Asian Journal of Applied Science and Technology (AJAST)

(Quarterly International Journal) Volume 3, Issue 4, Pages 73-78, October-December 2019

Utilization of Markovian Model in Queuing Theory in Banking Systems

D.Ravi[1] & Dr.V.Jeyanthi[2]

[1]*Research Scholar, Department of Mathematics, Sree Narayana Guru College, K.G. Chavadi Post, Coimbatore-641105, Tamilnadu, India.*
[2]*Assistant Professor, Department of Mathematics, Sri Krishna Arts and Science College, Coimbatore, Tamilnadu, India.*

Article Received: 17 April 2019 Article Accepted: 09 August 2019 Article Published: 24 October 2019

ABSTRACT

A definitive target of the investigation of queuing frameworks is to comprehend the conduct of their fundamental procedure with the goal that accurate decision choices can be made by the administration. The utilization of queuing ideas is an endeavor to limit cost through minimization of wastefulness and postponements in a framework. Different techniques for taking care of queuing issues have been proposed. In this examination, we have investigated a single – server Markovian queuing model with both appearance and administration times following exponential conveyance with parameters λ and μ, separately, and boundless queue size and boundless client populace. We apply this model to providing food information and gauge parameters for the equivalent. An affectability investigation is completed to assess the strength of the framework. There are numerous circumstances in day by day life when a queue is shaped. Queuing hypothesis is the numerical investigation of holding up queues and it is extremely valuable for breaking down the strategy of the queuing of day by day life of the person. Queuing hypothesis applies in everyday life as well as in succession of PC programming, systems, restorative field, banking segments and so forth. In this work, the essential highlights of the queuing hypothesis and its applications are dissected.

Keywords: Queuing, Markovian, Size, Single-server.

1. Introduction

A queuing framework comprises of the clients and the servers. Holding up queues or queues are in the schools, medical clinics, book shops, libraries, banks, post office, petroleum siphons, theaters and so on. All have Queuing issues. Queues are exceptionally common place in our day by day life. Queuing hypothesis is a part of tasks look into on the grounds that the outcomes are utilized for settling on choices about the assets expected to give the administration. Numerous significant utilizations of the queuing hypothesis are traffic stream (vehicles, airplane, individuals, interchanges), booking (patients in emergency clinics, employments on machines, programs on PC), and office configuration (banks, post workplaces, markets). A.K.Erlang (1878-1929) Danish Engineer who is known as the dad of Queuing hypothesis [4]. He distributed his articles identifying with the investigation of blockage in phone traffic. A queuing hypothesis is the Mathematics of holding up queues. A queuing framework can be portrayed by the progression of units for administration, shaping or joining the queue, if the administration isn't accessible soon, and leaving the framework being served.

The queuing hypothesis is a part of the applied likelihood hypothesis used to depict the more particular numerical models for holding up queues or queues. It utilizes Queuing models to speak to the different kinds of Queuing frameworks that emerge by and by. The models empower finding a suitable harmony between the expense of administration and the measure of pausing. The idea of Queuing hypothesis has been grown to a great extent with regards to phone traffic designing [2]. Queuing frameworks are included customer(s) hanging tight for administration and server(s) who serve the client. They are much of the time seen in certain territories of everyday life, for instance:

- People holding up at the registration counter of an air terminal
- Airplanes landing in an air terminal for landing
- On-queue train ticket reservation framework

- People standing by to be served at a smorgasbord
- Customers hanging tight at a hairstyling salon for a hairstyle
- The sequence of messages anticipating preparing in a mail server

Queues are normally portrayed by the appearance design (Poisson, deterministic or a general appropriation), Service design (consistent, exponential, hyper exponential, hypoexponential or general dissemination), number of servers (single server or numerous servers), most extreme framework limit (number of clients in a framework can go from one to vastness), populace size (queue can have unbounded or limited length) and queue discipqueue (request of administration conveyance can be First In First Out (FIFO), arbitrary request, Last In First Out (LIFO) or needs). All in all, the appearance example of the clients and the administration time dispensed to every client must be indicated probabilistically. Such assistance offices are hard to plan "ideally" as a result of the nearness of the haphazardness component in the appearance and administration designs. A numerical hypothesis has in this manner developed that gives intends to breaking down such circumstances. This is known as the queueing hypothesis (holding up queue hypothesis, blockage hypothesis, the hypothesis of stochastic help framework), which dissects the working attributes of a queuing circumstance with the utilization of likelihood hypothesis.

