8-day options), where customers are charged for the duration of garment use.

There are several pricing strategies for fashion rental companies. One type of pricing strategy is simply charging a certain percentage of the retail price, for example, one or more fashion items for a 4-day period at a fee equivalent to approximately 10–15% of the retail price (Elisa, 2021). While regular retail fashion follows a traditional sales model, setting prices based on production costs, markup, and demand (Jasmin, 2023).

2. Problem description

Evidently, the prevalent pricing strategy among fashion rental companies relies solely on the single model mentioned above. However, the pricing strategy may fall short in terms of precision and long-term strategic planning, potentially overlooking specific constraints or business objectives. In response, we devised a pricing approach to dynamic programming models for high-demand seasons (peak periods), combined with a price optimisation strategy based on customer choice for regular days (non-peak periods). The combination allows for a more sophisticated approach to resource allocation problems, considering both the dynamic nature of the system and the surplus resources available.

3. Methodologies

3.1. Justification of methodologies

In response to the varying demands for designer dress rental across different periods, *a seasonal pricing strategy* has been adopted, where time is categorised into high-demand seasons (peak) and regular days (non-peak). To refine our approach further, we employ *customer segmentation* to distinguish between customers who prefer regular service and those seeking premium service.

The choice of employing *a dynamic programming strategy* for peak days is driven by the perishable nature of designer dresses, considered fashion apparel. Fashion trends evolve with the seasons (Chatwin, 2000), making these products obsolete over time. Customer demand exhibits high sensitivity to timing and can fluctuate stochastically within finite periods (Talebian *et al.*, 2014). Additionally, fashion-conscious customers tend to be price sensitive. In certain situations, they are willing to pay premium prices for trendy items upon market release. However, their willingness to pay decreases with the passage of trends. To tackle these challenges effectively, a dynamic programming strategy is applied to maximise total revenue. Importantly, we assume that the demand function is known in advance. Given the limited capacity of designer dress inventory, *an optimal inventory allocation strategy* is also utilised to maximise revenue.

During non-peak periods, the demand for dress rentals tends to be lower compared to peak times. Here, we observe customer heterogeneity, where rental decisions are influenced by individual willingness to pay for varying rental durations and the prices associated with those durations. To optimise pricing to accommodate these variances and address issues such as buy-

up/down, imperfect segmentation, and cannibalization, we develop *a price differentiation strategy* based on insights derived from *customer behaviour analysis* that incorporates the *consumer surplus*. This price optimisation strategy aims to establish a deeper understanding of the relationship between pricing and demand and maximise total revenue. To gain further insights into the demand function and refine our pricing strategy, we propose conducting a simulated customer survey. Therefore, a "customer survey" has been generated, which is conducted among 100 individuals, extrapolated to represent a market segment of 1500 potential customers, and informs our pricing. This survey will provide more precise data for informed decision-making.

3.2. Model setting and Output interpretation

The fashion rental business utilises a combined approach, incorporating dynamic programming and price optimisation with customer choice at various price levels to maximise revenue. The concept revolves around differentiating between non-peak and peak periods, each characterised by standard and premium service tiers. In response to the subdued demand during these periods, the pricing strategy is adapted accordingly (please refer the codes and customer survey attached).

3.2.1 Peak Time

During peak times like holiday seasons, a dynamic programming model is employed to optimise revenue from dress rentals over a fixed horizon. It is assumed that there are 2500 designer dresses available, 1800-time segments for a 4-day duration, and 2000 time segments for an 8-day duration. For the 4-day duration, there is a 20% chance of no customers, a 50% chance for premium service, and a 30% chance for regular service. For the 8-day duration, the premium service is priced at £120, and the regular service is priced at £90. For the 8-day duration, the premium service is priced at £200, and the regular service is £150. There is a 10% chance of no customers, a 50% chance for premium service, and a 40% chance for regular service.

The model iterates through time units, estimating the value of dresses to diverse customer types or opting not to rent at a suboptimal lower price. It maximises revenue by considering demand probabilities and adjusting decisions based on changing inventory and time.

