World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:10, No:01, 2016

A Two Server Poisson Queue Operating under FCFS Discipline with an 'm' Policy

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Abstract : For profitable businesses, queues are double-edged swords and hence the pain of long wait times in a queue often frustrates customers. This paper suggests a technical way of reducing the pain of lines through a Poisson M/M1, M2/2 queueing system operated by two heterogeneous servers with an objective of minimising the mean sojourn time of customers served under the queue discipline 'First Come First Served with an 'm' policy, i.e. FCFS-m policy'. Arrivals to the system form a Poisson process of rate λ and are served by two exponential servers. The service times of successive customers at server 'j' are independent and identically distributed (i.i.d.) random variables and each of it is exponentially distributed with rate parameter μj (j=1, 2). The primary condition for implementing the queue discipline 'FCFS-m policy' on these service rates μj (j=1, 2) is that either (m+1) μ2 > μ1> m μ2 or (m+1) μ1 > μ2> m μ1 must be satisfied. Further waiting customers prefer the server-1 whenever it becomes available for service, and the server-2 should be installed if and only if the queue length exceeds the value 'm' as a threshold. Steady-state results on queue length and waiting time distributions have been obtained. A simple way of tracing the optimal service rate μ*2 of the server-2 is illustrated in a specific numerical exercise to equalize the average queue length cost with that of the service cost. Assuming that the server-1 has to dynamically adjust the service rates as μ1 during the system size is strictly less than T=(m+2) while μ2=0, and as μ1 +μ2 where μ2>0 if the system size is more than or equal to T, corresponding steady state results of M/M1+M2/1 queues have been deduced from those of M/M1,M2/2 queues. To conclude this investigation has a viable application, results of M/M1+M2/1 queues have been used in processing of those waiting messages into a single computer node and to measure the power consumption by the node.

Keywords : two heterogeneous servers, M/M1,M2/2 queue, service cost and queue length cost, M/M1+M2/1 queue
Conference Title : ICMCSSE 2016 : International Conference on Mathematical, Computational and Statistical Sciences and Engineering
Conference Location : Singapore, Singapore
Conference Dates : January 07-08, 2016