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How Queuing Theory Does Correlate with Our Lives-An Analysis

Preeti Johri[1] and Anuranjan Misra[2]

[1,2]Noida International University, Noida
E-mail: [1]preeti.johri002@gmail.com, [2]amc290@gmail.com

Abstract—*This paper is going to present the applications of Queuing Theory in our day-to-day life. Queuing Theory is the mathematical study of the processes which we handle in daily lives. It will give the calculation of, which process should be handle first and which should be left without handling, which should be given preference or which should not be given. Through this paper of mine, we will discuss the relation of Queuing Theory with our lives. The literature review on the topic will be discussed here. We will give some real live examples to show the relativity of queuing theory. We will discuss various Models in this paper to put some light on various techniques that we follow in our daily routine. It will give you the idea to provide the service to the processes as they enter. This paper discuss about the work previously done for the topic. It will tell you to opt a queuing model to achieve an efficient task according to your need. Queuing theory is generally considered a branch of Operation Research because the results are often used when making business decisions about the resources needed to provide a service.*

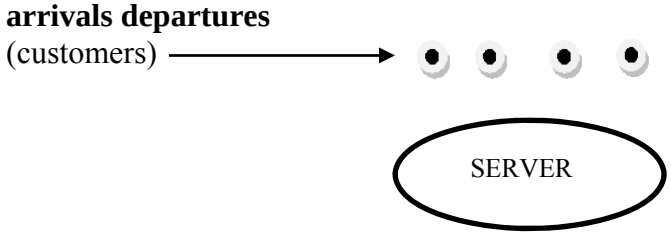
Keywords*: Server, Queuing, Theory, Finite, Infinite, Balking, Reneging.*

1. INTRODUCTION

Queuing theory is the mathematical study of waiting lines, or queues. In queuing theory, a model is constructed so that queue lengths and waiting can be predicted[1]. Queuing theory is generally considered a branch of Operation Research because the results are often used when making business decisions about the resources needed to provide a service[2].

How can we calculate queue lengths and waiting times?

See if we take an example of a Doctor's clinic then the model will be like,



The above example follows Single Server Models.

Since, there is only a single server to process the customers.

Arrival rate, λ=1/mean time between arrivals [13]

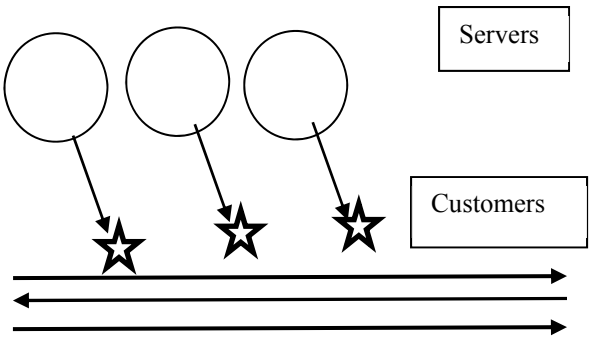
Service rate, μ=1/mean time to serve one customer[13]

And it comes under another category i.e. finite queue length hence, a single doctor can service a finite number of patients[9][10]

Hence, there are 2 type of Models, we can say,

1) Finite Queue length
In finite queue length, there are further 2 categories: -
a) Single Server Models, which we discussed above
b) Multiple Server Models

Multiple Server Models is a model which we can say our reservation system follows, like,



In the above example, there are more than one server is available to process the services. Any server can handle any customer[6].

2) Infinite Queue length

Now, the second type is Infinite queue length. In this type, there is no restriction on the length of queue[15].

2. COMPARISON BETWEEN FINITE QUEUE LENGTH ANDINFINITE QUEUE LENGTH

1) Length is fix	1) Length is not fix
2) Balking chance occurs(means when the person cannot join the line beyond the limit.)	2) Reneging(means person can join upto any no. because there is no limit but cannot be processed.)
3) Example: - A garage has the capacity of 10 vehicles. Hence, this is the limit. So, the mechanic will service only 10 vehicles at a time.	3) Example: - A service station has the capacity of 100 cars. In the meanwhile a 101 car has arrived for the service then they will give space to that car also. It will process after some time. Hence, there is a dedicated team.

