ANALYSIS OF THE QUEUEING THEORY AND ITS APPLICATION ON THE SYSTEM OF THE NATIONAL BANK CUSTOMERS IN QUEUE

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Abstract

The queue is a phenomenon that frequently occurs in the community. Nearly all ministries will form a queue. Process queue starts at the moment customers who require the service started to come. Process queue is a process associated with the arrival of customers at a service facility, waiting in a queue if the line has yet to be served, served and eventually left the facility after being served.

The research was carried out on: Wednesday, April 2, 2014 at 08.00-11.00 A.M. EST, Thursday, April 3, 2014 at 08.00-11.00 A.M., Monday, April 7, 2014 at 08.00-11.00 A.M., and Tuesday, April 8, 2014 at 08.00-11.00 A.M.. Data taken in this research include: arrival time, start time, end time ministry of service and long service. In this research program selected Visual Basic application to make calculations in the system queue.

Queue system model on Wednesday, April 2, 2014 at 08.00-11.00 A.M., Thursday, April 3, 2014 at 08.00-11.00 A.M., Monday, April 7, 2014 at 08.00-11.00 A.M., and Tuesday, April 8, 2014 at 08.00-11.00 A.M. EST following the model queue (M/M/2): (GD/∞/∞). Effectiveness the number of teller can be determined by looking at the percentage chances of unemployed teller (teller opportunities are not being catered to customers). This can be seen at the time of the busiest services i.e. on Tuesday, April 8, 2014 at 08.00-11.00 A.M. the teller opportunities are not being catered to customers amounted to 2.27%, thus it can be said that the number of National Bank teller at the time the research was implemented effectively.

Key words: |Exponent Ditribution | Poisson Distribution| queuing system |the application|

1. Introduction

Along with the increased competition that lead to the fulfilment of the demands of the customers needs both in quantity and quality of leads the corporate world must continue to strive to improve service and flexibility to adapt and innovate quickly and precisely. One of the striking things in a direct-to-customer service agencies are servicing facilities section. The best services which are providing fast service so that customers are not left waiting (queuing) for too long. The queuing time for too long could cause customers reluctant to visit again in the future, on the other hand, if there is no queue until the labor ministry facilities many of the unemployed will cause losses for the company.

The queue is a phenomenon that frequently occurs in the community. This phenomenon occurs due to a time there were a lot of customers who want to be served while the number of services is very limited. This phenomenon is also the direct result of randomness in the operation of the means of service in general, arrival time and customer service are not known in advance, because if it can be known that means operations can be scheduled in such a way that it will completely eliminate having to queue up.

As long as the customer in the queue are required to wait, and sometimes waiting takes time which is not a little. It would be nice if someone get services without having to wait. Because that's the theory of queues is urgently needed to resolve the problems associated with the queue. Queue theory is a mathematical theory that concerns the study of queue-queue or waiting lines. The queue will need to occur if a service exceed the capacity available to the host servicing it.

One example is the queue to get the service or conduct transactions at National Bank. Customers come take a number and fill out a slip and then queue waiting to get service in the space provided. Related thereto, will do research on the effectiveness of the National Bank's teller. The Data being sought is the arrival time, start time, end time Ministry service, and long periods of service. That Data will eventually be analyzed and the results will be used to determine the ideal number of tellers.

Visual Basic is a programming language used to create application programs based on the object orientation. The design of a program will be much easier and enjoyable if you are using Visual Basic, because it is supported by complementary components which have a standard Windows. Because of the long process of manual calculations to find the measures of effectiveness, it will be

created a program that makes it easy to calculate measures of effectiveness are needed in the queue. Based on above description and final project is organized by title "Analysis of the Queueing Theory and its application on the system of the National Bank customers in Queue".

Queueing Theory

The theory of queuing theory queue is a mathematical theory that concerns the study of queue-queue or waiting lines. The formation of these waiting lines, of course, is a common phenomenon that occurs when the need for a service exceed the capacity available to the host servicing it. Decisions with regard to the amount of this capacity must be determined, though it is not actually possible to made a precise prediction about when the units need servicing and it will come or how long it will take to hold that ministry (Dimyati, 2004: 349).

Queue System

A system of queues is a set of customers, waitress and a rule that governs the return to customers and processing problem. System queues are a birth-death process with a population consisting of those customers who are waiting to get service or is being served (Bronson, 1996: 308).

Factor in The System Queue

Factors that affect the system queue and his Ministry are as follows (Kakiay, 2004: 4-6):

1) Distribution Of Arrival.
2) Distribution of Service time.
3) Service Facilities.
4) Disciplined Services.
5) The Size Of The Queue.
6) The Source Of The Calling.

