

Application Of The Queuing System At The Renon Gacoan Noodle Restaurant

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ARTICLE INFO

Article history:

Received 30 April 2024

Accepted 10 Mei 2024

Published 30 August 2024

Keywords:

Mie Gacoan, Queue, FIFO, Single Channel-Single Phase, Distribution

ABSTRACT

Renon Gacoan Noodle Restaurant is a fast food spicy noodle restaurant in Bali. This restaurant, which carries a modern restaurant concept at affordable prices, has made Mie Gacoan Renon popular among various groups. Its strategic location in the city center makes this restaurant busy with visitors, which causes quite dense queues at certain hours. Mie Gacoan Renon uses a Single Channel-Single Phase queuing system to serve visitors. The service also uses a First In First Out (FIFO) model where visitors who arrive first will be served first. The average visitor arrival is 1 person/minute and the average service is 1.6 minutes. With the help of SPSS software In processing the data, it was found that the number of customer arrivals and Mie Gacoan Renon restaurants had a Poisson distribution and the distribution of service times was a Loglogistic distribution.

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INTRODUCTION

Nowadays, industrial development is increasing. This is marked by the emergence of the fast food *trend*. Fast food is food that is available for a short time and has previously undergone initial processing, then when an order is received, it only continues with further processing, ready to eat, easy to package, and practical (Hanum et al., 2014). The existence of fast food restaurants in Bali is never empty of visitors, especially Mie Gacoan restaurants.

The name "Mie Gacoan" is taken from the word "Gaco" which means hero or mainstay in Javanese. "Mie Gacoan" is a trademark of the number 1 spicy noodle restaurant chain in Indonesia, which is a subsidiary of PT Pesta Pora Abadi which was founded in early 2016. It carries a modern dining concept with affordable prices and a *pleasant* restaurant atmosphere. attractive, cool, spacious, and also equipped with various facilities, making Mie Gacoan a favorite place for Indonesian people, especially students, pupils and families. Mie Gacoan

currently has more than twenty restaurant branches in Indonesia. One of the Mie Gacoan branches in Bali is Mie Gacoan Renon. Mie Gacoan Renon has a very strategic location because it is in the city center. This causes many visitors to come there to eat during break times or to unwind after activities, which often causes huge queues at food ordering places, especially during break times and after work hours.

Queuing is a situation where someone has to wait their turn to get service (Bahar et al., 2018). Queues are used because there are a group of people who need public services at the same time. Public service is a form of service provided by the government to the community which basically has the function of providing certain services needed by the community. Along with this, demands from the public for quality services continue to increase.

THEORETICAL BASIS

Queuing Theory and Systems

Queuing theory is a theory which involves the mathematical study of queues or waiting lines (Taha, 1996). Waiting lines are a common occurrence when the need for services exceeds the capacity available to provide those services. The main goal of queuing theory is to achieve a balance between service costs and costs caused by waiting time.

In a queue there is a system called the queuing system. **The** queuing system is a "birth-death process" with a population consisting of customers waiting for service or being served. Birth occurs when a customer comes to the service facility and death occurs when the customer leaves the service facility. The queuing process is a process related to the arrival of customers to a queuing system, then waiting in the queue until the waiter determines the customer according to service discipline, and finally the customer leaves the system after completing the service.

According to Kakiay (2004) as quoted by Arum (2014), a queuing system is a collection of customers, waiters, and a rule that controls service to customers. At the same time, the system status refers to the number of customers at the service point, including the number of customers in the queue. One of them is the number of customers who come to the service facility. Population size is the number of customers who need service. The factors that influence the queue line and service are as follows:

1) Arrival Distribution

Customer arrival patterns are usually characterized by arrival time, namely the time between the arrival of two consecutive customers at a service facility. This pattern usually depends on the number of customers in the system.

2) Time Distribution

Service patterns can be characterized as service time, namely the time required for a waiter to serve a customer. Service time can be deterministic or a random variable whose probability distribution is assumed to be known.

3) Service Facilities

- a. Form a series, in a straight line or a circular line.
- b. Parallel form, in several straight lines between series and parallel.
- c. The form of a series of stations, which can be designed in series with more than one service at each station. This form can also be done in parallel with different stations.

4) Size in Queue

- a. The arrival size is unlimited (*infinite queue*).
- b. The arrival size is limited (*finite queue*).

5) Summoning Source

- a. Unlimited calling sources (*infinite queue*).
- b. The calling source is limited (*finite queue*).

Queuing Discipline and Queuing Model

Queuing discipline and queue structure in a queue are the basic elements of forming a queuing model. According to Heizer and Render (2005), queuing discipline is a queuing rule which refers to the rules for customers who are in line to receive services which consist of:

- 1) *First Come First Serve* (FCFS) or *First In First Out* (FIFO), meaning first come, first served (out).
- 2) *Last Come First Serve* (LCFS), meaning last come, first leave.
- 3) *Priority Service* (PS), meaning that service priority is given priority to someone who has a higher priority than other people.
- 4) *Service in Random Order* (SIRO), meaning service is based on random chance, not looking at who comes first.

