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SCHEDULING IN QUEUEING SYSTEMS

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The optimal control of arrivals to a service system is an area of research with applications in many industries, for example, manufacturing systems, call centres, hospitals, retail and computer systems. Scheduling is a well-known solution to the problem of controlling arrivals, and a proper scheduling approach can hugely increase a system's efficiency. There are two scheduling approaches: static scheduling and dynamic scheduling. Static scheduling also known as offline scheduling, is where we derive the optimum schedule to achieve desired objectives before starting the service period. On the other hand, dynamic scheduling, also known as online scheduling, considers uncertainties between two consecutive arrivals when deciding the next arrival time. The objectives change from system to system. For example, a surgeon whose time is expensive may prioritise minimising his expected idle time, while nurses at a donor centre may prioritise customers' expected waiting times.

In this thesis, we derive static scheduling models for different queueing systems. We start with a simple single server queueing system with stochastic service times and extend the system to a multi-server system. Our objectives are to minimise a linear combination of customers' total expected waiting cost and the server's total expected idle cost. Our primary aim in this thesis is analysing systems that accept both scheduled and randomly arriving customers. Many real-world scenarios such as medical clinics, barbershops, motor mechanics and restaurants accept randomly arriving customers and customers by appointment. However, the problem of scheduling customers in an environment where random arrivals occur has not been addressed widely. We consider a complicated system with added uncertainty brought by randomly arriving customers on top of the uncertainty of stochastic service times. The objective of this problem is to determine the optimum schedule for N customers so that the total expected

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cost of customers' waiting and that of the server being idle is minimised, whilst the system's expected revenue is maximised. We also consider different systems by changing objectives. Simply stated, this thesis gives an in-depth discussion on the static scheduling approach for determining optimum schedules in different queueing systems.

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