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Simulation of the BLT (Direct Cash Assistance) Distribution Queue With the Exponential Method

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Abstract

Queues are part of everyday human life. Queues occur when the number of customers to be served exceeds the capacity of an available service. This queuing situation can be found in several incidents, one of which is the queuing system at the Cash Direct Assistance (BLT) reception counter. Problems that often occur in receiving Direct Cash Assistance (BLT) at the village office are often queuing for more than 15 people to collect cash transfers, plus irregular queuing makes officers confused to serve the community, even sudden cancellations occur because of the short time. very limited and cut off when the officers rested at lunch time, which made several other people who had not been served annoyed and disappointed when they had to queue for a very long time, they had to come back tomorrow and queue again, causing public discomfort to services at the village office. Therefore, it is urgently needed a queuing system that is carried out to prevent prolonged queues in the distribution of BLT (Direct Cash Assistance) in the village, so that people who take BLT funds do not wait long enough and are more regular in queuing.

Keywords: Queue, exponential, Cash Transfer

INTRODUCTION

Queues are part of everyday human life. Queues occur when the number of customers to be served exceeds the capacity of an available service. This queuing situation can be found in several incidents, one of which is the queuing system at the Cash Direct Assistance (BLT) reception counter.

Simulation is a way to duplicate the features, appearance, and characteristics of a real system. The initial idea of simulation is to imitate real-world situations mathematically, then study the nature and operational characteristics and finally make a conclusion and make decisions based on the simulation results.

Problems that often occur in receiving Direct Cash Assistance (BLT) at the village office are often queuing for more than 15 people to collect cash transfers, plus irregular queuing makes officers confused to serve the community, even sudden cancellations occur because of the short time. very limited and cut off when the officers rested at lunch time, which made several other people who had not been served annoyed and disappointed when they had to queue for a very long time, they had to come back tomorrow and queue again, causing public discomfort to services at the village office. Therefore, it is urgently needed a queuing system that is carried out to prevent prolonged queues in the distribution of BLT (Direct Cash Assistance) in the village, so that people who take BLT funds do not wait long enough and are more regular in queuing.

The queuing system is the entire process of customers or goods arriving and entering the queue line which then requires service as it should apply. In studying a queuing system, it is necessary to know the structure of the queuing system, namely the unit that requires service is called the customer (customer) and the one serving is called the server (server).

The system is a unit which consists of elements or components that are connected together in order to facilitate the transfer of material, energy or information. The exponential method is a forecasting method that is quite good for long-term and medium-term forecasting, especially at the operational level of a company, in the development of the mathematical basis of the smoothing method it can be seen that the exponential concept has developed and become a practical method with quite wide use, especially in forecasting for supplies.

Based on the background of the problem described above, the writer can formulate the problem as follows:

1. How to build a queuing system that can streamline the existing service time so as to reduce the waiting time for people who take direct cash assistance?
2. How to apply the exponential method in the queuing system for the distribution of direct cash assistance?

The limitations of the problem are as follows:

1. The queuing system method used is the exponential method.
2. The software that will be used to build a queuing system for direct cash transfers with the exponential method is Microsoft VB.NET 2018.
3. The data taken is the BLT service queue data at the Stungkit Village Office, Wampu sub-district, Langkat Regency, North Sumatra Province.

Based on the explanation above, the objectives of this research are as follows:

1. Speeding up the queue in the distribution of Direct Cash Assistance (BLT) at the Stungkit Village Office.
2. Create a queuing system for the distribution of Cash Direct Assistance (BLT) using the Exponential method at the Stungkit Village Office.

The benefits obtained from the preparation of this thesis are:

1. Can be a reference in implementing the queuing system that has been made to be faster and more orderly in queuing for BLT (Direct Cash Assistance).
2. Can shorten the time of employees in providing BLT (Direct Cash Assistance) services quickly.

RESEARCH METHODS

Definition of simulation

Simulation is one way to solve various problems faced in the real world. Many methods are built in Operations Research and Systems Analyst for the benefit of decision making using various data analyzes. The approach used to solve various uncertain problems and long-term possibilities that cannot be carefully considered is simulation.

