# SMM641 - Group 1 Report

## Background

The baseline for this project is that we, as a group, work as revenue management consultants in a non-given consulting firm. We support our clients in optimising their revenue streams by researching, testing and advising in implementing different pricing, allocation and assortment strategies in their business.

Our latest project, covered in this report, involves a student accommodation house struggling with declining revenue and room coverage over an extensive period. As a result, the management has hired us to provide advice on how they can utilise one or several revenue strategies to maximise their revenue for the upcoming season.

## Problem description

We have received information about the house's current revenue strategy to support the business.

The student house consists of 200 rooms offered for £1000 a month on 12-month contracts. The house does not differentiate in price between the rooms and does not provide discounts. Over the last 12 month period, the accommodation had an average of 52.2% room coverage.

The student house's revenue last year was £1,252,000.

The current revenue strategy is static and does not consider the customer's demand and willingness to pay (WTP). We believe that performing market research and testing different revenue strategies can improve the revenue for the student house.

Our approach to helping the student house is to perform market analysis and test different revenue management methodologies by creating simulated revenue models based on the mentioned methodologies.

After creating the different models, we will compare them and their strategies to understand which ones give the highest simulated revenue. Finally, we will suggest a new revenue model for the student house based on our analysis of the strategies and simulation models. The recommended strategy will also be dependant on its fit to the student accommodation industry and customers.

## The Data

We simulated data about the WTP of 600 potential customers over five different product classes. The WTP of the classes helps reflect the differences in the services being offered to the target market.

For class 4, there was observed different WTP between the months coming closer to school start, August, September and October. We have generated data simulated for 600 respondents, which gives the WTP for class 4 with a distinction between the peak months, distinguishing between the peak and the non-peak months. We have the assumption that no other categories have observed a difference in demand between periods.

## Methodologies to be used

We explore various revenue management methodologies and their combinations to identify the best strategy for the student accommodation. We take a step-by-step approach to our analysis, increasing the complexity of our models as we extend our analysis.

### Current Model:

We use the WTP data to calculate the demand at various price levels and identify the demand at the firms’ current price level. This allows us to calculate the revenue of the student accommodation in their current state.

### Model 1: One class - single price

Since the firm offers a fixed price, we evaluate whether the price they currently charge is optimal. To ensure that they charge an optimal price for a single room, we use the market research for the WTP data to calculate the optimal price.

### Model 2(a): Multiple classes - multiple prices - surplus

Here, we shift away from the greedy heuristic approach of accepting an offer as it is made by exploring the effect of introducing multiple product classes on the firm’s revenue. We consider different combinations of prices for the 5 product classes and use the consumer surplus to

model the demand for the various classes. We aim to optimise revenue based on these prices.

### Model 2(b): Multiple classes - multiple prices - attraction

With a capacity of 200 rooms, offering five different products may not be viable for the business operations. Therefore, building on the model in 2 (a), we use the identified optimal prices for each class as an input to find the attraction values for the respective classes to determine the best products to offer. A size constraint reduces the burden on the operations team while allowing for price optimisation - increasing revenue.

### Model 3: Peak Price - Class 4

Having identified the disparity in WTP across different times of the year, peak and non-peak prices can be considered for one of their products to allow for price optimisation. Class 4 is the product to be considered for optimisation, and demand for all other classes is assumed to be constant throughout the year.

### Model 4: Protection Level - Class 4

With the peak and non-peak demand available for class 4, we can optimise the capacity to be protected for the peak demand period. This approach helps us evaluate whether protecting some rooms for the peak demand period helps increase the revenue of the student home.

## Methodology implementation

### Current Model:

We created a basic single price revenue model based on data about the WTP of 600 potential customers and identified the demand level at various price levels. We assume their current product offering to be Class 4, and thus, the WTP reflects the demand level at the different price levels.

Based on the single price model, we can identify the demand at the firm’s current price level (£1,000 per month) and use that result to calculate their revenue in the current state.

### Model 1: One class - optimised single price

Using the current model, we identify the optimal revenue based on a single price. The optimal price for a single room was identified as £833 p/m.

### Model 2(a): Multiple classes - multiple prices - surplus

Based on our research and simulated data, we identify differences in WTP for various potential product offerings. We use the simulated data relating to the 5 product classes and optimise prices for all of them simultaneously. First, the consumer surplus model models the demand at different combinations (~161,000) of prices for the 5 product classes. Then, we identify the prices for the five classes that give us the best revenue.

### Model 2(b): Multiple classes - multiple prices - attraction

With the optimal prices found in model 2(a), demand exists only for classes 4 and 5. Next, we use assortment to confirm that only offering these classes is optimal by calculating attraction levels by looping over obtained optimal prices in model 2(a).