Instances of the qualities that fill in as a proportion of the presentation of a framework are the "normal holding up the time until the administration of a client is finished" or "the level of time that the administration office isn't utilized" (the servers in the framework are inactive). Accessibility of such measures empowers experts to choose an ideal method for working such a framework. Queuing hypothesis assumes a significant job in demonstrating genuine issues including clogs in vide regions of applied sciences. Uses of queuing with anxiety can be found in rush hour gridlock demonstrating, business and enterprises, PC correspondence, wellbeing areas, and therapeutic sciences and so forth. Queues with debilitated appearances have applications in PCs with clump employment handling where occupation entries are disheartened when the framework is utilized as often as possible and appearances are displayed as a Poisson procedure with state subordinate appearance rate. The demoralization influences the appearance pace of the queuing framework [6].

Queuing with client restlessness has huge applications in PC correspondences, bio-therapeutic demonstrating, and administration frameworks and so on. Note that the predominance of the marvel of client anxiety has an extremely negative effect on the queuing framework under scrutiny. On the off chance that we talk from a business perspective, the organizations lose their potential clients because of client fretfulness, which influences the matter of firms all in all. On the off chance that organizations utilize certain client maintenance methodologies, at that point, there are chances that a specific portion of restless clients can be held in the queuing framework. A fretful client (due to reneging) might be persuaded to remain in the administration framework for his administration by using certain persuading instruments. Such clients are named as held clients.

2. Related Work

Client restlessness has turned into the consuming issue of private just as government segment ventures. Queuing with reneging is right off the bat examined by Haight [1]. He contemplates the issue like how to settle on judicious choice while holding up in the queue, the plausible impact of this choice and so on. Ancker and Gafarian [2] study

the M/1/M N queuing framework with recoiling and reneging and play out its unfaltering state investigation. Ancker and Gafarian [3] additionally acquire results for an unadulterated shying away framework (no reneging) by setting the reneging parameter equivalent to zero. Multi-server queuing frameworks with client fretfulness discover their applications in numerous genuine circumstances, for example, in medical clinics, PC correspondence, retail locations and so on. Xiong and Altiok [4] study multi-server queues with deterministic reneging times concerning the break component utilized in overseeing application servers in exchange handling situations. Wang et al. [5] present a broad survey on queuing frameworks with anxious clients.

Kapodistria [6] thinks about a solitary server Markovian queue with fretful clients and considers the circumstances where clients relinquish the framework at the same time. He thinks about two surrender situations. In the first, all present clients become anxious and perform synchronized abandonments; while in the subsequent situation, the client in administration is prohibited from the relinquishment strategy. He stretches out this investigation to the M/M/c queue under the second relinquishment situation too. Kumar [7] examines a related queuing issue with disastrous and helpful impacts with anxious clients that have exceptional applications in light-footed broadband correspondence systems. Kumar and Sharma [8] apply M/M/1/N queuing model for displaying store network circumstances confronting client restlessness. Queuing models where potential clients are disheartened by queue length are examined by numerous analysts in their exploration work.

3. Queuing Model

Queues (holding up queue) are a piece of regular day to day existence. Giving a lot of administration includes unnecessary expenses. What's more, not giving enough help limit makes the holding up queue exorbitantly long. A definitive objective is to accomplish a financial harmony between the expense of administration and the expense related to the hanging tight for that administration. The queuing hypothesis is the investigation of holding up in all these different appearances. Shaping a Queue being a social wonder, it is fundamental to the general public on the off chance that it tends to be overseen with the goal that both the unit that pauses and the one which serves get the most advantage [7].

The Queuing model is normally named as M/M/c/K, where first M speaks to Markovian exponential dispersion of between appearance times, second M speaks to Markovian exponential circulation of administration times, c (a positive whole number) speaks to the number of servers, and K is the predefined number of clients in a queuing framework. The queuing model of M/M/1 is spoken to in figure 1.