Exponential Distribution

The exponential probability distribution is a test used to make estimates or predictions by only requiring an estimate of the population average, because the exponential distribution has the same standard deviation as the average. This distribution is included in the continuous distribution. The characteristic of this distribution is that the curve has a tail on the right and the value of x starts from 0 to infinity.

Definition of Cash Transfer

BLT is a direct cash assistance to help maintain the purchasing power of poor and vulnerable households in order to be protected from the impact of price increases due to fuel oil (BBM) price adjustments. BLT is distributed to assist poor and vulnerable households in meeting household needs, purchasing health medicines, education costs and other necessities. BLT is not a long-term solution to reduce poverty, but it is a short-term solution to prevent the poor from selling assets, quitting school, and reducing consumption of nutritious food.

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RESULTS AND DISCUSSION

Flowchart Design

The result of this process is to determine how many arrivals, to generate a random number of inter-arrival times and to determine the arrival time for the duration of the simulation. The arrival flowchart can be seen in Figure III.1 below:

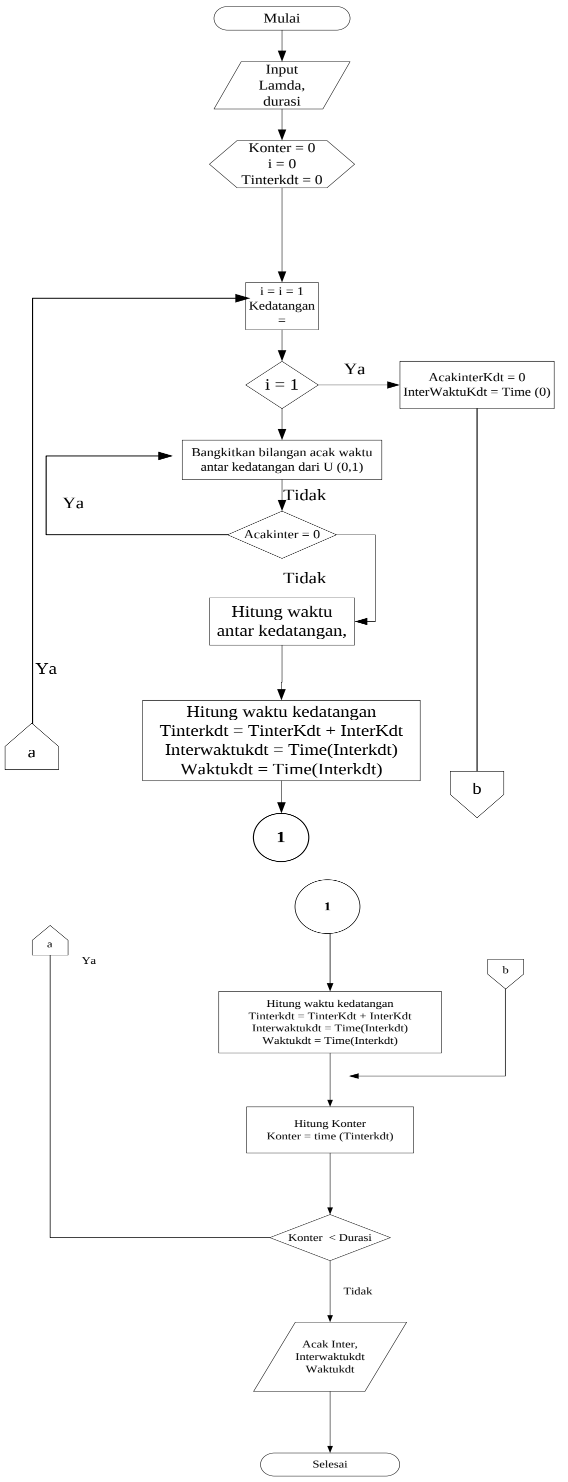

Figure 1. Flowchart Sistem

Support Data

The data used to support the research are as follows

Table 1. Random Data Rand ()

