Performance Analysis of Multiple Data Type Discrete System Through Flow Process

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Abstract: The evaluation of queueing system flow period and service process is a unique and influential concept for analyzing a flow period where every arriving data packet at any value in a system. The service and flow process evolution graphs are constructed and demonstrated in this study to calculate the time it takes for a data packet to flow in a finite capacity mechanism for queueing in discrete time with geometrically dispersed arriving data packets. We calculate the probability of totally possible preliminary states for an information packet to enter and the flow procedure to begin. We used simulation data to validate the derived analytical conclusions for probability mass function of individual beginning state also the whole probability mass function. Finally the structure of this paper in a whole scene using the 3D modelling system.

Keywords: *Queuing System, Flow process, Service process, Probability mass function.*

1. Introduction

The system having more than one data type are very complex to analyze. The discrete time systems in which data is sampled mostly analyzed through the differential equations and Markov chain through flow process, which shows the system behavior [1-3]. The system is probably consists of one server that provides services to the arriving customers in the system [4, 5]. The system manage the queues [6]. The single server is consists of one or more than one queues also[7]. This system basically consists of single server and three queues [8, 9]. Internal flow process, service process, number of servers, queuing capacity, number of customers, and queuing discipline are all characteristics [2, 10].

2. Methodology

2.1 Queueing System

Queuing systems are made up of one or more servers that give services to customers as they arrive. Almost everyone has had the unpleasant experience of waiting in line for a long time during their daily activities. It is reasonable to assume that service should be offered to the first person in line. However, this rule may not always apply. Customers served at random may be served based on priorities specified by the server, so the last comer or the client with the highest priority may receive service before the one who has been waiting in line for a long time.

The system is probably consists of one server that provides services to the arriving customers in the system. The system manage the queues. The single server is consists of one or more than one queues also. This system basically consists of single server and three queues. Inside entrance rate of customer, number of server, queue size are some of the characteristics.

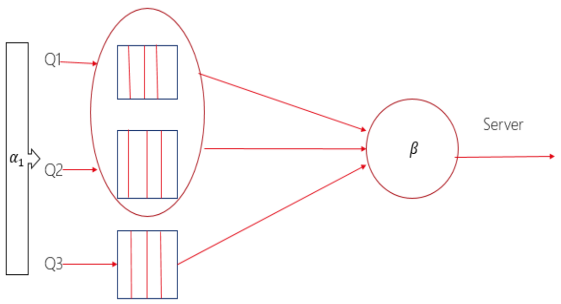

Fig-1.Queueing System Model of Q1 and Q2

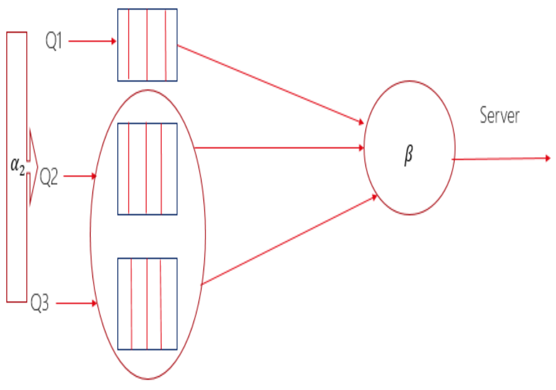

Fig-2. Queueing System Model of Q2 and Q3

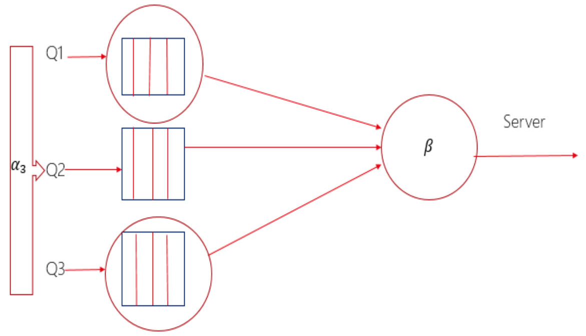

Fig-3. Queueing System Model of Q1 and Q3

The system is consists of three data types, $\alpha 1$ for first queue, $\alpha 2$ for second queue and $\alpha 3$ for third queue.

