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A BRIEF EXPLANATION ABOUT QUEUING MODELS

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ABSTRACT: -

Queuing model is the branch of mathematics that studies waiting in line. Queuing model help to improve the service efficiency and increase the customer satisfaction. It gives advice to increase the no. of servers which help to give better service to the customer. This method also reduces the wastage of time of customer. Queueing models provide the analyst with a powerful tool for designing and evaluating the performance of queueing systems. The main aim is to achieve an economic balance between the two related costs i.e., cost of service and the cost associated with the waiting for that service. Queuing theory is the study of waiting in all these various guises.

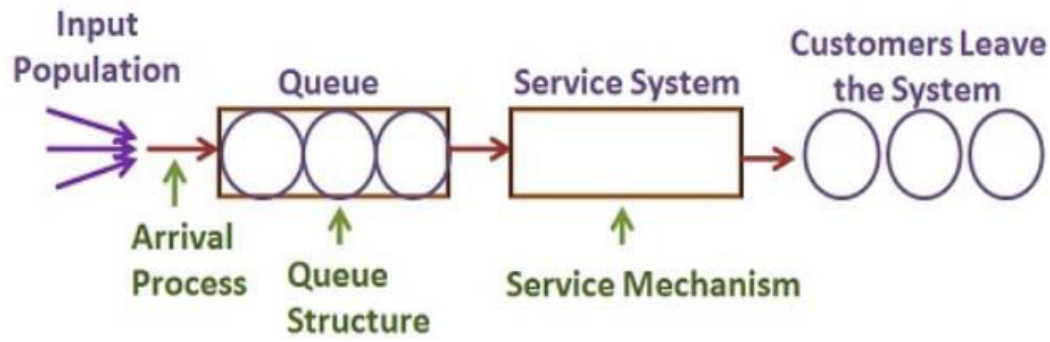
KEYWORDS: -

Queuing theory, little's theorem, Kendall notation, waiting lines.

INTRODUCTION: -

The queuing model are very helpful for determining how to operate a queuing system in the most effective way if too much service capacity to operate the system involves excessive cost. Queuing theory is a powerful tool to analyse the daily phenomenon of waiting in line. Queuing theory refers to the mathematical study of the formation, function and congestion of waiting lines or queues. Queuing theory check the entire system of waiting in line, including elements like the customer arrival rate, number of servers, number of customers, capacity of waiting area, average service completion time and queuing discipline.

STRUCTURE OF QUEUING SYSTEM: -



CREATION OF QUEUING THEORY: -

Queuing theory was first introduced in the early 20th century by Danish mathematician and engineer Agner Krarup Erlang.

Erlang worked for the Copenhagen Telephone Exchange and wanted to analyse and optimize its operations. He sought to determine how many circuits were needed to provide an acceptable level of telephone service, for people not to be "on hold" (or in a telephone queue) for too long. He was also curious to find out how many telephone operators were needed to process a given volume of calls.

REASON OF QUEUE: -

A queue is formed when a customer is made to wait due to the fact that number of customer are more than the service provider.

REASON TO STUDY QUEUE: -

1)To find out the cost of offering the service.

2)To find out the cost incurred due to delay in offering service.

3)To allocate the resource.

TYPES OF QUEUING SYSTEM: -

Queuing theory uses the Kendall notation to classify the different types of queuing systems using the notation *A/S/c/K/N/D, here*

- ***A*** is the arrival process
- ***S*** is the mathematical distribution of the service time
- ***c*** is the number of servers
- ***K*** is the capacity of the queue, left out if unlimited
- ***N*** is the number of possible customers, left out if unlimited
- ***D*** is the queuing discipline, assumed first-in-first-out

CUSTOMER BEHAVIOUR

1) **Balking**: - By seeing the number of customers already standing in the queue or by predicting the waiting time, customers do not join the queue.

2) **Reneging**: -After joining the queue, customers wait for some time in the queue but leave before being served because of some reasons.

3) **Jockeying**: -Customers shift from one queue to a new one with the hope of receiving service more speedily.

QUEUE DISCIPLINE: -

1) Static Queue Disciplines:
   First come first served (FCFS)
   Last come first served (LCFS)

2) Dynamic Queue Disciplines:
   Service in random order (SIRO)
   Priority service

TYPES OF QUEUING MODEL: -

1)Single server queuing model
   a) with unlimited queue & FCFS
   b) with unlimited queue & SIRO
c)with limited queue & FCFS

2)Multi server queuing model
   d) with unlimited queue & FCFS
   e) with limited queue & FCFS

3)Finite population queuing model
   f) single server finite population
   g) multi server finite population

QUEUING EXAMPLE: -

System	Customer	Server
Reception desk	People	Receptionist
Hospital	Patient	Nurses
Airport	Airplanes	Runway
Road network	Cars	Traffic light
Grocery	Shoppers	Checkout
Station computer	Jobs	CPU, disk, CD