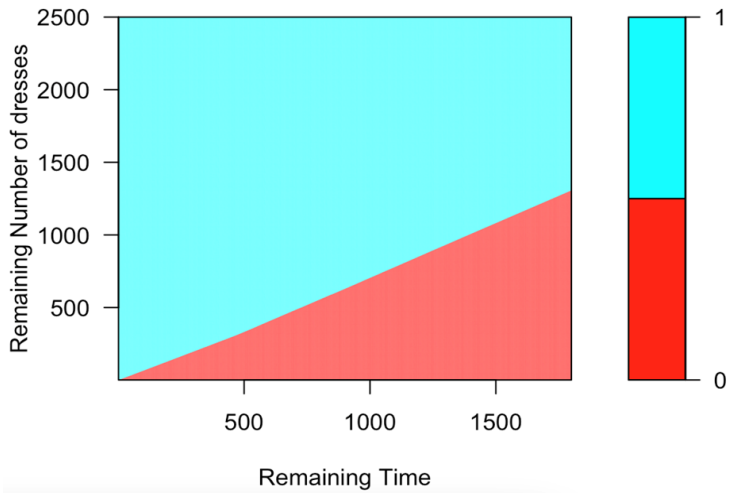

Figure 1. Structure of the Optimal Acceptance Decision for Dresses at t=1800

Figure 1 shows the 4-day rental duration's optimal policy for renting to customers choosing regular services, with the red area indicating acceptance (1) and the blue area representing non-acceptance (0). Over time (right to left on the x-axis), more dresses are rented to customers choosing regular services, signalling an inclination to lower prices to avoid unrented inventory.

As inventory decreases (y-axis), the policy becomes less selective to minimise leftover stock. The graph depicts a dynamic pricing and inventory management strategy, adjusting based on time and remaining inventory. As the rental period progresses or stock diminishes, the model is more likely to accept lower prices. For example, with 1000 time segments and 500 dresses left, the decision shifts to the red area, indicating not renting to regular customers. This preserves dresses for premium customers, capturing more opportunities and boosting revenue.

The dynamic pricing model informs decisions on renting a product at various prices over time. In this case, the model suggests the optimal revenue to be £156,600.

Figure 2 shows the 8-day rental duration's optimal policy, which results in an optimal total expected revenue of £320,000.

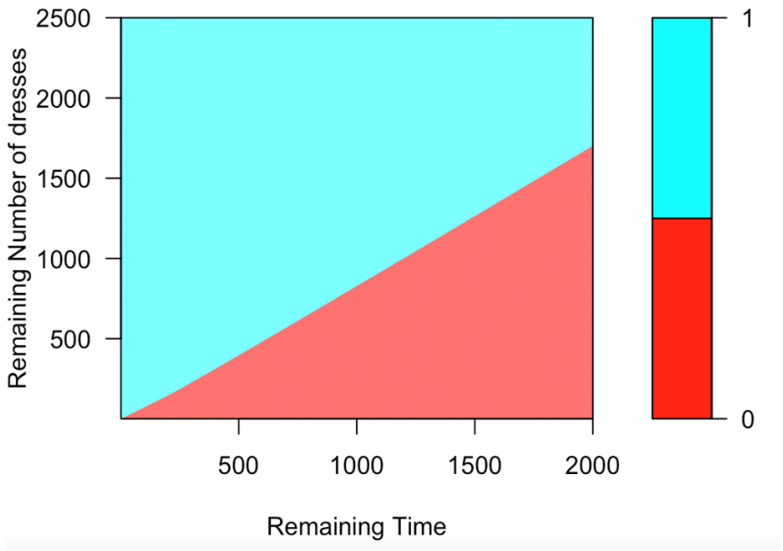

Figure 2. Structure of the Optimal Acceptance Decision for Dresses at t=2000

3.2.2 Non-Peak Time

In a 4-day non-peak period, this model, focused on demand estimation and revenue maximisation based on consumer surplus, sets the regular service price at £70. The surplus for regular service is calculated as WTP minus the regular price for each customer. The surplus for premium service is determined by subtracting the potential premium price from each customer's WTP. The model estimates demand for both regular and premium services at various potential premium prices. If the surplus for regular service is higher than the premium surplus, customers choose regular service.

Revenue is calculated for each potential premium price by multiplying estimated demand by prices and scaling up to 1500 customers. As Figure 3 illustrates, the optimal premium service price, the one yielding the highest revenue, is £90. At this price, demand for premium service is 70% (1050 customers), and for regular service, it is 27% (405 customers). The maximum revenue achievable at this price is £122,850.

As the premium service price increases, demand generally decreases. Conversely, as the premium service price rises, regular service becomes more appealing, increasing its demand. However, if the premium service price is too high, overall demand might drop, as some customers may not find enough value in either option. The optimal £90 premium price represents a balance, maximising combined revenue from both regular and premium services, considering their respective demands at this price point.