2.2 Markov Chain

A mathematical probabilistic tool to understand and figure out a way to handle a "queue" of clients in different scenarios. Internal flow process, service process, number of servers, queueing capacity, number of customers, and queueing discipline are all characteristics. A mathematical probabilistic tool to understand and figure out a way to handle a "queue" of clients in different scenarios. This provide better description and analysis of the internal behavior of the system. Markov Chain of the system through flow process defines that the upcoming state of the system only be contingent on the current state of the system tells us that we can predict upcoming state of the system by its current state and have no need to go to or analyze whole history of the system.

A. Markov Chain of Queueing Model of Q1 and Q2

Queueing model of Markov chain is shown below in fig: 4, which shows initially there is no arrival no service in the system, horizontally Q1 increase, Q2 remain same, vertically Q2 increase Q1 remain same Q3 in this system is empty. Alpha1 (α1) show's customer or data in queue one (Q1), Alpha2 (α2) show's customer or data in queue two (Q2), alpha complement α' shows no arrival in the system beta (β) show service and beta complement (β') show no service in the system.

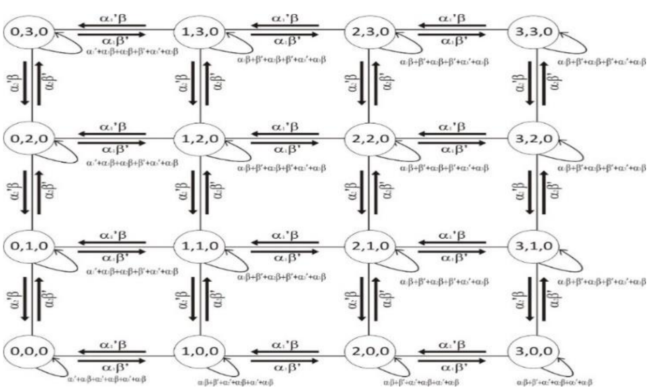

Fig-4. Markov Chain of Q1 and Q2

B. Markov Chain of Queueing Model of Q2 and Q3

Queueing model of Markov chain is shown below in fig: 5, which shows initially from right bottom there is no arrival no service in the system. Vertically Q2 increase Q3 remain same, diagonally Q3 increase, Q2 remain same, and Q1 in this system is empty. Alpha1 (α2) show's customer or data in queue two (Q2), Alpha3 (α3) show's customer or data in queue three (Q3), alpha complement α' shows no arrival in the system beta (β) show service and beta complement (β') show no service in the system.

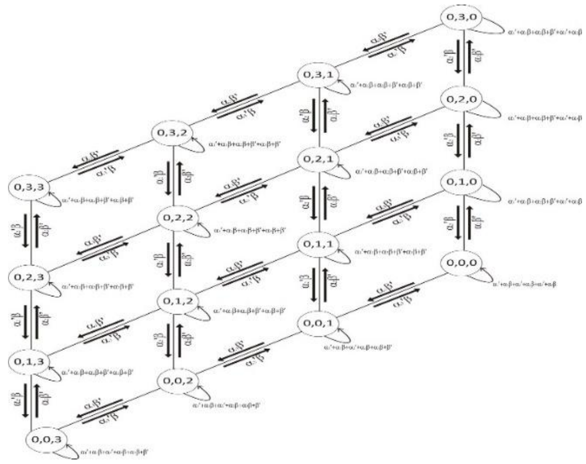

Fig-5. Markov Chain of Q2 and Q3

C. Markov Chain of Queueing Model of Q1 and Q3

Queueing model of Markov chain is shown below in fig: 6, which shows initially from left top there is no arrival no service in the system. Horizontally Q1 increase Q3 remain same, diagonally Q3 increase, Q1 remain same, and Q2 in this system is empty. Alpha1 (α1) show's customer or data in queue one (Q1), Alpha3 (α3) show's customer or data in queue three (Q3), alpha complement α' shows no arrival in the system beta (β) show service and beta complement (β') show no service in the system.

