Journal of Artificial Intelligence and Engineering Applications

Website: https://ioinformatic.org/

15th October 2023. Vol. 3. No. 1; e-ISSN : 2808-4519

# Simulation Of The Queue For Collecting Village Social Assistance Funds Using The Exponential Method

**Triana Dewi Lestari[1], Akim M H Pardede[2], Katen Lumbanbatu[3]**

*[1,2,3]Teknik Informatika STMIK KAPUTAMA*
*Jl. Veteran No 4A-9A Binjai Sumatera Utara,Indonesia*
*trianadewilestari88@gmail.com[1] akimmhp@live.com[2] katen.lumbanbatu@gmail.com[3]*

**Abstract**

This research aims to model and analyze the queuing process for collecting Village Bansus funds using an exponential distribution-based simulation method. The exponential method is used to describe the time variability between the arrival of the applicant and the service time in the queue. By utilizing simulation software, this research will examine various fund collection scenarios, including the effect of the number of service personnel on applicant waiting times and the efficiency of the fund collection process.
It is hoped that the results of this simulation can provide recommendations for increasing efficiency in the process of collecting Village Bansus funds, including determining the optimal number of service officers. Apart from that, this research can also help village governments in planning and managing the Village Assistance program so that it can be more effective and responsive to community needs. This simulation provides important insight into how the queuing process can be optimized to improve the quality of service to applicants for Village Bansus funds.

***Keywords***: *simulation, social assistance fund, village, exponential method*

## 1. Introduction

The problem that often occurs in receiving Direct Cash Assistance (BLT) is that there is often irregularity in receiving direct cash assistance because you have to spend quite a long time queuing [1], even rejections and cancellations often occur. In the queuing system, problems sometimes arise, problems arise because of the large number of queues being served, therefore solving this problem is solved using a sequential number queuing system[2], each person who comes is given a queue number. In this thesis, the author will discuss the queues used to prevent long queues in withdrawing village funds using Exponential[3].

### 1.1. Poison Distribution

A distribution follows the poison distribution pattern if it follows the following rules [4]:

a. No two events can occur simultaneously.
b. Arrival process is random.
c. The average number of arrivals per time interval is known from previous observations.
d. If the time interval is divided into smaller intervals, then the following statements must be fulfilled.

### 1.2. Exponential Distribution

The exponential distribution is a test used to estimate or predict by only needing an estimate of the population average, because the distribution is continuous. The characteristic of this distribution is that the curve has a tail to the right of the x value starting from 0 to infinity.
This distribution is used to calculate the inter-arrival time and service time for each customer served by the server. Service time between one customer and another customer is not constant. The exponential distribution is useful for providing information about operations that occur in an queue. The property of the exponential distribution that makes it easy to analyze is that it does not depend on time.

## 2. Queuing System

The queuing system is the whole and process of customers or goods arriving and entering the queue line which then spawns services as they should apply. In studying a queuing system, it is necessary to know the structure of the queuing system, namely the units that require service are called (customers) and those that serve called(server)[4].

### 2.1. Queue Component

According to Pardede [4] there are 3 (three) components in queuing theory that must be truly known and understood, namely
a. Arrival Rate
b. Service Level
c. Queue Discipline

### 2.2. Queue Discipline

Queuing Discipline is the rule in which customers are served, or service discipline which contains the order in which customers receive service. This service rule according to arrival can be based on, is [4].

1. First in first out (FIFO); FIFO (first in first out) is a rule where the customer who arrives first will be served first.
2. Last in first out (LIFO); is a queue where the person who arrives last is the one who is served first or first, which is often also called LCFS (last come first served).
3. Service in random order or (SIRO); SIRO (Service In Random Order) where service is carried out randomly, often also known as RRS (Random Selection For Service).
4. Priority based service (PRI), where service is based on special priority, for example at a party where guests categorized as VIP will be served first.

### 2.3. Notation In Queuing System

- n = number of customers in the system.
- Pn = certainty probability of n customers in the system.
- λ = average number of customers coming per unit time.
- μ = average number of customers served per unit time.
- Po = probability that there are no customers in the system.
- P = level of insensitivity of service facility.
- L = average number of customers expected in system.
- Lq = number of customers expected to wait in system.
- W = time expected by the customer to arrive system.
- Wq = the time the customer expects to wait in queue.
- 1/μ = average time.
- 1/λ = average time of arrival.
- S = number of service facilities.

According to Pardede (2014). The performance of the queuing system can be searched using the following formula:
a. Customer waiting time in queue
= service start time = customer satisfaction time.
b. Customer waiting time in the system

= service completion time = customer arrival time.
c. Average waiting time in queue (Wq)
Wq=∑customer waiting time in queue
total customers
d. Average waiting time in the system(Ws)
Ws=∑customer waiting time for customers in the system
Total customers
e. Average customer in queue (Lq)
Ls= ∑ customer waiting time in queue Duration
f. Average customer in the system(Ls)
Ls=∑ customer waiting time in the system
Duration
g. The probability that the server is busy
P=∑ service time
Multiple servers*duration

### 2.4. Queuing System Factors

The factors that influence the queue and service are as follows[5]:
1. Distribution of arrivals
In the arrival distribution queue system is an important factor that has a big influence on the smooth running of services.
2. Distribution of service time
The distribution of service time is related to how many service facilities can be provided.
3. Service facilities
Service facilities are closely related to the queue lines that will be formed.
4. Service discipline
Service discipline is closely related to the order of service for customers who enter the service facility.
5. Size in queue
The size of the queue of customers who will enter the service facility also needs to be considered.
6. Calling source
In service facilities, the source of calling can be either a machine or a human. If a number of machines are damaged, the source of calling will be reduced and the customer will be unable to serve.

