MRP(S) 638/09-10/KLKE 029/UGC/SWRO, dated 30/11/2009 and
MRP(S) 622/09-10/KLKE 029/UGC/SWRO, dated 27.01.2010

Objective of the Minor Research Project

Self -Generation of Priorities and Non-preemptive Service in Queueing/Inventory Models

Self-generation of priorities was introduced in the papers of A. Krishnamoorthy, Viswanath C. Narayanan and T. G. Deepak (Nural parallel and Scientific Computations-Vol-13, P 119-130, 2005), Antonio Gomas Corral, A. Krishnamoorthy and Viswanath. C. Narayanan (Stochastic Models 21: 427-447, 2005) and in the Ph.D Thesis of Viswanath C. Narayanan (submitted at the Department of Mathematics Cochin University of Science and Technology(CUSAT), Kochi-22, 2007).

This is applied to Hospital management, Production inventory, designing of computer processor and so on. For example, in a typical hospital scenario, we come across patients waiting in a queue to consult physicians. While waiting, some patients may turn critically ill. Such patients are either immediately taken to service, bypassing all patients ahead of him in the queue and even the one being examined by the physician. At least, he will get the next immediate chance to be examined by the physician. If the case being examined by the physician is a priority generated one he will have to leave the system in search of emergency service elsewhere.

Retrial queueing models are of great significance, particularly in Communication and Network (the concept of retrials was introduced in queues by Kosten in 1947). In this, customers who could not access the server during his earlier attempt join the orbit of finite or unlimitted capacity and try repeatedly to access the server for service.

We analysed the impact of priority generation and restricted waiting space of customers in a retrial queueing enviornment. Analysed a cost function numerically. FORTRAN-95 is used for numerical computations.

Details of work done and papers published

1. Paper I: **MAP/(PH,PH)/c Retrial Queue with Self-generation of Priorities**; published in the journel 'Bulletin of Kerala Mathematics Association, Vol. 6. No. 1(2010 June) 17-26 '

   In this paper we discuss a multi-server queuing process in which customers in the orbit generate into priority. The capacity of the orbit is unlimited. Each

service is preceded and followed by an idle period which is terminated either by a retrial or by the arrival of a primary customer or by a priority generation. The service discipline is non-preemptive and so a priority generated customer waits until one server becomes free, provided all servers are busy at the priority generation epoch. Thus we assume that a waiting space of capacity c (as many as the number of servers) is provided exclusively for the priority generated customers. We compute numerically the optimal number of servers to be employed to minimize the loss of customers due to priority generation.

2. Paper II: **MAP/PH/1 Multi-priority Retrial Queue with Self-generation of Priorities and Non-preemptive Service**; published in the journel 'Bulletin of Kerala Mathematics Association, Vol. 8. No. 2(2011, Dec.) 195-205'

   A single server multi-priority queueing system with self-generation of priorities is analysed in this paper. Priorities of the classes are labelled $1, \ldots, m$. Customers arrive according to marked Markovian arrival process(MMAP), join the priority class according to the priority at the time of arrival, provided there is vacant space. The least priority class customers do not have waiting space at the service station with the result that if such a customer arrives to find the server busy immediately proceeds to an orbit of unlimited capacity and retries for service. Service times are phase type distributed. It is established that the system is always stable. The system state distribution in the long run is computed. Several performance measures useful for design of an appropriate system, are obtained. A cost function is numerically analysed.

Dr. S. Babu
Associate Professor
Department of Mathematics
University College