Structure of the Queuing

Process queue is generally categorized into four basic structure according to on-site service (Aminudin, 2005: 175-176).

1) Single Channel Single Phase
2) Single Channel Mutiple Phase

3) Multiple Channel Single Phase
4) Multiple Channel Multiple Phase

The Pattern of Arrival

Arrival patterns of its customers are typically characterized by the time between arrivals, i.e. the time between the arrival of two successive customers on an on-site service. Of particular interest is whether the customers are coming one by one or in group, and whether the refusal or cancellation (balking at) (reneging) allowed. When it is not specifically mentioned, the default assumption is that all customers arrived one by one and also that not happen the rejection and cancellation (Bronson, 1996: 308).

Poisson Distribution Model

Definition

Gaussian random variables X with parameter Poisson λ, written X~POI (λ) if X has f.k.p as follows:

$$f(x) = \begin{cases} \frac{\lambda^x e^{-\lambda}}{x!} & ; x = 0,1,2,\ldots \\ 0 & ; x \text{ the other} \end{cases}$$

(Djauhari, 1990: 163)

Poisson distribution can be used to calculate the probability of x successes in n trials, for example as follows:

1) Number of coconut trees in 100 ha area of the garden.
2) Large number of typographical errors per page annual report.
3) Number of orders coming in per week (Supranto, 1986: 107).

According to Sudjana (2005: 135) Poisson distribution is often used to determine the odds of an event in a particular opportunity areas are expected to be a very rare occurrence, for example:

1) Many people passing through the face of the market every day, but it is very rare that someone found a lost item and return it to the owner or report it to the police.

2) Within every 5 minutes, the telephone operator received a request number for many connected, is expected to occur only rarely wrong dial.

Pattern Service

The pattern of services is usually characterized by the time service (service time), i.e. the time it takes a steward to serve a customer. What's interesting is whether or not a customer is served by only one waiter or customer it takes a lineup of Ministers. When it is not specifically mentioned, the presumption is that one waiter just may serve completely the Affairs of a customer (Bronson, 1996: 310).

Exponential Distribution Model

Definition

If X ~ Exp (μ), then X is said to exponential distribution with parameter μ. F.k.p of X is:

$$f(x) = \begin{cases} \frac{1}{\mu} e^{-t/\mu} & ; t > 0, \mu > 0 \\ 0 & ; x \text{ the other} \end{cases}$$

(Djauhari, 1990 : 175)

X can declare the time it takes to occur one time success with λ equal to the average amount of success in the time interval units.

Model (M/M/s):(GD/∞/∞)

The customers arrive at a rate of λ and maximum constant's customers can be served concurrently and the pace of service per the waiter is μ. The influence of the use of the waiter's parallel is speed up service by enabling it does some services simultaneously. If the number of customers in the system is n, and $n \geq s$, then the rate of departure means the same as s.

The formula measures of effectiveness:

$$L_q = \frac{\rho^{s+1}}{(s-1)!\,(s-\rho)^2} p_0 = \left[\frac{s\rho}{(s-\rho)^2}\right] p_0$$

$$L_s = L_q + \rho$$

$$W_q = \frac{L_q}{\lambda}$$

$$W_s = W_q + \frac{1}{\mu}$$

(Taha, 1996: 199)

Application

According to Santoso (2005: 9) application is a group of files (form, class, report) which aims to conduct certain activities are interlinked.

According to the Dictionary Of Indonesian Language (2001: 1353) applications is:

1) Ornamental works of art by gluing sewing (stitching) fabric cuttings are shaped like flowers (fruit, animals, etc.) on other fabrics as decoration.
2) Additional.
3) The use of the application.
4) Application, application, registration

Visual Basic

According to Utami (2005: 83) Visual Basic is a programming language event drive, where the program will wait until there is a response from the user/wearer application program that can be either incident or event, for example when the user clicks the button or pressing enter. **Problem Formulation in the research are as follows**; (1) How to model a queue at the National Bank? (2) How the effectiveness of the National Bank teller? (3) How the application program system of queues at the National Bank?

2. Method

Method of collecting data in this study using the method of observation. Data taken directly on the system queues that exist on a teller at the National Bank. The research was carried out during a busy time. The research was carried out on Wednesday, April 2, 2014 at 08.00-11.00 A.M., Thursday, April 3, 2014 at 08.00-11.00 A.M., Monday, April 7, 2014 at 08.00-11.00 A.M. and Thursday, April 8, 2014 at 08.00-11.00 A.M..

Analysis of the research data is carried out by five steps, namely the organisation of the data, determine the probability distribution of the data, specifying the model and the system queues based

on probability distribution and Chi-square test, determine the size of steady state and measures of effectiveness, and application programs from system queues.