According to Heizer and Render (2005), there are four basic queue structure models that usually occur in a queuing system, namely:

- 1) *Single Channel-Single Phase* , meaning there is only one path to enter the service system.
- 2) *Single Channel Multi Phase* , where the term *multi phase* means there are two or more services carried out sequentially.

- 3) *Multi Channel Single Phase* , This means that this system occurs when there are two or more service facilities fed by a single queue.
- 4) *Multi Channel Multi Phase* , where this system shows that each system has several service facilities at each stage so that more than one customer can be served at the same time.

The queue structure used in the Introduction to Stochastic Processes course project is *Single Channel-Single Phase* where there is only one line in the queue service system at the Mie Gacoan Renon restaurant.

RESEARCH METHODS

This research uses quantitative data, namely data in the form of numbers which can then be calculated using arithmetic units. Quantitative data in this research, namely calculating the number of visitors who come and the service time served by. The data source used is primary data, which is data collected through observation, namely direct observation at the research location.

This research took several samples at a time span of 2 hours during the day. This research was conducted at the Renon Gacoan Noodle Restaurant which is located on Jln. Tantular Bar. No. 83, Dangin Puri Klod, District. East Denpasar, Denpasar City, Bali on Wednesday, 30 November 2022 at 14.30-16.30 WITA for two hours. The variables used in the research are: (1) Data on the number of visitor arrivals who come to Mie Gacoan Renon; and (2) Data on service times for visitors who come to Mie Gacoan Renon. The following is a description of the data that has been collected.

Number of Services	Number of Arrivals (people)	Service Time (Minutes)
64	131	39.91666667

In this research, the queuing model applied at Mie Gacon Renon is Single Channel-Single Phase. Quoting Nengsih (2020) , in the Single Channel-Single Phase model or one-lane, one-stage queuing model, the formulas used are as follows:

- 1) Probability of system busyness level

$$p = \frac{\lambda}{\mu}$$

- 2) The probability that there are 0 people in the system

$$q = 1 - p$$

- 3) Average number of visitors in the system

$$L_s = \frac{p}{q}$$

4) Average number of visitors in queue

$$Lq = \frac{\lambda^2}{\mu(\mu-\lambda)}$$

5) The time a visitor spends in the system

$$Ws = \frac{1}{\mu-\lambda}$$

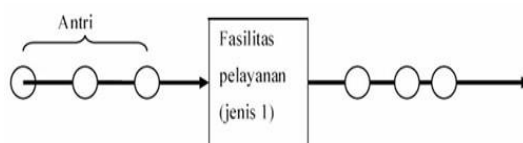
6) The time required for visitors to queue

$$Wq = \frac{\lambda}{\mu(\mu-\lambda)}$$

DISCUSSION

Queue Design and Discipline

The service queue at the fast food restaurant, namely Mie Gacoan Renon, uses *Single Channel-Single Phase*. The queuing discipline applied is *First In First Out (FIFO)*, meaning first come, first served (exit). The following is an overview of the queuing system at the Renon Gacoan Noodle Restaurant .



Determining the Queue Model

The Mie Gacoan Renon queuing system in the customer service section has a system with the number of arrivals having a Poisson distribution and service time having a loglogistic distribution. Through this we obtain a queuing model that is in accordance with Kendall's notation, namely $(M / M / 1): (FIFO / \infty / \infty)$.

m : The number of arrivals has a Poisson distribution

G : The level of service is logistically distributed

1 : The number of servers (c) is 1

FIFO (*First In First Out*) or the same as FCFS (*First Come First Served*) which means that customers who come first will be served first

∞ : The maximum queue limit is infinite

∞ : The population is infinite

System Performance Measures

By using the queuing model ($M /G/1$): ($FIFO /\infty/\infty$) we can find the following system performance measures.

- 1) Arrival rate (λ)

Through research, data on the number of arrivals was obtained, namely 131 people with a time interval for 1 day, namely 24 hours of observation time interval (1 minute interval in 120 minutes).

$$\lambda = \frac{131}{120} = 1.091666667 \approx 1 \text{ orang/menit}$$

- 2) Average service level (μ)

$$\mu = \frac{64}{39.65833632} = 1.603340292 \approx 1,6 \text{ menit}$$

- 3) Probability of system activity level or *steady state* (p)

$$p = \frac{1.091666667}{1.603340292} = 0.680870226 \approx 68\%$$

- 4) Probability that there are 0 people in the system (q)

$$q = 1 - 0.680870226 = 0.319129774 \approx 32\%$$

- 5) Average visitors in the system (L_s)

$$L_s = \frac{0.680870226}{0.319129774} = 2.133521472 \approx 2 \text{ orang}$$

- 6) Average visitors in queue (L_q)

$$\frac{1.091666667^2}{1.603340292(1.603340292 - 1.091666667)} = 1.452651246 \approx 1 \text{ orang}$$