Arrival	Random Rand()
1	0
2	0.7154
3	0.3929
4	0.4750
5	0.4240
6	0.2540

Implementation of the Exponential Method

To generate arrivals, a Poisson distribution with a random number generator is used $-\frac{1}{\lambda}.\log(U), for\ example\ \lambda = 6$

with a duration of 1 hour (60 minutes).
Note: The value of = 6 is taken from a total of 6 customers
Arrival 1:
Random = 0
Arrival time interval = 0
Arrival time = 0
Arrival 2:
Generate U = U (0.1) = 0.7154 (searched from excel random values with the formula =RAND()
)
Arrival time interval = -1/6 .log(0.7154) = 0.0242
x = Interal arrival time * 3600
x = 0.0242 * 3600
x = 87.12
Minutes = x / 60
= 87.12 / 60
= 1 minute
Seconds = x mod 60
= 87.12 mod 60
= 27 seconds

Arrival time = 0 + 0.0242 = 0.0242
x = Interal arrival time * 3600
x = 0.0242 * 3600
x = 87.12
Minutes = x / 60
= 87.12 / 60
= 1 minute
Seconds = x mod 60
= 87.12 mod 60
= 27 seconds
For minutes that bullying applies, the remaining decimals go to seconds.

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Likewise, the nth arrival is calculated by the same formula.
Counter = Total arrival time interval,
If counter duration then done, if counter < duration then generate next arrival.

Table 2. Arrival

Arrival	Rondom Rand()	Arrival Time Interval	Arrival Time
1	0	0	0
2	0.7154	0.0242	0.0242
3	0.3929	0.0676	0.0919
4	0.4750	0.0539	0.1215
5	0.4240	0.0621	0.1160
6	0.2540	0.0992	0.1613

The table above shows that the results of the simulation are still decimal units, for that we have to convert these units into time units, for that we use the formula:

Table 3. Arrival

Arrival	Rondom Rand()	Arrival Time Interval	Arrival Time
1	0	0	0
2	0.7154	01:27	01:27
3	0.3929	04:03	06:31
4	0.4750	03:14	07:17
5	0.4240	04:44	07:58
6	0.2540	06:57	10:41

1) Service

After previously getting the total arrivals, then proceed to generate service time using an exponential distribution $-\frac{1}{\mu}\,.\log(U)$, for example total arrivals = 6 and = 10

citizen 1:
Start time = arrival time = 0
Generate U = U(0,1) = 0.1043
Service Time = -1/10 .log(0.1043) = 0.0982
Completed Service = 0 + 0.0982 = 0.0982
Queue waiting time = 0
System timeout = 0.0982

Citizen 2:
If the arrival time finished the previous community service:
Start time = end of previous community service.
If arrival time > finished previous community service:
Start time = arrival time
Arrival time = 0.0242 < 0.0982, then start time = 0.0982
Generate U = U(0,1) = 0.0100
Service time = $-\frac{1}{10}\,.\log(0.1043)$ =0.1526

Finished service = 0.0982 + 0.0298 = 0.1280
x = finished service * 3600
= 0.1280 * 3600
= 460.70
minutes = x / 60
= 460.70/60
= 8 minutes
Seconds = x mod 60
= 460.70 mod 60
= 41 seconds
waiting time queue = 0.0982-0.0242 = 0.0740
x = queue waiting time * 3600
= 0.0740 * 3600 = 266.30
Minutes = x / 60
= 266.30/60
= 4.44
= 4 minutes
Seconds = x mod 60
= 266.30 mod 60
= 26.30
= 26 seconds
System timeout = 0.1280-0.0242 = 0.1038
x = Queue waiting time * 3600
= 0.1038 * 3600
= 373.58
minutes = x / 60
= 373.58 / 60
= 6.23 = 6 minutes
Seconds = x mod 60
= 373.58 mod 60
= 13.58 = 13 seconds
Table III. 4 Service