3. REAL LIFE EXAMPLES FOR QUEUING THEORY ARE:

1) Fast Food:- McDonalds, Burger King,…..
2) Retail:- Supermarkets, Stores, Banks,…..
3) Medical:- Doctor's office, access to diagnostic procedures, specialist referrals
4) Airports:- Check-inn, baggage collection, runway delays, waiting to land
5) Traffic:- Congestion

4. SERVICE DISCIPLINES

Various scheduling policies can be used at queuing nodes:

First in first out

This principle states that customers are served one at a time and that the customer that has been waiting the longest is served first.

Last in first out

This principle also serves customers one at a time, but the customer with the shortest waiting time will be served first. Also known as a stack.

Processor sharing

Service capacity is shared equally between customers.

Priority

Customers with high priority are served first.Priority queues can be of two types, non-preemptive (where a job in service cannot be interrupted) and preemptive (where a job in service can be interrupted by a higher priority job). No work is lost in either model.

Shortest job first

The next job to be served is the one with the smallest size

Preemptive shortest job first

The next job to be served is the one with the original smallest size

Shortest remaining processing time

The next job to serve is the one with the smallest remaining processing requirement.

Service facility

- Single server: customers line up and there is only one server
- Parallel servers: customers line up and there are several servers
- Tandem queue: there are many counters and customers can decide going where to queue
- Customer's behavior of waiting
- Balking: customers deciding not to join the queue if it is too long
- Jockeying: customers switch between queues if they think they will get served faster by so doing
- Reneging: customers leave the queue if they have waited too long for service

5. LITERATURE REVIEW

List of the topics on which work has been done along with the concern researchers.

1) The monitoring of the Network Traffic Based on Queuing Theory	PalashSahoo, 2011
2) A Queuing model of hospital congestion	PouyaBastani ,2009
3) Queuing theory for healthcare operations management	Albert Imahsunu
4) Sub-optimization of bank queuing system by qualitative and quantitative analysis	A Ullah, X Zhang, K Iqbal, M Ayat
5) Trading time in a Congested Environment	Luyi Yang, Laurens Debo and Varun Gupta
6) Analysis of Ticket Queues with Reneging Customers	Ding Ding, JihongOu, Soo Keng
7) Modeling the Behaviour of Patients Who leave the Ed Without Being seen	Ehsan Bolanfifar, Nicole DeHoratius, Tava Olsen and Jennifer L. Wiler
8) Queuing Dynamics and State Space Collapse in Fragmented Limit Order Book Markets	CostisMaglaras, Ciamac C. Moallemi and Hua Zheng

9) Managing Long Queues in Seasonal Sales Shopping	Chun Qiu and Wenqing Zhang
10) Bridging genetic networks and queuing theory	A Arazia
11) A self-clocked fair queuing scheme for broadband applications	SJ Golestani, INFOCOM'94. Networking for Global….1994
12) Finite queues in series with exponential or Erlang service times- a numerical approach	FS Hillier, RW Boling Operation Research, 1967 (pubsonline.informs.org)
13) Queuing systems with vacations- survey	BT Doshi- Queuing systems, 1986 springer
14) Performance analysis of cloud computing centers using m/g/m/m+r queuing systems	H Khazaei, J Misic, VB Misic- Parallel and Distributed Systems(2012)
15) Applications of queuing theory in healthcare	R Mehandiratta, International Journal of Computing and Business Research, 2011
16) Discrete Simulation and Animation for Mining Engineers	John R. Sturgul, 2015

6. CONCLUSION

Queuing theory is a major system in our society. Every person has had to stand in line at one point in their lives. Understanding queuing theory helps businesses compensate for these waiting periods.

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