A STUDY ON CONVENTIONAL BULK QUEUES IN QUEUEING MODEL

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Abstract

The study on bulk arrival and batch service queueing models is discussed in this article. The mathematical logic of queueing models is crucial in many industries, especially in production lines, to minimize congestion issues. This survey seeks to review and model different occurrences in the area of bulk queues with vacations, breakdowns, and repairs. This research goals to provide enough information to analysts, researchers, and industry professionals to simulate congestion problems and create various performance measures to improve the queueing model.

Keywords: Bulk Arrivals and Batch service,Vacations,Breakdown and Repairs.

1. Introduction

“Queuing theory" is an application of stochastic processes in Operations Research. Predictions of waiting times and the duration of the server(s) are busy are heavily reliant on the concept of “stochastic processes". The inventor of queueing theory was Agner Krarup Erlang (1909-1917), a Copenhagen telephone exchange engineer. The idea was not recognised as having a variety of uses until after World War II. Erlang was the first to address congestion issues in the early twentieth century. His work motivated engineers and mathematicians to use probabilistic methods to solve queueing problems. Many of these findings have been applied to fields such as operations research, computer science, telecommunications, traffic engineering, and reliability theory.

The idea of bulk queues has exploded its popularity in recent years, because of the congestion concerns that have occurred in communication/computer networks and industrial/manufacturing systems. Consumers arriving in large groups or in quantity at a post office, ships arriving in a port in a column, or a few ideas include people going to a restaurant. In many cases, such as an unreliable server,a vacation, and so on,bulk queues can be used.
In this review, a study on conventional bulk queues has been done. We assumed that the bulk queues are supervised by an arbitrary distributions. The structure of the paper is as follows: batch arrival and bulk service are analysed in section 2, Bulk queues with different vacations are investigated in section 3. Bulk queues with breakdown and repairs are presented in section 4. Finally, section 5 discusses the final notes and the summary of the survey.

2. Bulk Arrival and Batch Service

In many real-world queueing situations, the arrival of more than one customer at the same time is called a “bulk queue". Bulk queues can be employed in a number of different production

scenarios and manufacturing processes. Mathematical modelling of bulk arrival and service queues yields various performance measurements for analysing assembly line systems. The optimization method can be used to set the server's minimum and maximum capacities. The group of arrivals can be determined by using a random variable or by a predetermined quantity. This is a challenging problem to solve on a large scale, both mathematically and practically.

Neuts [1] classified bulk queues with Poisson input. The output process has been described as the length of the queue in discrete and continuous time. Customers enter at a counter to a homogeneous Poisson process rate and subsequent service times are conditionally independent. The embedded semi-Markov Process approach has been the subject of the investigation. A single server queue(SSQ) with service interruptions was described by Takine and Sengupta [5]. They have measured the length of a SSQ and the distribution of waiting times during service problems. They have also considered arrivals according to the Markovian Arrival Process (MAP). "bulk service queue with accessible and non-accessible batches at discrete times" was obtained by Goswami et al. [9]. They evaluated steady state probability for both finite and infinite buffers in this model. Numerical results were used to demonstrate the utility of the model variables. Al-Khedhairi [10] studied the Bernoulli schedule which was used to choose and re-service services in a bulk service queue (BSQ). Results were obtained in both discrete and continuous time for the proposed queueing model. In addition, the real-time scenarios includes an explicit explanation of service and re-service types. Sanjeet Singh and Naveen Kapil [21] investigated the system had been in an idle state before the appearance of a client, and once it's in a working state, it may breakdown, and the system may progress on vacation during that time.