### 2.5. Exponential Algorithm Implementation

The queue simulation using the exponential algorithm illustrates that the person who arrives first will be served first. If there are processes arriving at the same time, then their service is carried out in their order in the queue. Processes at the back of the queue must wait until all processes in front of them have finished. The weakness of the exponential algorithm is that the average waiting time is quite long and the convoy effect occurs, namely processes waiting a long time to wait for 1 large process being served by the server [6].

## 3. Research methods

The research method is carried out to look for something systematically by using scientific methods from valid sources. In this research process, it is shown to provide more meaningful results for the Financial Processing Agency, the income and assets of the sub-district area are completed. To simulate the queue for distribution of village assistance funds. The results of the conceptualization will be translated into a complete research method with a literature study pattern, collecting the necessary data. To analyze the system that will be created, namely to simulate the queue for distributing village assistance funds at the village office using the exponential method [7].

### 3.1. System Analysis

Based on the introduction and referring to the theoretical basis that will become the frame of mind, it can be analyzed as follows:

1. A system analysis of the queue simulation technique was carried out using the exponential method which will be processed using a system that uses the Visual Basic 2010 programming language with a SQL Server 2008 database.
2. Determine system requirements so that it can be carried out in simulating the queue for distributing village social assistance funds
3. Simulation data for the queue for distribution of village assistance funds which is used as an assessment which is then processed and calculated using the exponential method, which can then be obtained from the results of these calculations.

### 3.2. Current System Analysis

In the current system for simulating queues at the DESA office, queue simulations have never been carried out to determine the average timeliness of the people to be served, so they do not know the effectiveness of the service process for distributing social assistance funds to the community**.**

### 3.3. New System Requirements Analysis

Requirements analysis of the new system contains hardware requirements, software requirements, information requirements, and user requirements.

1. The hardware requirements used in analyzing new requirements are a computer, 2 GB memory, 500 GB hard disk, keyboard and mouse.
2. The software requirements used are a SQL server database and the Visual Basic programming language
3. The information requirement for this new system is regarding a queue simulation for the distribution of village assistance funds which will be processed using the system.

### 3.4. Exponential Method process flowchart

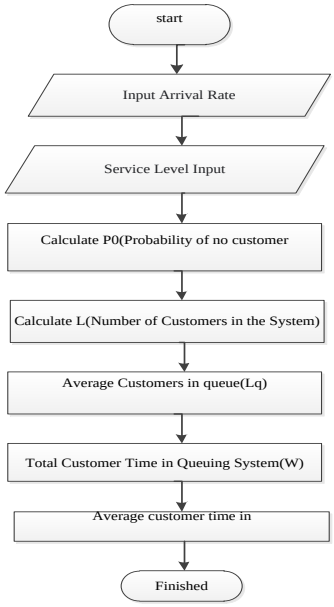


**Fig .1:** Exponential Method process flowchart

### 3.5. Exponential Method Analysis

**Table 1:** Exponential

| No | Alternative | Time of arrival | Service time | Waiting time | Time's up |
|---|---|---|---|---|---|
| 1 | P1 | 09:00 | 7 | 0 | 09:15 |
| 2 | P2 | 09:18 | 4 | 18 | 09:23 |
| 3 | P3 | 09:20 | 3 | 21 | 09:26 |
| 4 | P4 | 09:24 | 3 | 26 | 09:29 |
| 5 | P5 | 09:27 | 6 | 28 | 09:30 |
| 6 | P6 | 09:29 | 5 | 35 | 09:33 |
| 7 | P7 | 09:30 | 5 | 37 | 09:36 |
| 8 | P8 | 09:32 | 2 | 40 | 09:37 |
| 9 | P9 | 09:35 | 8 | 42 | 09:39 |
| 10 | P10 | 09:37 | 8 | 44 | 09:42 |
| 11 | P11 | 09:38 | 6 | 46 | 09:45 |
| 12 | P12 | 09:43 | 3 | 50 | 09:47 |
| 13 | P13 | 09:45 | 4 | 68 | 09:50 |
| Total time | | | 64 | 455 | |

1. Probability of no customers in the system.
   P0 = 1λ/π = 1- 6.5/11 = 1 – 0.59 = 0.41.
2. The number of customers in the system
   L = λ/π = (6.5 )/(11-6.4) = 1.85 = 1 person.
3. The average number of customers in the queue line.
   Lq = λ2/(π (π-λ)) = 6.52/(11 (11-6.5)) = 36/52 = 0.69.
4. Total customer time in queue time.
   W=1/(π-λ)=1/(11-6.5)= 0.22*11 = 2.2*11 = 24.2 minutes.
5. Average customer time in queue
   Wq = λ/(π(π-λ)) =6.5/(11(11-6.5)) = 0.13*11 = 1.43 minutes.
6. Average Waiting Time
   AWT = ΣWT/π = 455/11 = 41.3 minutes.
7. Average service time
   WP = ΣWP/π = 64/11 = 5.8 minutes.
   Number of servers
   If 1 server 1 = 6.5/1 = 6.5 minutes.
   If 2 servers 2 =5.8/1 = 5.8 minutes.

## 4. Conclusion

This research has succeeded in designing and implementing a simulation model to understand and optimize the process of withdrawing village social assistance funds. The exponential method is used to represent queues in this process quite effectively, and the simulation results show several important findings.

1. This simulation identifies that there are several critical points in the process of collecting village social assistance funds that can hinder efficiency. these include long waiting times at certain locations, excess capacity, and unequal distribution of recipients.
2. The results of this simulation provide a clear view of how changing parameters, such as adding service counters or increasing the number of staff, can affect the overall performance of the system. This provides valuable guidance for the village government or related institutions to make better decisions in managing the process of withdrawing village social assistance funds.

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