

## Abstract

Bulk-service queues arise in telecommunication networks, transportation and manufacturing systems. Performance analysis of such queues is one of the main issues that need to be looked into for the better management of queues and also to increase the efficiency of the system. The objective of this thesis is to analyze some single-server finite-buffer bulk-service, bulk-arrival bulk-service, queueing models. Further, congestion in queueing system can be reduced by controlling either arrival-rates or service-rates. In this thesis we consider the second approach and analyze some bulk-service queues under batch-size-dependent service.

The thesis consists of seven main chapters and a concluding chapter. Chapter 1 is the introductory chapter where the brief literature survey on various topics of queues and the research interface has been presented.

Chapter 2 deals with the single-server finite-buffer bulk-service queues where customers are served according to the general bulk service rule. We obtain the joint distribution of the number of customers in the queue and number with the server. Several performance measures of interest such as average queue (system) length, average number of customers with the server, probability of blocking and average waiting time of a customer in the queue as well as in the system have been obtained. Similar studies have been carried out in Chapter 3 for bulk-arrival bulk-service queues where customers arrive in batches of random size and are also served in batches of random size.

Performance analysis of bulk-service queue with batch-size-dependent service has been carried out in Chapter 4 under general bulk service rule. It is found that the batch-size-dependent service leads to shorter queue (system) length, shorter waiting time and lower probability of blocking. Similar studies have been carried out in Chapter 5 for bulk-arrival bulk-service queues. Further, a more general bulk-service queue under versatile batch service rule has been analyzed in Chapter 6.

The traffic in modern communication networks is highly irregular (bursty and correlated) with a typical non-Poisson behavior and a good representation of such traffic is a Markovian arrival process (*MAP*). In Chapter 7 a bulk-service queue with general bulk-service rule has been analyzed under Markovian arrival process (*MAP*) and batch-size-dependent service.

**Keywords** Batch-size-dependent service; Blocking probability; Bulk-arrival; Bulk-service; Congestion; Embedded Markov chain, Finite-buffer; Markovian arrival process; Queue; Single-server; Supplementary variable; System length distribution.