Pradhan et al. [24] was completely researched "An infinite-buffer batch-size-dependent batch-service queue with bunch of arrivals and arbitrary serving capacity". It was demonstrated that the Probability Generating Function(PGF) for line content at the service completion time may be used to obtain the probability distributions for departure periods and related performance characteristics. Schwarz and Martin [25] introduced a new discrete-time Markov chain-based approach. The Supplementary Variable Technique(SVT) was used to investigate extensively spread inter-arrival and service times. The suggested technique provides detailed probability distributions for crucial performance indicators such as length of the queue, waiting time, departing batch size, and non-empty batch inter-departure period. Rashmita Sharma [27] examined "$G^X/G/m$ queueing model with finite capacity using the diffusion approximation approach". The two boundaries connected to the fundamental return procedure have been placed at 0 and N for the aim of the result. In this paper, equations for the steady-state distribution, the No. of clients, delay opportunity, and suggest line period have been obtained.

Madhu Jain [31] explained "priority queue with batch arrival, balking, threshold recovery, unreliable server, and optimal service". They explored a SSQ system with two situations of priority for clients: high priority and low priority. Priority clients are admitted with preemptive priority over low-priority clients. Under the priority rule, customers of various classes are suitable to gain varying levels of quality of service. In the event that the server fails while delivering service to priority customers, it is instantaneously transferred for repair. The queue size distribution and other performance indicators were calculated using the matrix geometric method (MGM). Bruneel et al. [33] analysed a discrete-time double-class SSQ system with bulk service at arbitrary slot borders, calculated the steady-state PGF of the No. of clients in the station, and visualised the effect of different arrival process parameters on the average system occupancy. Charan Jeet et al. [34] investigated the waiting time, under the ideas of a Bernoulli feedback (BF) schedule and the maximum entropy principle was used to analyze a bulk arrival unreliable queue with necessary (optional) services. Sushil Ghimire et al. [35] investigated the batch QM with multiple servers. Customers are served individually if there are fewer than the batch size. They also evaluated the probability distribution and performance characteristic of the size of the queue and the waiting time spent for both scenarios. Krishna moorthy et al. [36] examined the client has the option of joining a service at any time within the stages. The service rate at each stage is determined by both the stage and the number of clients serviced in a batch. An analysis based on performance characteristic had been developed, and it was presented to obtain the effect of service rates on

this cost function. Gupta and Pradhan [37] analyzed a batch-service line with unlimited buffers and a Markovian arrival procedure, extensively distributed service time at the batch's departure time, and they were suitable for developing a bi variate vector generating function for system size and server content distribution.

Geetha et al. [41] described the queue parameter was estimated and predictor analysis was performed on non-parametric bulk arrival fuzzy queueing systems. The inverse participation function of the k-stage fuzzy queueing model was initially created, followed by a proposal for a system performance algorithm. The optimality level of the interval was investigated as well as the system's level of uncertainty. Shavej Ali Siddiqui [46] focused on an interdependent system with a BSQ model with distinct capacity. Queueing models with arrival and service procedures that are both Poisson which follow a bi variate Poisson process were studied. These models system characteristics are investigated. Santhi and Saravanan [49] proposed a cloud computing architecture model for examining performance metrics like waiting time for different i-classes of public cloud customers or units accessing cloud databases in size K batches. The overall waiting time and the No. of consumers in the system showed a substantial difference in simulation results. Sinu Lal et al. [51] examined the batch size, which has been decided by the No. of emergency clients waiting in line. This model was shown in a courier delivery system with two different kinds of arrivals, created by a matrix analytic method (MAM). Hemanth Kumar et al. [53] studied the SSQ model with non-homogeneous arrival rates and batch size distribution factors reached system performance measures, which were determined to be significant. Djamila Zirem et al. [56] analysed a bunch of arrivals in queue that included general retrial time, breaks, repairs, and reserved time. In this situation, customers are expected to arrive via compound Poisson process(PP). Cognitive radio networks and manufacturing systems, for example, could benefit from this paradigm. The average queue length in orbit has been determined, as well as system performance metrics.