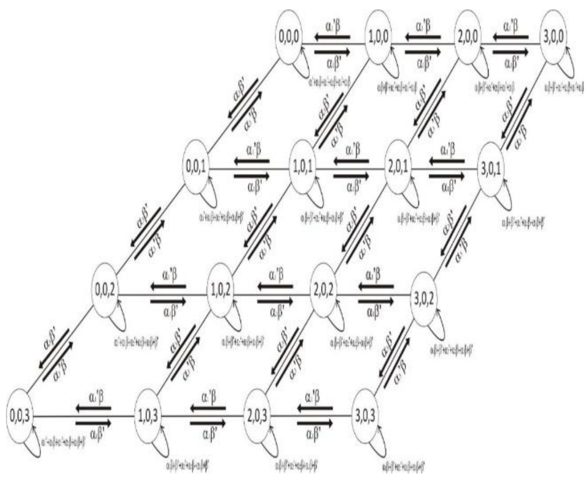

Fig-6. Markov Chain of Q1 and Q3

D. 3D Markov Chain

The discrete Markov chain of the 3D model is established on an evolution probability medium, as shown in Fig. 7, where the probabilities are derived from 3D geometric model data samples. The Markov chain model contains of numerous states where every one state represents the number of customers or arrivals that pass the signal trail. As shown in Fig. 7, the initial state, 0, 0, 0, indicates that there is no customer or arrival while Q1 is the state when there is customer or arrival in α1, Q2 is the state when there is customer or arrival in α2 and Q3 is the state when there is customer or arrival in α3. Moreover, β is the service that gives to the customer and β' is no service for customer. The evolution probabilities out of somewhat state addition to one. However, demonstrating the movement from single sample point to another, the evolution can go from any state to itself again or to any other state with a given transition probability. The key goal is to get the Markov chain model to produce an entry density sequence that fits the statistical behavior of the geometric model using only the evolution probability matrix obtained from the geometric model.

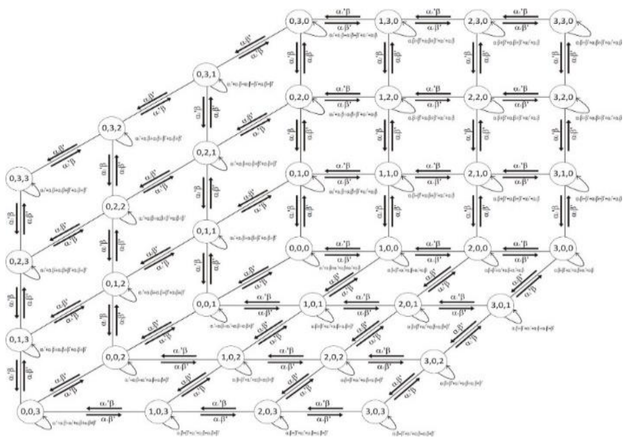

Fig-7. 3D model of Markov Chain

2.3. Flow Process and Service Process

The flow and service process evolution statistics are built as illustrated in the figures below. A data packet's service if the procedure begins with the chance of β, then no service will be provided with the likelihood ofβ'. There are three main sorts of states in a flow process transition diagram.

1) When a customer arrives in the system, flow process starts. These are referred to as the initial states.

2) The flow process do not commence in present states. These are known as secondary states.

3) The state in which the flow procedure comes to a finish. These are known as absorbing states.

When a customer arrives to the system and is acknowledged, so flow process begins. In the system that is saturated, just three structure situations are able to accept the trial data collection, as given Figure 11. When test customer arrives at stage 5 and discovers that the system is empty, the flow process commences quickly, with a short flow time. When a trial customer arrives at state 8 and finds another customer already within the system, then this will stay until the other customer leaves. This test data packet has a longer flow time comparatively the trial customer that reaches at state 5 because there are already two customers in the system, the test customer that arrives at state 10 has a longer flow time than the customer that arrive at state 5 and 8. The states 1 through 4 are absorption states, in which test data packets are removed from the system.

