

Parameter Estimation

Earlier, we had defined lead time to be the total time between a customer joining a queuing system and leaving it to be lead time. By simulating an alternative queuing structure we hope to bring reduce our estimate for a food stalls's lead time. This type of problem is of terminating type, as peak periods eventually come to an end, and arrival behaviour changes. As such, we initial the queue by simulating 30 minutes of non-peak queuing behaviour followed by 60 minutes of peak queueing behaviour. The arrival rate of customers is thus non-homogeneous, comprised of both peak and non beak inter-arrival times.

The alternative queuing system is one in which queues are forcefully split, customers are asked to wait in line again at a separate counter, immediately after making an order. This meant that in addition to inter-arrival time, additional sources of randomness originated from the payment time (ie. time taken to a process a payment once the customer reaches the front of the first queue, and before he joins the second queue), as well as the final preparation time (ie. Customers are not served first-come first serve anymore, instead served whenever there order is ready).

Thus, the following population parameters were estimated by collecting queuing behaviour data and modeling parameter distributions:

Initial Model

- Non-Peak Inter-arrival time, $\lambda = \exp(56)$
- Peak Inter-arrival time, $\lambda = \exp(43)$
- Fixed Service time, $\mu = 45$ seconds

Alternative Model

- Non-Peak Inter-arrival time, $\lambda = \exp(56)$
- Peak Inter-arrival time, $\lambda = \exp(43)$
- Payment time, $\mu_p = 20$ seconds
- Food Preparation time, $\mu_f = N(20, 10), min = 10$ seconds