Yahya Mohamed and Karthikeyan [60] provided an analysis of group arrivals in QM. Bulk queueing models are very helpful in resolving the problem of congestion. A review of the work completed on bulk queues was attempted with this survey and modelling of different phenomena. Kunpeng Yang and Hangguan Shan [61] explored "A tandem open-queuing network with multiple Geo/Geo/1 customers and a server-based bulk service queue". The primary goal of this project is to examine the usual delay as well as the likelihood of overflow for each customer's message going through the system. Alexander Zeifman et al. [63] provided a technique for estimating "convergence bounds for four kinds of multi server queueing systems with an non homogeneous $M/M/S$ queueing system" with probable state-dependent arrival and service strength, as well as possible to arrival of groups and bulk service. Cruz et al. [64] derived various performance metrics for "General bulk-arrival Markovian multi-server finite queues" and investigated their operation in limited-sample conditions.

Jitendra Kumar and Vikas Shinde [67] investigated the performance of bulk queues with several servers using a queue model. In this research, they have presented explicit mathematical formulae for real-world problems such as customer transmit procedure for bulk queues with multi-servers, and this model can be investigated with time-dependent arrival and service rates. MATLAB-9 was used to calculate the numerical results. Kirupa and Udaya Chandrika [68] presented the steady state analysis(SSA) for "an unreliable batch arrival retrial G-queue with M service modes, priorities, active breakdown, delayed repair, and orbital search". PGF have been used to determine the No.of consumers in orbit and in the system. Barbhuiya and Gupta [69] derived an entirely new method for testing the $GI^X/M^Y/1$ queue used to the SVT and the difference equation method to carry through the entire analysis and obtain explicit expressions of system content distributions before the arrival of any time epoch. Atina Ahdika [73] developed a queuing model for a tiny system that integrates dual servers and multi phase processing into a single system. Customers arrive in bunches, and each server has a separate service time. This model was created on the basis of the birth-death process to address the problem of system performance measures. It was calculated by using the global balance condition. Nithya and Haridass [74] studied the purpose of modelling and simulating a bulk queueing system. They

investigated the performance metrics and provided simulation modelling for the textile industry in a group of arrival and service queueing systems. Gupta and Banerjee [75] analysed a bulk arrival and service on a finite buffer queue with line length and batch size dependent service. In a steady state, a SS offers a service that meets the fundamental bulk service criteria. Depending on queue length, the service time distribution followed any generic distribution and represented batch size. The SVT and embedded Markov chain methodology were used to enumerate the joint probability of queue length.

Gupta et al. [76] investigated bulk service queues that has a finite capacity and two vacation rules: Single Vacation(SV) and Multiple Vacation (MV). The service time was supposed to come after a generic form distribution, which has been dependent on the batch size being served. Vacation time was determined by the length of the queue at the moment of vacation inception. Andrew Daw and Jamol Pender [77] discussed the impact of bulk arrivals on countless server queues. A Poisson process was considered to determine the arrival epochs with both stationary and non-stationary arrival rates and they examined fixed and arbitrary arrival batch sizes as well as exponentially and generally distributed service duration's. "A multi-class batch-service QM with restricted flexible service capacity and system occupancy" was presented by Jens Baetens et al. [78]. A single batch server creates a queue for all clients of the same class, up to a class-reliant greatest service capacity. They investigated a BSQ with two discrete-time customer classes, focusing on system occupancy during service initiation chances to compute comparability for slow and heavy traffic in order to decrease the numerical involvement generated by highest service capacity.

Madhu Jain and Sandeep Kaur [79] explored a QM with a (p,N)-policy to estimate the validity and possibility of utilizing the SVT and maximum entropy principle (MEP) to produce different performance measure outcomes. Sree Parimala [82] examined the $M/M(a,b)/(2,1)$ queueing model with heterogeneous servers and batch-based delayed vacation for slow down servers. The two fundamental aims of queueing theory as a whole have been simplified to client wait times and queue length. The quick server has always been existing in the system, but the slow server can only take a postponed vacation. Singh and Srivastava [83] explored the Markovian queueing model with group of arrival and three categories of bulk services,the 1^{st} is a mandatory service, the 2^{nd} and 3^{rd} are optional services depending on the customers preferences. This effort will aid in reducing client wait times at service stations,when they will be dealing with one or more servicing facilities. Bank and Samanta [85] derived the steady-state queue -length distributions of the BMAP/BMSP/1 queue by using analytical results at random, pre-arrival, and post-departure epochs. They have also done a detailed investigation of the system-length distribution at arbitrary time by applying the MGM.