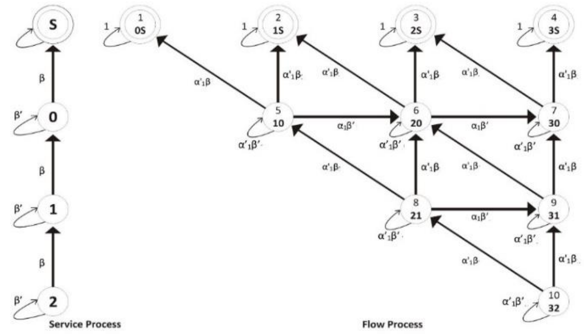

Fig-8. Flow Process and Service Process of Q1

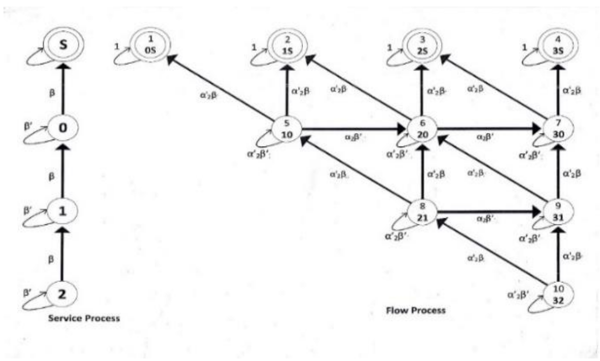

Fig-9. Flow Process and Service Process of Q2

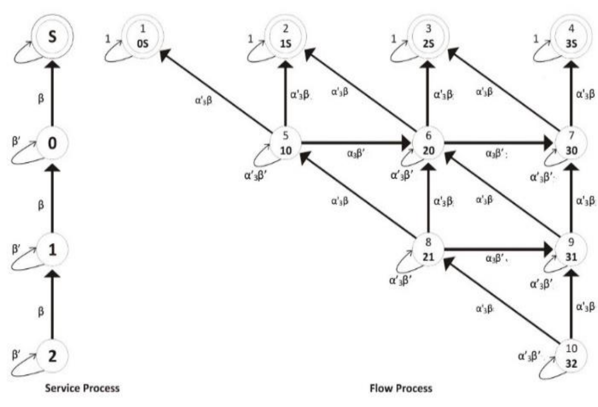

Fig-10. Flow Process and Service Process of Q3

A. Flow Process and Service Process of Overall System

Overall system behavior of Markov chain through flow process is represents in figure10. This shows the all system flow process and service process.

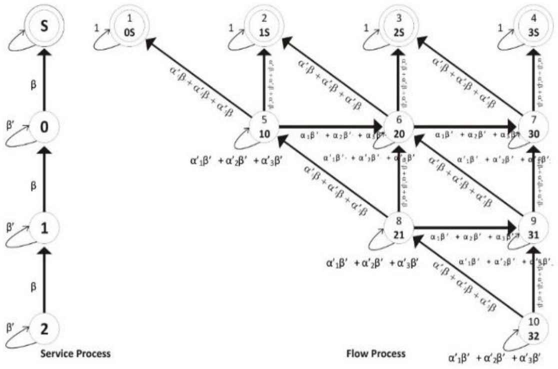

Fig-11. Flow Process and Service Process of Q1, Q2 and Q3

3. Results and Discussion

In order to calculate the flow process and probability mass function, MATLAB is used to write analytical and simulation algorithms. As demonstrated in Figures 12, 13, 14, and 15, the probability mass function (pmf) of the flow process of data packets in 3D modeling systems can be calculated analytically.

The probability mass function of individually initial condition at someplace a trial customer can begin its workflow in the circumstance of a multiple discrete data system is shown in the higher regions of Figures 12, 13, 14, and 15 for various values of α1, α2, and β.

The whole probability mass function of the measured system is shown in the lower section of each figure. Similarly, the upper parts of Figures 12,13,14, and 15 express the analytical outcomes of the (PMF) probability mass function of individually initial state for different values of α1, α2, also β, wherever the test customer can begin its workflow, while the lesser portion of individually figure express the whole probability mass function when we employ the 3D modeling method. In graph 15 depicts an assessment of analytical and simulation findings for numerous discrete data sets using a 3D modeling system.