ANALYTICAL FORMULA:-

1)Probability that the queuing system is idle: - $P_0=1-\rho$

2)Average no. of customers in the system: - $Ls=\rho/(1-\rho)$

3)Average queue length: -$Lq=Ls * \rho$

4)Average waiting time of a customer in the queue: -

$$Wq=\lambda/\mu(\mu-\lambda)$$

5)Average waiting time of customer in the system: -

$$Ws=1/(\mu-\lambda)$$

6)Probability of n customers in the system: -

$$Pn=\rho^n(1-\rho)$$

7)Probability of 'n' customers arriving in time 't': -

$$P_t(n)= \frac{(\lambda t)^n e^{-\lambda t}}{n!}$$

LITTLE LAW

Little's Law connects the capacity of a queuing system, the average time spent in the system, and the average arrival rate into the system. The formula is written as follows:

$$L = \lambda W$$

Where:

- ***L*** is the average number of customers in the system
- ***λ*** (lambda) is the average arrival rate into the system
- ***W*** is the average amount of time spent in the system

IMPORTANCE OF QUEUING THEORY: -

Waiting in line is a part of everyday life because as a process it has several important functions. Queues are a fair and essential way of dealing with the flow of customers when there are limited resources. Negative outcomes arise if a queue process isn't established to deal with overcapacity. For example, when too many visitors navigate to a website, the website will slow and crash if it doesn't have a way to change the speed at which it processes requests or a way to queue visitors. Queuing theory is important because it helps describe features of the queue, like average wait time, and provides the tools for optimizing queues.

APPLICATION OF QUEUING THEORY: -

Queuing theory has been applied to a wide variety of business situations. All situation where customers are involved such as restaurants, cafeterias, departmental stores, cinema halls, bank, post office, petrol pumps, airline counters, patients in clinic, etc. are likely to have waiting lines.

A problem that has to be successfully solved by waiting line theory is the determination of the proper number of docks to be constructed for trucks or ships.
Queuing method has also been used for the problem of machine breakdown and repairs.
Queuing theory has also been applied for the solution of
a) Scheduling of mechanical transport fleets.
b) Minimization of congestion due to traffic delay at tool booths.
c) Solution of inventory control problems.
d) Scheduling of jobs in production control.

CONCLUSION:-

In general speaking, queuing system or waiting line are widely used in each area in the world nowadays. In our essay, we mention about the past for the queuing system, the queuing using presently, and how the queuing system will change or develop in the future. Also, the essay includes three industries that using queuing system or waiting line, for example, how queuing system and waiting line use in the company or industry, how the queuing system or waiting line change the port berth design and transportation system and so on. In the future, queuing system or waiting line will be more widely use in all kinds of area for all kinds of professions. Moreover, queuing system or waiting line will turn into a new situation

REFERENCE: -

[1] Dr. Umesh Sharma; Kajal Garg. "A Queuing Model for Improving the Management of Oxygen Cylinder in COVID-19." Volume. 6 Issue. 5, May - 2021, International Journal of Innovative Science and Research Technology (IJISRT), www.ijisrt.com. ISSN - 2456-2165, PP: - 729- 731.

[2] Dr. Umesh Sharma; Kajal Garg." IMPACT OF QUEUING THEORY IN WHOLE PROCESS IN BUSINESS FROM MANUFACTURE TO CONSUM Authors," Year: June 2021 | Volume: 8 | Issue: 1, International journal of Innovative Research in Technology, editor@ijirt.org Page No: 297-300

[3] Priyanshi, Dr. Umesh Sharma, "QUEUING THEORY APPLIED IN PROFESSIONAL LIFE", IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348- 1269, P- ISSN 2349-5138, Volume.8, Issue 2, Page No pp.778-783, June 2021.

[4]Jin,D., & Zhang, H. (2012). Advanced Research on Engineering Materials, Energy, Management and Control: Selected, Peer Reviewed Papers of the 2012 Second International Conference on Engineering M aterials, Energy, Management and Control (MEMC2012), March 17-18, 2012, Wuhan, China. Durnten-Zuerich, Switzerland: Trans Tech Publications.

[5]Wang,Y., Shi, P., Li, K., & Chen, Z. (2012). An energy efficient medium access control protocol for ta rget tracking based on dynamic convey tree collaboration in wireless sensor networks. International Journ al of Communication Systems, 25(9), 1139-1159. doi:10.1002/dac.2355

[6] Hanna, M. E. (2012). Waiting lines and queuing theory model. In B. Render, Quantitative Analysis (p. 499).

[7] Mordfin, R. (2015). why long lines can be good for shoppers, and business. chicagobothreview