Bharathi Ramesh Kumar et al. [86] discussed that the estimation theory was used to examine the system performance in $FM/FM^{(k)}/\infty$. Initially,they have applied Alpha-cut approach to convert an Erlang queueing system into a fuzzy Erlang system. Finally,the defuzzification values can be measured by using the Robust ranking approach. Deena Merit and Haridass [88] analysed flexible general batch service (FGBS) queueing model to constrict the resting time of consumers. The server starts serving when the required number of consumers is available. Customers that have already arrived must stay for the duration of this period, regardless of when they arrived. This research developed the FGBS rule to enable batching flexibility in production.

3. Bulk Queues with Different vacations

Initially Doshi [2] investigated queueing systems in combination with vacations. They concentrated on single-server queues. There has been quite a little work accomplished on multi-server queues with vacations. A few generic decomposition outcomes and the technique utilised to attain these conclusions are explained for two vacation models. Only in single-server vacation(SSV) models with general arrival procedures is the simple deconstruction known when the vacation order is unaffected by the arrival and service operations. Lee et al. [3] investigated "M^X/G/1 queueing system with MV and N-policy". When the system has been emptied, the server is

shut off. When the queue length attain or surpass a predefined value N (threshold),the server is activated and proceeds servicing consumers.

The single vacation model with probabilistic measures and thresholds was the main focus of Lee et al. [4]. They devised a method for reducing the system's long-term average cost. Arumuganathan and Jeyakumar [7] established "steady-state conditions for batch queueing models deals with N-policy MV, set-up and close-down times". They analysed this model uses to the SVT deals with the appropriate numerical illustration. Many performance indicators such as predicted queue length,anticipated length of busy and idle periods were obtained. The probabilities of the server getting overloaded and of the server which takes a break from the queueing process were also calculated. Chang and Choi [8] explored "a single-server bulk arrival and batch service" in which clients were serviced in arbitrary-size groups and the server took MV when the line was unoccupied. "Discrete time $GI/Geo/1$ queue with working vacation and vacation interruption" was analysed by Tain and Li [12]. The authors of this paper introduced vacation interruption. This is the concept that if there are no consumers,a server goes on vacation. If customers continue in the system after a service has been performed throughout the vacation time, the server will return to normal operations. Otherwise it continues on its vacation.

Samanta et al. [13] proposed "discrete-time $Geo^X/G^{(a,b)}/1/\mathrm{N}$ queues with group of arrival and service under single vacation and multiple vacation policies". The ranges of batch service times and server vacation times has been an integral several's of slot duration. They derived queue size distribution functions at service completion, vacation termination, random, and pre-arrival epochs. Li et al. [14] analysed a single server vacation queue with a general arrival process. The "two policies of working vacations and vacation interruption" have been linked in this model to certain practical problems. The MAM was used to examine the "$GI/M/1$ queue" with these two strategies in order to achieve different performance indicators such as mean length of the queue and pausing time. Li et al. [16] presented "steady state conditions for discrete time batch arrivals and a single service queueing model with working vacations". They modelled the system as an embedded Markov chain(EMC) with a PGF of $M/G/1$ type stationary queue length. In the above scenario, stochastic decomposition was also used to produce an equivalent queue PGF. Zhang and Hou [17] analysed "working vacations and vacation interruptions in an $M/G/1$ queue". They determined the distribution of length of the queue and service status at an random epoch under SSC using the process of a SVT and the MAM. Jeyakumar and Arumuganathan [18] studied "$M^X/G^{(a,b)}/1$ queueing model with multiple vacations, control policy on request for re-service". Re-service has only been offered in this model. if the size of the system is less than the server's minimum threshold value. They were able to generate steady-state conditions along with many performance measures in this investigation by using the SVT and it also includes a cost analysis.