The upper portion of the picture depicts the probability mass function's analytical results of individual beginning state-run for the systems, while the lesser section depicts the whole systems' probability mass function as well as the simulation outcome. The derived analytical results perfectly match the simulation results of a variety of discrete data systems.

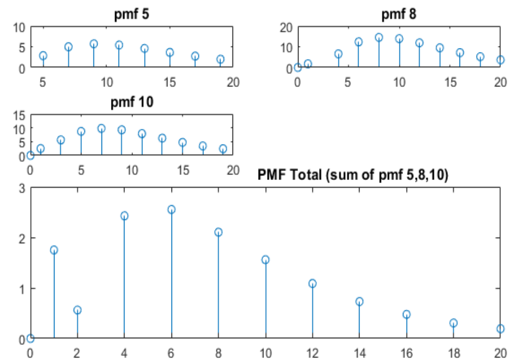

Fig-12. PMF individual initial state and total PMF: α1 = 1, α2 = 2, β = 3

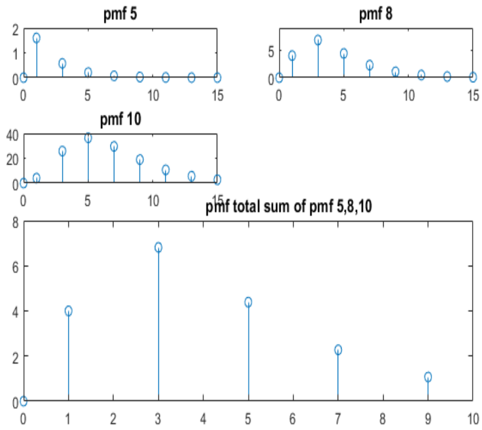

Fig-13. PMF individual initial state and total PMF: α1 = 2, α2 = 4, β = 7

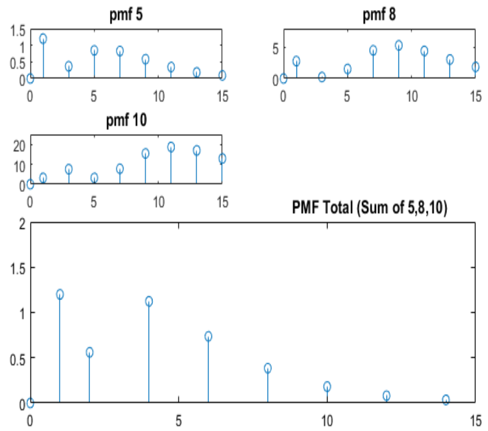

Fig-14. PMF individual initial state and total PMF α1= 0.08, α2 = 0.12, β = 1.5

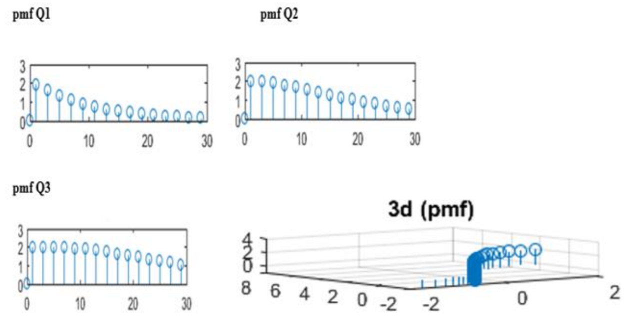

Fig-15. PMF individual initial state and total PMF α1 = 1.5, α2 = 1.75, β =2

4. Conclusion

A queueing model of discrete system with geometric distribution is deliberated in this study. To represent the queue's arrival process, we employed geometric distribution. A 3D system modeling approach was used to analyze the system. Flow process and service process evolution figures stayed created, and the flow time stayed determined. The beginning probabilities of the flow process were also determined. The probability mass function (PMF) results as well as the entire probability mass function, as well as their simulation results, were also given. The simulation results were perfectly matched to the analytical results.

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