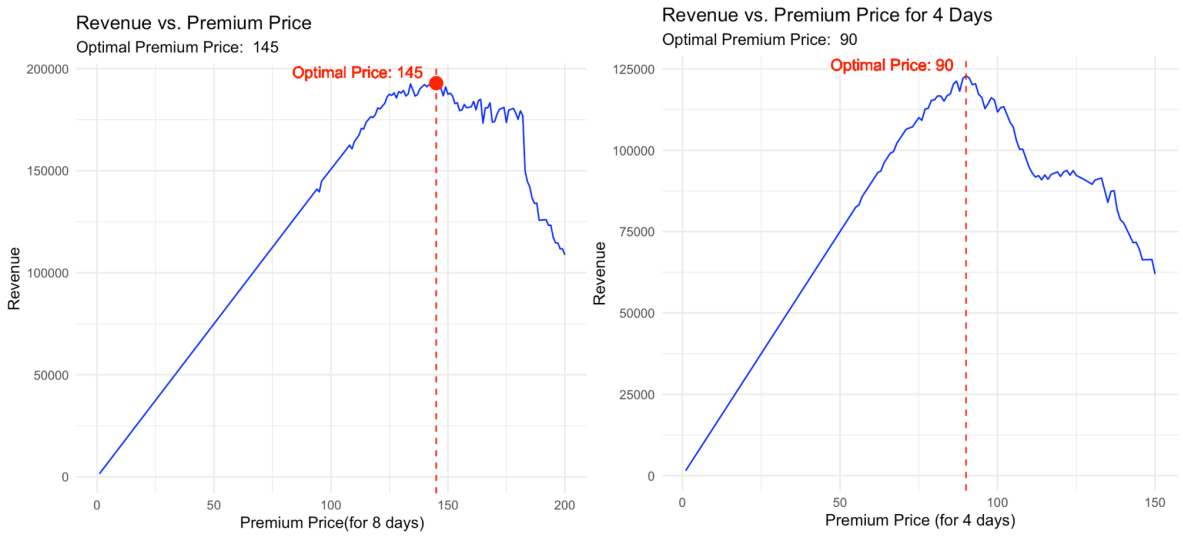

Figure 3. The Optimal Premium Price for 8-day and 4-day

The same strategy has been applied to the 8-day model as well. The optimal premium price is £145 (shown in Figure 3), while the regular price is fixed at £125. This price setting leads to a high utilisation of services, indicating that it resonates well with the customer's perceived value and willingness to pay. Under this price point, 92% of the customers are purchasing this service, with 68% choosing premium service and 24% choosing regular service. This indicates a strong preference for premium services among the majority of customers, likely due to perceived value or additional benefits offered by the premium option. The distribution of customers at the optimal price is 1020 for premium and 360 for regular service, out of a total of 1500 customers. The revenue at this point reaches £192,900. These figures show significant revenue generation from the premium service, highlighting its profitability. The model prioritises revenue maximisation over simply maximising the number of customers. This approach focuses on identifying a price point that yields the highest total revenue rather than purely aiming for the highest number of service users.

4. Conclusion

Period	Optimal Premium Price	Optimal Regular Price	Premium Service Demand	Regular Service Demand	No Customer Probability	Premium Customer Probability	Regular Customer Probability	Total Expected Revenue	Total Customers	Premium Customers	Regular Customers
Peak 4-days	£120	£90	N/A	N/A	20%	50%	30%	£156,600	1500	750	450
Peak 8-days	£200	£150	N/A	N/A	10%	50%	40%	£320,000	1500	750	600
Non-peak 4-days	£90	£70	70%	27%	N/A	N/A	N/A	£122,850	1500	1050	405
Non-peak 8-days	£145	£125	68%	24%	N/A	N/A	N/A	£192,900	1500	1020	360

Table 1. Key Outputs of the Model

In conclusion, the London-based fashion rental enterprise applied a dual-strategy model; the enterprise synergizes dynamic programming during peak times with customer-centric price optimisation in non-peak periods. This strategy effectively balances the fast-paced nature of fashion trends with market demand fluctuations.

As shown in Table 1, significant outcomes of this approach include the pricing of £120 for premium and £90 for regular service during peak 4-day rentals, achieving a maximum revenue of £156,600. For 8-day rentals, the strategy yielded an impressive revenue of £320,000, with prices set at £200 and £150 for premium and regular services, respectively. This dynamic pricing model adeptly capitalises on high-demand seasons.

Contrastingly, during non-peak periods, the model's pricing strategy is based on customer willingness to pay, with a premium service price of £90 for 4-day rentals and £145 for 8-day rentals, maximising revenue. These strategic decisions not only underscore the potential for sustainable growth but also position the enterprise as a forerunner in the fashion rental sector, demonstrating the effectiveness of adaptive, customer-centric pricing strategies in a competitive market.

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