3. Result

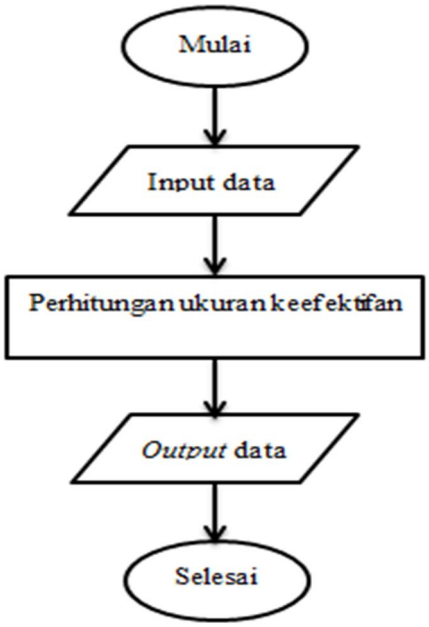
Results of Calculation Process Effectiveness Service

Table 1. Results of Calculation Process Effectiveness Service

	Wednesday, April 2nd, 2014	Thursday, April 3rd, 2014	Monday, April 7th, 2014	Tuesday, April 8th, 2014
(1)	(2)	(3)	(4)	(5)
λ	0,4611	0,4444	0,4333	0,4778
μ	0,2448	0,2703	0,2977	0,2500
P_0	0,02997	0,0976	0,1576	0,0227
L_q	15	4	2	21
L_s	17	6	4	23
W_q	32,0590	7,7057	3,7828	42,0603
W_s	36,1440	11,4053	7,1419	46,0603

Application Programs

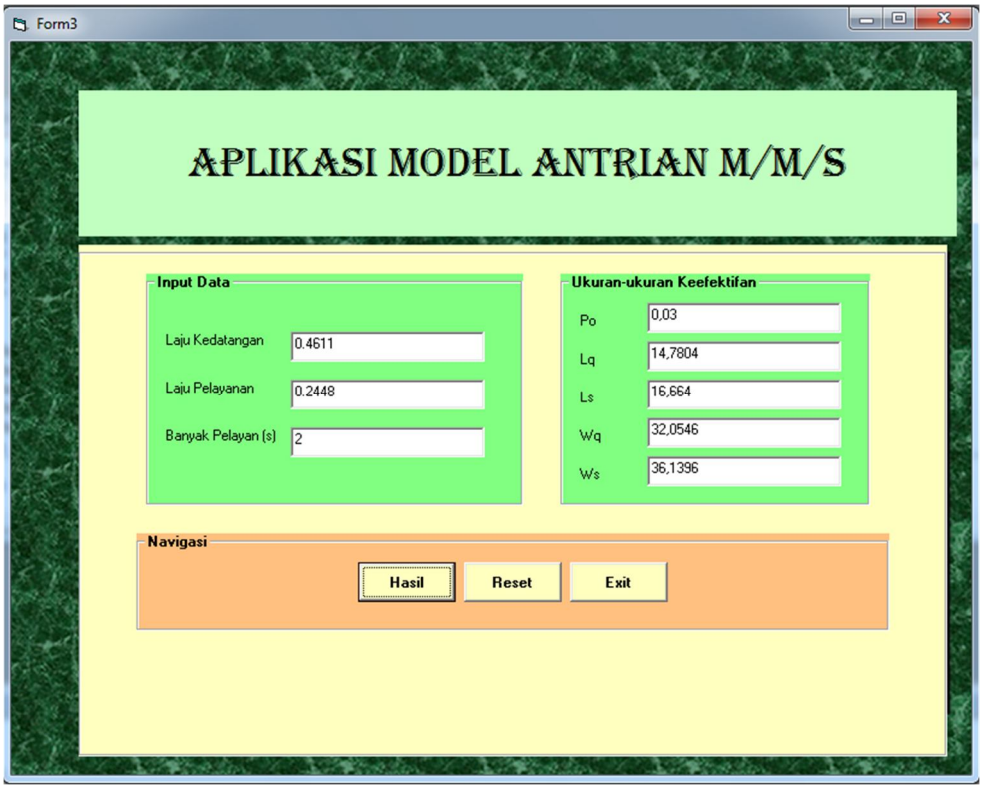
The application is one of the more effective model to solve problems of this type of queue. To calculate the time of arrival and time of Ministry that is random, then it will use random numbers. Data processing procedure on the application can be described with the flowchart as there is in Picture 1.