A theoretical replica of a QM that deals with the restricted admissibility policy of arriving batches with multiple vacations has been explained by Haridass and Arumuganathan [20]. The outcome of this research were verified by numerical examples.The above queueing system is also complemented by an optimum cost analysis, which was used to calculate the minimum and maximum capacity of the server. Suganya [22] examined "$M^X/G(a,b)/1$ model with vacation interrupted, optional re service and balking" using the SVT and derived a steady conditions for a batch arrival queueing system. It is feasible to obtain the PGF of system length during any period epoch. Mishra and Pandey [23] considered a bulk queueing model $M/G^k/2$ for two non-identical servers including batch service and a grand vacation process. A few significant performance indicators are incorporated in this model, including a stationary and leaving point system length distribution and the joint distribution of system length and vacation duration. Maragathasundari and Karthikeyan [28] examined a server which may suffer a failure followed by a recover process in the bulk QM. They suggested a two-phase service queueing system, with the 2 phase potentially optional. The server has been allowed to take a long or short vacation when the service is completed, depending on the demands. Kalyanaraman and Nagarajan [29] investigated the arrival of random size X with a "single server, batch service (fixed) with compulsory vacation, and an unreliable server". This representation can be developed by considering the failure interval as a random variable. They have presented several numerical examples to show the model's

analytical compatibility. Jeyakumar and Senthilnathan [32] examined a SSA of a QM with a widely distributed variable batch size service and varied service rates. The PGF of queue size was calculated for any time epoch and for various completion epochs. It has been possible to obtain the models of busy and idle time distributions. Ayyappan and Deepa [38] analysed the steady-state case. They calculated the PGF of the system size for a QM with MV, closedowns, and state-dependent arrival rates and also collected a variety of performance indicators and tested numerically.

Thangaraj and Rajendran [39] designed and investigated "bulk arrival queueing systems with two different cases of service patterns and vacations". The batch service can be distributed in this model and Service will not be disrupted under the suggested technique, if the system length is greater than or equal to the lowest batch size, except during vacation periods. Rajendran and Thangaraj [40] proposed a bulk QM with a single service and vacation, and with the aid of the PGF technique, they were able to identify the suggested model's system size distribution and the performance metrics of the provided queueing system. This investigates group of arrival in QM with dual cases of service patterns on a SV. Vignesh et al. [42] investigated bulk arrival queueing model with multistage heterogeneous service provided by a SS with distinct service time distributions, feedback with BV, and optional server vacation, in addition to restricted admissibility. This study analysed the model's transient solutions, steady-state results, and many performance metrics. Niranjan et al. [47] studied "bulk arrival and service retrial queueing systems with server failures, thresholds, and multiple vacations". Different performance measurements as well as specific cases were examined.The orbit size of PGF at any time epoch was calculated by using the SVT. Niranjan et al. [50] explored "bulk arrival queueing system with server loss and vacation break-off". where the queue length was determined by the service. An ideal cost model was also established for the system, allowing management to decide on the threshold value at which service can start. For the suggested queueing model, the PGF of queue size at all time was computed.This paper also includes other performance measures.

