Abstract

Performance is one of the key factors that influence the design, configuration and tuning of computer communication systems and queueing models have been efficiently used to obtain these performance measures. In particular, vacation queues have been widely used in modern telecommunication and manufacturing systems. Moreover, in telecommunication systems based on Asynchronous Transfer Mode, the input traffic is highly correlated and bursty. Markovian arrival process is a very good representation of such traffic. The objective of this thesis is to analyze some bulk service vacation queueing models with input as Poisson/Markovian arrival process and suggest computational procedure for computing state probabilities.

This thesis is formed of eight chapters. Chapter 1 is introductory, justifies the purpose and reasons for our work.

In Chapters 2 and 3, we analyze an infinite buffer bulk-service queue with single and multiple vacations in which the inter-arrival and service times are exponentially and arbitrary distributed, respectively. Using the supplementary variable method we obtain the probability generating function of queue length distributions at service completion, vacation termination, departure and arbitrary epochs. We also obtain relations among queue length distributions at arbitrary, service completion and vacation termination epochs. In addition, the evaluation of state probabilities are also discussed. Various performance measures such as the average queue length at arbitrary epoch, the average queue length when the server is busy/on vacation/in dormancy, etc. are obtained.

In Chapters 4 and 5, we consider the finite buffer bulk-service queue with single and multiple vacations where the inter-arrival and service times are exponentially and arbitrarily distributed. The distributions of the number of customers in the queue at service completion, vacation termination, departure and arbitrary epochs are obtained using a combination of the supplementary variable method and the imbedded Markov chain approach. Finally, various performance measures such as the probability of blocking, average queue lengths, etc., are presented.

Chapter 6 deals the finite buffer single and multiple vacations queue wherein input process is Markovian arrival process and service time follows general distributions. The distributions of the number of customers in the queue at service completion, vacation termination, departure, arbitrary and pre-arrival epochs are obtained using a combination of the supplementary variable method and the imbedded Markov chain techniques. Computational procedure has been suggested for computing the state probabilities when the service time distribution is of phase type. In addition, the waiting time analysis is also carried out. Finally, various system performance

measures and some numerical results are presented.

In Chapters 7 and 8, we carry out the analysis of the finite buffer bulk-service queues wit single and multiple vacations where input process is Markovian arrival process. We obtain tl distributions of number of customers in the queue at service completion, vacation terminatio departure, arbitrary and pre-arrival epochs.

Keywords: Bulk service; Computational; Finite buffer; Imbedded Markov chain; Infinite buffe Loss probability; Markovian arrival process; Multiple vacations; Probability generating functio Queue; Relation; Single server; Single vacation; Steady state; Supplementary variable.