Conclusion

CONCLUSION

Threshold policies have been investigated by several authors in applications to queues, where server, who enters an idle period, will start his service again, only when the queue reaches certain level. In some queueing situations, server needs an additional amount of random length called SET, in order to set the system into operative mode before actual service begins. Further from the utility point of view of idle time, the server may take vacations single or multiple whenever the system becomes empty.

Though the vast literature of queueing theory bounds in results of considerable theoretical elegance and significance, the user of various results in different situations and contexts feels that the theory has, a larger extent still remained behind the control of service process or arrival process. However in chapter II, we have analysed models, which deal with the aspects of concerning the control of the arrival process as well as the service process. It is assumed that, not all arriving batches are allowed to join the system at all times. It is also assumed that, the server is subject to breakdowns while doing service. The probability that an arriving batch is allowed to join the system varies according to the system state. The control policy adopted for service is the most general (m,N) policy introduced by Lee and Park (1997). The bi-level control for two Markovian batch arrival queues with server breakdowns, vacations are studied under restricted admissibility in Chapter II.

The batch arrival queues under bi-level threshold control policy considered in Chapter III to V belong to a class of system where the service discipline involves more than one service and this has been receiving a lot of attention recently. The server provides two types of heterogenous service. All the customers undergo First Essential Service (FES) and as soon as the FES of a customer is completed, the customer leaves the system with probability (1-r) or may opt for Second Optional Service (SOS) with probability r. The SOS rule combined with (m, N) policy is studied under single and multiple vacations in

Chapter III and under Bernoulli schedule vacations in Chapter V. The two phase service policy in which customers receive both types of heterogeneous service one after the other before departing the system can be considered as a special case of SOS policy when r=1.

The service policy considered in Chapter IV is multi- optional in the sense that, the server provides C-types of general heterogeneous service and the arriving customers have the option of choosing the i^{th} type of service with probability r_i (i = 1 to c) . It is also assumed that the server is subject to breakdowns at any time while serving.

The models discussed in Chapters II to V are quite general containing a number of arbitrary distributed random variables. These models include many previous work as special cases. The models are successfully described as a Markovian process by using supplementary variable technique. The key PGFs of the steady state system size equations are obtained in a closed form and these PGFs give rise to interesting performance measures. The condition of stability is derived for all the models.

Besides, system size distributions at departure epoch are also obtained. The existence of stochastic decomposition property of the queue size distribution at arbitrary epoch is demonstrated. Finally, the total expected cost function per unit time is developed to determine the optimal thresholds of m and N at a minimum cost. Some numerical examples are presented in order to illustrate the solution procedure of determining the minimum value of total expected cost optimal thresholds m* and N*. The effect of various parameters on the performance measures are also analysed for the models. Through numerical analysis it is observed that the (m,N) policy provides lower average cost than the usual (N,N) policy and the expected length of cycle is longer in (m,N) policy model.

Chapter VI and VII dealt with working vacation queueing models, where the server works under low service rate during vacations rather then completely stopping the service. The models considered in these Chapters are more general than the existing working vacation models, since the arrivals or services occur in batches. Bulk input models under multiple and single working vacations are considered in sections 6.1 and 6.2. The general bulk service rule is adopted for the multiple working vacation models of section 6.3 and Chapter VII. The model analysed in Chapter VII is non-Markovian since the inter-arrival times follow a general distribution. Steady-state arrival epoch system size probabilities are calculated for the non-Markovian model using Embedded Markov chain technique. Many existing queueing systems are proved as special cases of the model.

For the numerical study, the algorithms were implemented in computer programes written in C++, using objective oriented tools. The graphical representations were constructed by means of soft wares Origin 8.1 version and D-plot for 3- D figures and Microsoft Excel 2007 for 2-D line graphs.

The numerical illustrations show that the mean system size increases along with (i) mean arrival rate (λ) (ii) mean service time E(S) (iii) mean vacation time E(V) (iv) mean setup time E(D) (v) the second optional service probability r (vi) the Bernoulli vacation probability p_i (vii) the failure rate α and the (viii) mean repair time $E(B_r)$.

The following are some of the possible extensions suggested for future esearch.

- The waiting time distribution , busy period distribution may be derived for all the models.
- The models of Chapter III ,V,VI and VII may be analysed for unreliable server and the server breakdowns may be allowed to occur during the idle time of the server also.
- The bi-level control policies may be investigated for finite queues and for the systems in which inter-arrival times follow a non-Markovian distribution.