Picture 1. Application Flowchart

Queuing models used in this thesis is a model queue (M/M/s): (GD/∞/∞). This model is a queuing model with Poisson distributed arrival time and service time distribution is exponential. Examples of application of the model (M/M/s): (GD/∞/∞):

In a queue, there are two tellers, with the rate of arrival of the customer 0,4611/min and teller could serve customers 0,2448 transactions/minute. Results of the application of the theory of queueing models (M/M/s): (GD/∞/∞) can be seen in Picture 2



Picture 2. Program (M/M/s): (GD/∞/∞)

After the above process is executed then retrieved the output results as in Picture 2.

4. Discussion

Analysis of Arrival Customer

The system queues that are present on a bank teller on Wednesday, April 2, 2014 at 08.00-11.00 A.M., Thursday, April 3, 2014 at 08.00-11.00 A.M., Monday, April 7, 2014 at 08.00-11.00 A.M., and Tuesday, April 8, 2014 at 08.00-11.00 A.M. following the model (M/M/s): (GD/∞/∞).

On research in the National Bank, the busy going on Wednesday, April 2nd, 2014 and Tuesday, April 8th, 2014. This event is shown in table 1 that on Wednesday, April 2nd, 2014 the number of customers in a queue of 15 customers each minute of it and in the system of 17 customers every minute of it, for the average time spent in the queue of customers about 32,0590 seconds for each customer and for the average time spent on a customer in the system of approximately 36,1440 minutes to each customer. And for the day Tuesday, April 8th, 2014 the number of customers in the queue every minute of it customers and 21 in 23 customers each minute of it system, to the average

time spent in the queue of customers about 42,0603 seconds for each customer and for the average time spent on a customer in the system of approximately 46,0603 minutes to each customer. As for Thursday, April 3rd, 2014 and on Monday, April 7th, 2014 can be said that customers come with a number of not very large, the event can be seen from the average of the number of existing customers on Thursday, April 3, 2014 i.e. only around 4 customers in the queue and approximately 6 customers in the system, for the average time spent in the queue of customers about 7,7057 seconds for each customer and for the average time spent on a customer in the system of approximately 11,4053 minutes for each customer. Similar events also took place on Monday, April 7, 2014 the number of customers in the queue every minute of it customers and 2 in the system 4 customers every minute of it, for the average time spent in the queue of customers about 3,7828 seconds for each customer and for the average time spent on a customer in the system of approximately 7,1419 minutes to each customer.

Determine the Ideal number of Teller

From the above analysis results obtained has the percentage of unemployed teller opportunities numbers that small, visible on Wednesday and Thursday the percentage unemployed teller is very small, i.e. of 2,997% and 2.27% and on Thursday and Friday the percentage of young unemployed, the teller of 9,76% and 15,76%. This means most of the time is teller used to serve the customers. The effectiveness of the number of teller on Wednesday, Thursday, Friday and Saturday are effective, i.e. by opening two service teller.

Analysis of The Results of The Program

The data is calculated using the original data applications on Wednesday, April 2nd, 2014, in the form of μ = 0,2448 customers per minute, λ = 0,4611 customers per minute and many tellers (s) = 2. Generate opportunities teller are not serving customers is equal to 0,03, the average number of customers in a queue of 15 customers, the average number of customers in the system by 17 customers, average time spent on a customer in the queue 32,0546 minutes, and average time spent on a customer in the system is equal to 36,1396. With this application in the calculation of the result equals the results of the calculations manually.

5. Conclusion

Based on the results of the research that has been done, then the conclusions to be drawn as follows:

1) Queuing system at the National Bank teller service on Wednesday, April 2nd, 2014 at 8:00 to 11:00 A.M., Thursday, April 3, 2014 at 8:00 to 11:00 A.M., Monday, April 7, 2014 at 08:00 to 11:00 A.M. and Tuesday, April 8th, 2014 at 8:00 to 11:00 A.M. following the model of the queue (M/M/2): (GD/∞/∞).
2) Opportunities teller was idle on Wednesday, April 2, 2014 at 08.00-11.00 am GMT of 2,997%, Thursday, April 3, 2014 at 08.00-11.00 am GMT of 9,76%, Monday, April 7, 2014 at 08.00-11.00 am GMT of 15,76% and Tuesday, April 8, 2014 at 08.00-11.00 am GMT of 2.27%. So the number of bank teller at the time the research is implemented can be said to have been effective.
3) In this final project application using the Visual Basic programming. The end result in this application calculates the keefektidan measurements on queueing system. And output the results of this application is similar to the calculation using the formula manually.

6. Suggestions

1) Preferably in the data retrieval so that more accurate use of seconds.
2) Implementation of this application determines the solution of the problem of queuing system M/M/s, the application can still be developed again to the subject of another queue system model.
3) Before doing the test with applications should clarify the distribution of queueing models.
4) In serving customers, the National Bank would have to maintain service system applied, i.e. by opening 2 teller daily.

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