SMM641 REVENUE MANAGEMENT AND PRICING

Individual Problem Set 1
Due: Thursday, 24 October 2024, 23:55pm

General Guidelines:

- **This assessment is individual work**. You are allowed to discuss questions with your classmates, but **all work and writing in your submission must be completely your own.**
- **Each of the three questions has equal weight. The overall marking will be based on both the quality of your analysis and the expositional clarity of your descriptions.** Please clearly describe the steps you take and allow the reader to follow your work with ease.
- Please **submit a single pdf document** (please do not submit a Word document) to Moodle.
- **Limit your submission to ~500 words in total for the entire submission** (not per question).
- Please submit any code files separately (e.g., as an .R file), which should be clear to follow (commented with clear descriptions) and be ready to run.

Question 1:

A hotel in Cotswolds has 23 rooms. Its regular daily rate is £195 but it also offers a 20% discount for some early reservations. Suppose that the early reservation demand is approximated by a Poisson distribution with mean 32 and the regular demand (arrivals after the early discount period and until the day of stay) has a Poisson distribution with mean 18.

- (a) Suppose the hotel operates on a first-come first-serve (FCFS) basis. Compute the hotel's expected daily revenue.
- (b) How many rooms should the hotel reserve for regular (late) arrivals in order to maximise their expected daily revenue? What is the expected daily revenue from this protection (reserve) policy? What is the per cent improvement compared to the expected daily revenue from the FCFS allocation that you computed in part (a).
- (c) Explore how the allocation decision changes with changes in key problem parameters (e.g., prices for each reservation type, etc.). Please also briefly comment on whether you would expect these changes and why.

Question 2:

Consider the Airline Network Example we discussed in class, in which an airline is operating two flights, one from Dublin to London, and the other from London to Edinburgh.

- (a) Please explain in words what the value function for the state (50,50,100) represents.
- (b) Consider the structure of the optimal acceptance decision for product 2 at t=100 periods to go (available in the slides). Please explain in words the main insights you gain from this figure.
- (c) Suppose the company is considering adding a new product, which will be a flight from Dublin to London at a premium fare for £200, for which it estimates that the per-period arrival probability will be 1/20. Please explain how you would modify the dynamic program we have discussed in class to accommodate this new product. (Do not implement the changes or run the revised code.)

Question 3:

Identify a relatable setting either based on a service/operation on campus, in London, or your hometown, in which any of the concepts and methodologies we have learned so far can potentially improve the service provider's objective (e.g., maximizing revenue).

Please describe the setting and how you would model/analyse it. Please do not work on the analysis itself yet or provide any results at this stage.

Try to pick a setting that allows a sufficiently rich variation and extension to the examples we have covered in class, that is, ideally, your analysis should not be a very simple variation of the examples we have discussed in class but be challenging and require you to think creatively. If you'd like, and if the setting is relevant and enables a sufficient depth of analysis, you will have the option to expand on your idea as your project work as well.