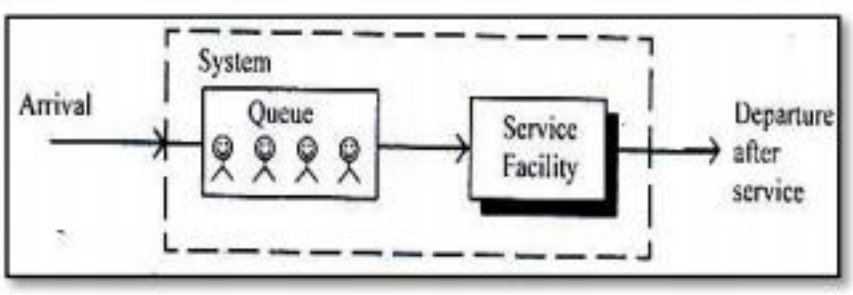

Figure No: 1 Queuing Model

 Online ISSN: 2456-883X

This work depicts a procedure intended to help the basic leadership process by the banks to fulfill the need. To decide an ideal number of servers, the queuing hypothesis is applied. The impact of queuing in connection to the time spent by clients to access bank administrations is progressively turning into a significant wellspring of concern.

This is because keeping clients standing by too long could result in a cost to them (holding up cost). Giving a lot of administration the ability to work a framework includes over the top expense. In any case, not giving enough assistance limits brings about over the top holding up time and cost. In this investigation, the queuing qualities at the banks were examined utilizing a queuing Model. The Waiting and administration Costs were resolved with the end goal of deciding the ideal assistance level.

4. Markovian Model for Queuing Theory

In Markovian models, the examination is led utilizing the memory-less property of exponential circulation [8]. A queueing framework can be spoken to by a Markov chain (states and change rates). We utilize the number of clients in the framework to speak to the condition of the framework. In this way, we have two states (0 and 1). The progress rate from State 1 to State 0 is μ and the change rate from State 0 to State 1 is λ.

- In-State 0, the difference in the state happens when there is an appearance of clients and the holding up time is exponentially appropriated with parameter λ.
- In-State 1, the difference in the state happens when the client completes his/her administration and the holding up time is exponentially disseminated with parameter μ.
- Recall that from the no-memory property, the hanging tight time dispersion for change of state is a similar free of the previous history (for example to what extent the client has been in the framework).

There is a holding up space of size n − 2 in the framework. A showed up client will leave the framework just when he finds no holding up space left. This is an M/M/1/n − 2 queue.

We state that the framework is in the state I if there are I clients in the framework. The base number of clients in the framework is 0 and the greatest number of clients is n − 1 (one at the server and n − 2 holding up in the queue). Along these queues, there are n potential states in the framework. The Markov chain of the framework has appeared in figure 2.

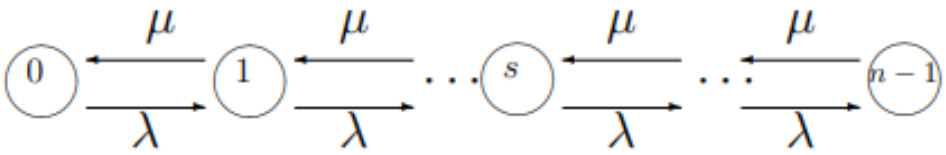

Figure No: 2 The Markov Chain Model

The generator matrix is given by,

$$\begin{array}{c} \\ 0 \\ 1 \\ 2 \\ \vdots \\ \vdots \\ \vdots \\ n-2 \\ n-1 \end{array} \begin{array}{c} \begin{array}{ccccccccc} 0 & 1 & 2 & 3 & \cdots & n-3 & n-2 & n-1 \end{array} \\ \begin{pmatrix} -\lambda & \mu & & & & & & 0 \\ \lambda & -\lambda-\mu & \mu & & & & & \\ & \ddots & \ddots & \ddots & & & & \\ & & \lambda & -\lambda-\mu & \mu & & & \\ & & & \lambda & -\lambda-\mu & \mu & & \\ & & & \ddots & \ddots & \ddots & & \\ & & & & & \lambda & -\lambda-\mu & \mu \\ 0 & & & & & & \lambda & -\mu \end{pmatrix} \end{array}.$$

Hence the steady state probability vector p is given by

$$\frac{1-\rho}{1-\rho^n}(1, \rho, \rho^2, \ldots, \rho^{n-1})^t.$$

5. Data Analysis

Today banks are one of the most significant units of general society. Most banks utilized standard queuing models. It is helpful to abstain from remaining in a queue for quite a while or in an off-base queue and to offer passes to all clients. The bank is a case of boundless queue length. The queuing is utilized to produce a grouping of clients' appearance time and to pick haphazardly between three unique administrations: open a record, exchange, and equalization, with the various timeframe for the support. The results are illustrated in table 1 and figure 3.

