

## Question - 1

Codes with detailed step by step explanation can be found in Rmd script

### *Model Comparison*

Overall, under different objectives, the output differs. The model that can help the city generate the most revenue is model 1 with a peak pricing; however, when the objective is to minimise emission, model 3 is the best with the least amount of revenue generated.

Model No.	Objective	Price	Revenue	Emission
1	Maximize revenue and a single congestion charge	8	1349009	49323717
2	Maximize revenue and a peak period pricing	9	1371826	37110105
3	Minimize emissions	13.77	1216361	25233083

## Question - 2 (153 words)

### *Sub-question - (a)*

Price differentiations improve profits by charging different prices to different customers. This strategy offers the optimal prices for target groups to entice them to purchase more and it can also motivate otherwise uninterested target groups to purchase.

### *Sub-question - (b)*

Price differentiation has the following major disadvantages:

#### 1. Imperfect segmentation/ Cannibalization

Segment customers into wrong groups and offer prices misalign with their expectation. Different Customers Segments may find a way to purchase at the lower price.

#### 2. Arbitrate

Customers who qualify for a lower price could turn around and sell it to other segments for a higher price.

#### 3. Additional cost

Research and analysis required to separate the market which incurs additional cost

### ***Sub-question - (c)***

Taking the company's pricing strategy into consideration, a linear demand model for the aggregate potential demand from all segments for different products is constructed. And then it was used to determine prices for different products, maximizing overall revenue.

### **Question - 3 (206 words)**

This practical setting is built based on the setting described in problem set 1

#### **Situation**

The expenditure of UK households on online grocery shopping grows exponentially. One of the main challenges for it to grow further is logistics cost.

#### **Complication**

An online grocery shopping client based in London asked the consulting team to help it design a system that allocates available delivery spots on different time windows from 8am to 10pm and find out profit-maximising delivery window prices of its attended home delivery.

#### **Objective**

Maximise profits and set differentiated delivery window prices

#### **Preliminary Modelling and Analysing**

Consumer's willingness to pay on different delivery time windows will be surveyed and their surplus will be calculated. Profits is equal to revenue minus cost. Assume the cost is same for all the delivery. Based on previous information, a price optimization function will be created. Within the function, linear demand models will be built for the aggregate potential demand from all time windows for different delivery prices. And then it was used to determine prices for delivery windows, maximizing overall revenue. Given the objective function, constraints will be set so that overall demand will not exceed the capacities and demand on each window should be greater and equal to 0.