Citizen 2:
If the arrival time finished the previous community service:
Start time = end of previous community service.
If arrival time > finished previous community service:
Start time = arrival time
Arrival time = 0.0242 < 0.0982, then start time = 0.0982
Generate U = U(0,1) = 0.0100
Service time = -1/10 .log(0.0298) = 0.1526

Finished service = 0.0982 + 0.0298 = 0.1280
x = finished service * 3600
= 0.1280 * 3600
= 460.70
minutes = x / 60
= 460.70/60
= 8 minutes
Seconds = x mod 60
= 460.70 mod 60
= 41 seconds
waiting time queue = 0.0982-0.0242 = 0.0740
x = queue waiting time * 3600
= 0.0740 * 3600 = 266.30
Minutes = x / 60
= 266.30/60
= 4.44
= 4 minutes
Seconds = x mod 60
= 266.30 mod 60
= 26.30
= 26 seconds
System timeout = 0.1280-0.0242 = 0.1038
x = Queue waiting time * 3600
= 0.1038 * 3600
= 373.58
minutes = x / 60
= 373.58 / 60
= 6.23 = 6 minutes
Seconds = x mod 60
= 373.58 mod 60
= 13.58 = 13 seconds

Table III. 4 Service

No	Arrival Time	Start Time	Random	Arrival Time	Finished Service	Queue Waiting Time	System waiting time
1	0	0	0.1043	0.0982	0.0982	0.0000	0.0962
2	0.0242	0.0982	0.0298	0.1526	0.1280	0.0740	0.1038
3	0.0919	0.2848	0.3561	0.0448	0.6409	0.1929	0.5490
4	0.1215	0.2580	0.8808	0.0055	1.1388	0.1365	1.0173
5	0.1160	0.3041	0.3891	0.0410	0.6932	0.1881	0.5772
6	0.1613	0.3255	0.2145	0.0669	0.5400	0.1642	0.3787

Table 5. Services in units of time

No	Arrival Time	Start Time	Random	Arrival Time	Finished Service	Queue Waiting Time	System Waiting Time
1	00:00	00:00	0.1043	05:53	05:53	00:00	05:46
2	01:27	05:53	0.0298	09:09	08:41	04:26	06:13
3	05:30	17:05	0.3561	02:41	38:27	11:34	31:56
4	07:17	15:28	0.8808	00:19	68:20	08:11	61:02
5	06:57	18:14	0.3891	02:27	42:36	11:17	34:37
6	09:40	19:31	0.2145	09:51	31:24	09:51	43:32

Table 6. Services in units of time

Hasil Simulasi	Wq $(\sum WaktuTgu/6)$	Ws $(\sum WaktuTguSys/6)$	Lq $(\sum WaktuTgu/60)$	Ls $(\sum WaktuTguSys/60)$	ρ
	0.1259	0.4537	0.0125	0.0453	0.00341

From the conclusion by using = 3 and = 10, the simulation results are obtained in table III. 5 with conclusions:
= 0.0248 x 100% = 3.41%
Wq = 0.1259
x = Wq * 3600
= 0.1259 * 3600 = 453.24
minutes = x / 60
= 453.24 / 60
= 7 Minutes
Seconds = x mod 60
= 453.24 mods 60
= 33 Seconds
Ws = 0.4537
X = 0.4537 * 3600 = 1633.32
Minutes = x / 60
= 1633.32 / 60 = 27 minutes
Seconds = x Mod 60
= 1633.32 mod 60
= 13 seconds

It can be seen that the probability of busy service is 3.41% with the average waiting time in the queue 0.1259 or 7 minutes 33 seconds and the average waiting time in the system 0.4537 or 27 minutes 13 seconds.

The conclusion is that one service still cannot serve well, because the probability number exceeds 1, which means that there are sufficient queues.

CONCLUSION

From the calculation results above, it can be seen that the probability of a busy service is 3.41% with an average waiting time in the queue of 0.1259 or 7 minutes 33 seconds and an average waiting time of 0.4537 or 27 minutes 13 seconds in the system. Therefore, it can be concluded that one service still cannot serve well, because the probability number exceeds 1, which means that the queue is sufficient.

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