### Model 3: Peak Price - Class 4

As said under section “The data”, we assume a higher demand for class 4 in the months before study starts. We use the peak/non-peak WTP data to calculate the peak and non-peak periods surplus. We have an assumption that the non-peak price will remain the same as the optimal price for class 4, found in model 2. We loop through all possible peak prices to calculate the demand and revenue at each peak price level. The peak price that optimises the revenue for class 4 is £2,133,200.

### Model 4: Protection Level - Class 4

Based on the demand at the optimal peak price obtained in model 3, we calculate the mean demand for class 4 during peak and non-peak periods. With a non-peak price of £900, peak price of £985 and capacity at the student house for class 4 of 100 rooms, we loop through all possible protection levels for the peak period to obtain the revenue at each level. The optimal protection level is obtained by selecting the protection level with the highest revenue. The optimal protection of rooms for peak periods for class 4 is 86.

## Analysis results

**Model 1: One class - single price**The price level that maximises total revenue is £833. At this level, the accommodation can earn revenues of £1,752,632. This is 40% higher than their revenue for their current model.

**Model 2 (a): Multiple classes - multiple prices - surplus**  
With 5 classes, the optimal products to use are class 4 and 5 at prices of 900 each with a total expected revenue of £1,987,200. Here, the prices of the other classes are not important as the price of 900 for class 4 and 5 give zero demand for the other classes. Granular price combinations could be considered to see if the results change.

**Model 2 (b): Multiple classes - multiple prices - attraction**Assortment selection concludes that the assortment should offer all five products. But, we see that classes 1, 2 and 3 have ~0 probability of buying. These probabilities confirm that we should offer 2 classes (4 & 5).

Assortment selection, with a constraint of 2 products, optimizes revenue with class 4 and 5 with a total revenue of £1,129,106. The lower revenue here is the result of the probabilities of buying being incorporated in the revenue calculation.

**Model 3: Peak Price - Class 4**The model 3 finds optimal prices for peak periods for class 4. The optimal peak price for class 4 is £985. A non-peak price of £900 and peak price of £985 gives £2,133,200 in total revenue.

**Model 4: Protection Level - Class 4**Model 4 finds the optimal protection of class 4 rooms for high peak periods. The optimal protection of rooms is 86.

## Methodology fit to business/problem

## There are many different methodologies that are possible for the student house to improve and optimise their revenue. We have implemented and obtained the results of several methodologies with various complexity. The student house has historically operated with a simple revenue model. Only optimising the price with their current model gives a 40% increase in revenue. This method does not require much complexity to be added to their current revenue model and significantly increases the student house's revenue.

## The WTP data shows a difference in WTP for different classes, so the student house should consider offering several product classes. Using assortment selection methods to optimise the different product classes, we identify two classes as optimal. We see that this model's expected revenue, compared to the current model, increases by 59%. Furthermore, by taking into account peak demand and protection of rooms for peak demand for class 4, the expected revenue compared to the current revenue model increases by 70%.

## Combining the methodologies and basing the revenue model on several classes, protecting rooms for high demand and finding the optimal prices based on customers' WTP will provide a higher revenue to the student house. In addition, these models add complexity and flexibility in controlling and working with the revenue model. Recommendation

The student house can potentially improve its revenue streams by applying different revenue management techniques. We have tested several potential methodologies that the student house could apply. If the student house does not bother with complexity and wants to optimize its revenue fully, we recommend introducing two classes with the price of £900 p/m for each class. The class, similar to today's offering (class 4), should protect 86 rooms for the peak periods of August, September and October and set the price of class 4 to £985 during the peak demand periods. This model increases the revenue by 70% from the current revenue model.

If the student house wants to keep its current product offering and revenue model, the revenue could be increased by 40% by only changing today's price to £833.

## List of references used

Thecompleteuniversityguide.co.uk. 2022. How much does uni accommodation cost?. [online] Available at: <https://www.thecompleteuniversityguide.co.uk/student-advice/before-you-start/how-much-does-uni-accommodation-cost> [Accessed 3 April 2022].

Letting Agent Today. 2022. Student accommodation giant reveals figures on Covid recovery. [online] Available at: <https://www.lettingagenttoday.co.uk/breaking-news/2022/1/student-accommodation-giant-reveals-figures-on-covid-recovery> [Accessed 3 April 2022].

## Appendix

1. Overview of the first 5 rows of the WTP data for the 5 classes

A screenshot of a computer screen

Description automatically generated with medium confidence

1. Overview of the first 5 rows of the WTP for class 4 during peak and non-peak periods

A screenshot of a computer screen

Description automatically generated with medium confidence

1. Overview of the top 5 rows of the optimized solution of model 2 (a). We see that the demand between class 4 & 5 is evenly distributed.

Graphical user interface, application

Description automatically generated

1. Optimal peak price for class 4

A picture containing shape

Description automatically generated