Anitha et al. [52] investigated a queuing system for a consumers are served in three phases, with the first two phases being required and the third optional. After the service has been done, the server can take a short or extended vacation.The PGF of the cloud computing user queue size was determined by using the SVT and a generating function approach. Little's law was used to calculate the models of other performance measures. "State-dependent arrival in a bulk retrial queueing system with active Bernoulli feedback, multiple vacations and threshold" was investigated by Niranjan et al. [54]. The PGF describing the orbit size was examined by using the SVT, and many numerical examples were derived to complement the various performance characteristics. Niranjan et al. [55] examined a bulk service QM with a vacation. Finally, in order to renew their service station, they established a service threshold for the $M^X/G(a,b)/1$queuing system. Niranjan et al. [59] analysed a service QM with WV that was based on bunch of arrivals and batch sizes. Depending on the system size, the server gives a single or fixed-batch service. During WV, the server can provide service in two different modes. The PGF of the queue size at any time was determined. Ayyappan and Supraja [62] investigated "an $M^X/G(a,b)/1$ queueing model with a 2^{nd} optional service that was subjected to server failure and two different vacation and unrestricted admissibility policy". They calculated the PGF of the No. of consumers in the line at a arbitrary interval along with the system size distribution at a departing period in both transient and SSC.

Apoorv Saxena et al. [65] studied "data backup process Quality of Service (QoS) measures" such as the duration of period the supporting server is busy and the repetition of new connections. This approach enables us to easily evaluate the QoS dependent on model parameters and also compute backup parameters. Ayyappan and Karpagam [70] analysed "Bulk queue with an unreliable server, immediate feedback, N-Policy, Bernoulli Schedule MV, and a standby server". The stand-by server has only been used while the main server is being repaired. The main server may be allowed to take a short break when each service is done. The queue size PGF was estimated along with few significant performance measures. Kalyanaraman and Nagarajan [72] studied BV in the $M^{[X]}/G^K/1$ queue. Moreover,the server may suffer a breakdown, causing the

server to wait an unknown amount of time for repairs. This model was examined by using the SVT. “A bulk arrival retrial queue with starting failures and exponentially distributed multiple working vacation" was presented by Pazhani Bala Murugan and Vijaykrishnaraj [80]. Customers utilizing FCFS can connect to the server from orbit. When a server starts to fail, it is immediately dispatched to be repaired. The repair time is completely random. The SVT was used to calculate the PGF for the No. of consumers in orbit.

Karpagam et al. [81] proposed rework and repair processes were essential components of the manufacturing process. When a problem arises and a manufacturing issue needs to be addressed prior to delivery to the customer, these processes must pass the same level of inspection and repair as normal production. Tamrakar and Banerjee [84] discussed an unlimited capacity BSQ with SV and MV by using the SVT and the bi variate generating function method. Steady-state joint probabilities have been established at different epochs. Sadhna Singh and Srivastava [87] investigated the SS Markovian queueing system that has an idle and busy server, a vacation,a failure and recover states. The Markovian queueing model allows for repeated service completion attempts as well as customer impatience. They have compared it to the FCFS and bulk service strategies by calculating the total probability of these scenarios. Ayyappan and Nirmala [89] investigated “customer impatience in a non-Markovian multiple vacations queueing system using an inconsistent bulk queueing model with two types of vacation" on a single server. The server was permitted to take binary sorts of vacations based on queue length, and the PGF of the system size distribution in random and departure time was also examined. Bouchentouf and Guendouzi [90] discussed a single server batch arrival Bernoulli feedback queueing system with waiting server, K-variant vacations and impatient customers. Pradhan and Karan [91] explored of an infinite-buffer batch-size-dependent bulk service queue with server breakdown and multiple vacation.

4. Bulk Queues with Breakdown and Repairs

Madan et al. [6] investigated the steady-state behaviour of two $M^X/M^{(a,b)}/1$ queue model with random breakdowns. They assumed that the recover period for 1^{st} model was exponential, whereas for next it was predictable. In the BSQ model, all writers deal with server breakdown (SB) and a server that can only serve one client at a time, with the exception of Madan et al. [6]. In this research on queueing systems with SB, suspending the server before it has completed its batch of services is practically impossible. Ke [11] studied the operation of batch arrival queues with SB and start-up/close-down times under vacation policies. single vacation and multiple vacation policies are the two cases of vacation policies. when a consumers arrives through a shutdown interval, the server will start instantly and without start-up time.