- 7) Time required by visitors in the system (W_s)

$$W_s = \frac{1}{1.603340292 - 1.091666667} = 1.954370814 \approx 1,9 \text{ menit}$$

- 8) Time required for visitors in queue (W_q)

$$W_q = \frac{1.091666667}{1.603340292(1.603340292 - 1.091666667)} = 1.330672897 \approx 1,3 \text{ menit}$$

Steady State Determination

In the Mie Gacoan Renon restaurant service, researchers only observed one cashier service, therefore they used $c = 1$. In determining *the steady state* , the values of λ and μ . The following is a calculation table for determining *steady state* .

n	c	λ	μ
64	1	1.091666667	1.603340292

steady state condition is met for all data if $p = \frac{\lambda}{c\mu} < 1$, then $p = \frac{1.091666667}{1 \times 1.603340292} = 0.680870226 < 1$. The utilization factor value is obtained so that it reaches 0.6808 steady state conditions .

Distribution Test

In this research, researchers carried out hypothesis testing using SPSS software to prove the alleged distribution of the number of arrivals. Through this test, it can be determined whether the random sample has a Poisson distribution.

1) Test the distribution of customer arrivals

a. Determine the hypothesis

H_0 : The number of customer arrivals at the Mie Gacoan Renon restaurant has a Poisson distribution.

H_1 : The number of customer arrivals at the Mie Gacoan Renon restaurant does not have a Poisson distribution.

b. Level of significance

Researchers use the significance level $(\alpha) = 5\% = 0.05$

c. Distribution test results

One-Sample Kolmogorov-Smirnov Test

		JumlahKedatangan
N		64
Poisson Parameter ^{a,b}	Mean	2.05
Most Extreme Differences	Absolute	.149
	Positive	.149
	Negative	-.129
Kolmogorov-Smirnov Z		1.188
Asymp. Sig. (2-tailed)		.119

a. Calculated from data.

b. Calculated from data.

In the output results above, testing the distribution of the number of customer arrivals gives a p-value of 0.119. This means p-value $0.119 > 0.05$, then there is not enough evidence to reject H_0 . Therefore, the number of customer arrivals at the Mie Gacoan Renon restaurant has a Poisson distribution.

2) Test customer service distribution

Test results using SPSS are as follows:

a. Determine the hypothesis

H_0 : The number of customer arrivals at the Mie Gacoan Renon restaurant is distributed logistically.

H_1 : The number of customer arrivals at the Mie Gacoan Renon restaurant does not have a logistic distribution.

b. Level of significance

Researchers use the significance level(α) = 5% = 0.05

c. Distribution test results

Goodness of Fit Test

Distribution	AD	P	LRT	P
Normal	1.675	<0.005		
Box-Cox Transformation	0.134	0.978		
Lognormal	0.134	0.978		
3-Parameter Lognormal	0.149	*	0.433	
Exponential	8.901	<0.003		
2-Parameter Exponential	2.553	<0.010	0.000	
Weibull	0.969	0.014		
3-Parameter Weibull	0.204	>0.500	0.000	
Smallest Extreme Value	5.115	<0.010		
Largest Extreme Value	0.276	>0.250		
Gamma	0.333	>0.250		
3-Parameter Gamma	0.180	*	0.079	
Logistic	0.914	0.009		
Loglogistic	0.202	>0.250		
3-Parameter Loglogistic	0.225	*	0.366	
Johnson Transformation	0.129	0.982		

Based on the test results above, we can see that the smallest Anderson Darling value and the largest *p-value* are found in the Loglogistic distribution. Because the *p-value* is > 0.05, there is not enough evidence to reject it H_0 . Therefore, the distribution of service time is Loglogistic distributed.

CONCLUSION

When this research data was taken, it was on November 30 2022 at 14.30-16.30 WITA at the Renon Gacoan Noodle Restaurant, this place operates one cash register or known as *Single Channel-Single Phase* . Based on direct observation results, it is known that the average number of visitors coming per minute is one person, and the average service level is 1.6 minutes. With the probability that the system is busy (p) is 68% and the probability that there

are 0 people in the system (q) is 32%. The average visitor in the system (L_s) is two people with the average visitor in the queue (L_q) being one person. The time required for visitors in the system (W_s) is 1.9 minutes and the time required for visitors in queue (W_q) is 1.3 minutes. Based on the results of the distribution test with the help of SPSS *software*, it is known that the number of customer arrivals at the Mie Gacoan Renon restaurant has a Poisson distribution and the distribution of service time is a Loglogistic distribution.

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