Performance Measures	Accuracy (%)
Arrival Rate	92
Service Rate	100

Table No: 1 Performance Measures

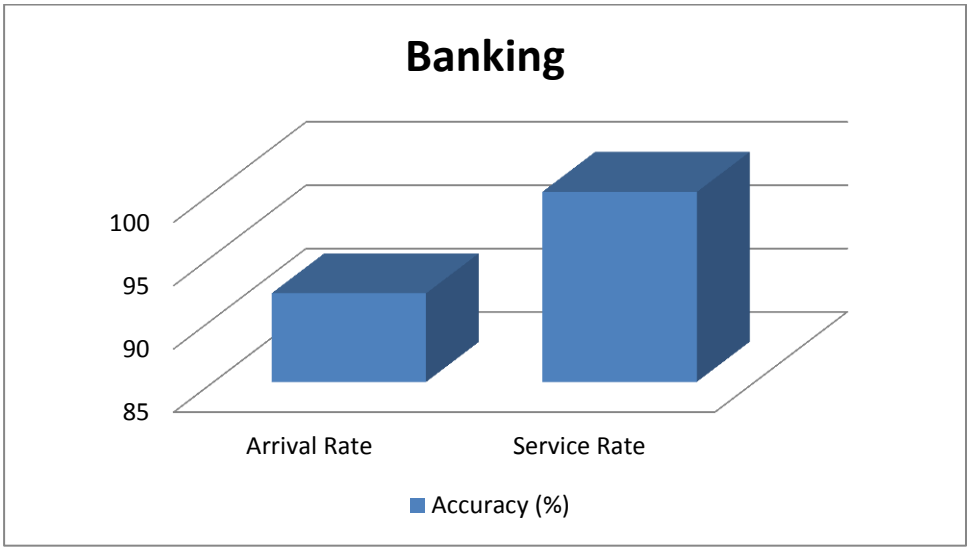

Figure No: 3 Performance Measures

Online ISSN: 2456-883X

To assess and decide the ideal number of servers in the framework, two restricting costs must be considered in settling on these choices: (I) Service costs (ii) Waiting for the time expenses of clients. Financial examination of these costs causes the administration to make an exchange off between the expanded expenses of giving better assistance and the diminished holding up time expenses of clients got from giving that administration.

Expected Service Cost E (SC) = SC_s ------- (1)

Where, S= number of servers, C_S= service cost of each server

Expected Waiting Costs in the System E (WC) = λW_S CW -------- (2)

Where λ =number of arrivals, W_S = Average time an arrival spends in the system

CW = Opportunity cost of waiting by customers.

Adding (1) and (2) we have,

Expected Total Costs E (TC) = E (SC) + E (WC)

Expected Total Costs E(TC) = $SC_S + (\lambda W_S)$

6. Conclusion

The development of the queue is a typical wonder which happens at whatever point the present interest for a help surpasses the present ability to give that administration. Queuing frameworks are valuable all through society. The ability of these frameworks can have a significant outcome on the nature of human life and the efficiency of the procedure. Queuing frameworks are effectively utilized for the exhibition investigation of various frameworks, for example, PC, correspondences, transportation systems and assembling. Furthermore, instances of queuing hypothesis applications are given. This examination gives some essential ideas of the queuing hypothesis and their applications.

REFERENCES

[1] Haight, F. A. (1959). Queueing with Reneging. Metrika. 2:186-197.

[2] Ancker Jr., C. J. and Gafarian, A. V. (1963). Some Queuing Problems with Balking and Reneging. I. Operations Research. 11: 88-100.

[3] Ancker Jr., C. J. and Gafarian, A. V. (1963). Some Queuing Problems with Balking and Reneging. II. Operations Research.11: 928-937.

[4] Xiong, W. and Altiok, T. (2009). An approximation for multi-server queues with deterministic reneging times, Annals of Operations Research, 172:143-151.

[5] Wang, K., Li, N. and Jiang, Z. (2010). Queuing System with Impatient Customers: A Review. 2010 IEEE International Conference on Service Operations and Logistics and Informatics. 15-17 July, 2010, Shandong, pp. 82-87.

[6] Kapodistria, S.(2011). The M/M/1 Queue with Synchronized Abandonments, Queuing Systems, 68:79–109.

[7] Kumar, R. (2012). A Catastrophic-cum-Restorative Queuing Problem with Correlated Input and Impatient Customers. International Journal of Agile Systems and Management. 5:122- 131.

[8] Kumar, R. and Sharma, S.K. (2012). Managing congestion and revenue generation in supply chains facing customer impatience. Inventi Impact: Supply Chain & Logistics. 2012:13-17.