Wang et al. [15] derived on characterizing the different system performance for the “T-policy of the M/G/1 queue with server breakdown and general start-up times". At least one person must join the queue after the server has been reopened after a specified length of time. The server needs start-up time before starting the service. Jeyakumar and Senthilnathan [19] investigated “$M^X/G^{(a,b)}/1$ QM with MV and close down period". The behaviour of a server failure without interruption. They developed a PGF for the service, vacation, and renovation completion epochs with a close down period. Sumitha and Udaya Chandrika [26] analysed a “batch arrival retrial QM with delay time and multi-stage repair" using for SVT. In a steady state, the PGF of the server state and performance measures has been constructed with numerical results. The model can be discussed in a fuzzy environment. Nithya and Haridass [30] explored a bulk QM with breakdown, batch control, and MV. The PGF for queue size at any time epoch was determined. In particular, a amount model has been developed to produce managerial decisions about how to reduce total costs.

Bharathidass et al. [43] examined the ideas like vacation, break down, and repair on a single server in an Erlang bulk service queue. The whole arrival at the service point through the PP and differing arrival rates depending on the servers position. The units were provided in bunches according to the usual bulk service rules during the k-service phase. Sasikala et al.

[44] examined "The behaviour of the $M^X/G(a,b)/1$ queue in the presence of server breakdown without interruption, multiple vacations, setup time, and N-policy". The proposed queueing systems steady state equations were derived and also developed, along with queue size PGF. Jeyakumar and Senthilnathan [45] studied a variable bulk service QM with various WV and server breakdowns. The queue length has been calculated at different arrival rates, service rates during WV and regular periods of service over an interval of time and finally, a PGF was also obtained on system length at any random period and various completion epochs.

Singh et al. [48] developed a single-repairable server QM with batch input and state-dependent rates. Throughout the repair, the server has to go through a No. of different required steps. The PGF of the queue size distributions are created by using the SVT. Ayyappan and Deepa [57] investigated the steady-state case of a "$M^{[X]}/G(a,b)/1$ queueing model for bulk queues with multiple vacation,close down,essential and optional repair". They determined the PGF of the system size and obtained different performance measures that have been numerically verified. "Analysis of Batch Arrival Bulk Service Queueing System with Breakdown, Different Vacation Policies and Multi phase Repair" was developed by Thangaraj and Rajendran [58]. The queue size distribution and performance indicators of a wide queueing system were constructed, and particular examples of the suggested QM were evaluated.

Ebenesar Anna Bagyam and Udaya Chandrika [66] examined in a proper sequence, the server gives M-phases of heterogeneous service. In a SS retrial queueing model, customers arrive in bunches through a PP. After the 1^{st} stage of service has been completed, the clients have the option of continuing on to the third stage or departing from the server. Deepa and Azhagappan [71] analysed a single group of arrival and bulk service queue with MV close downs and repairs. The server begins a close down and then goes on a random-length MV, if the system is unoccupied or the server is ready to serve after the repair but no one is waiting. The steady-state PGF of the line size at any time was derived by utilizing the SVT. Niranjan and devi Latha [92] investigated two-phase heterogeneous and batch service queuing system with breakdown in two-Phases, feedback, and vacation.

5. Conclusion

This survey aims to assess the work done on bulk queues, which are used to estimate the system in advance and avoid loss by utilising these models to simulate different phenomena. It can aid researchers, operations analysts, engineers, and statisticians in the use of these models. Many workers have combined the concepts of group of arrival and batch service queues with vacations, breakdowns, and repairs. These models can be used to help reduce traffic congestion and act as a source of inspiration for researchers in the field of queueing theory. A wide range of literature has been reviewed, and appropriate citations have been produced. This review provides a comprehensive overview of the incorporation of bulk queues in different scenarios. Batch arrival and bulk service queueing models play a crucial role in forecasting queue lengths, waiting periods, and other performance metrics in queue systems.

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