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Binjai Train Ticket Counter Queue Simulation Using Weibull Service Distribution

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Abstract

This research aims to improve the efficiency of train ticket counter services at Binjai Station through the use of Weibull service distribution-based queuing simulations. Long queues and excessive waiting times are often problems at many train stations, and this research aims to address these problems.This study collects queuing data from train ticket booths at Binjai Station over a certain period and analyzes them to identify existing queuing patterns. The Weibull service distribution was chosen as the appropriate model to describe the ticket counter service time, because this distribution has the flexibility to handle variations in service time well.

Queue simulation is carried out using simulation software that models the queuing process at the train ticket counter. Weibull distribution parameters are integrated into the simulation to predict service time at the ticket counter. In this simulation, various scenarios and strategies for improving service efficiency are evaluated to identify the best alternative that can be implemented at Binjai Station.

The results of this study will provide guidance to the management of the Binjai train station in making decisions regarding increasing the efficiency of ticket counter services. By optimizing service time and reducing customer waiting time, it is expected to increase customer satisfaction and operational efficiency of train stations.

Keyword: *simulazion, ticket, train, weibull distribution, servicing efficiency, binjai station***.**

1. Introduction

The history of queuing was first introduced in 1909 by A.K Erlang. Queuing activity can occur due to the need for services beyond the capacity provided by the service or service facility, so that customers who come cannot immediately get service. In daily routines, humans are never separated from queuing activities. Almost everyone has experienced queuing because of the need for services beyond the capacity provided by the services or service facilities, making it possible to not immediately get services effectively.
A queue is a condition where there is a delay in the service of an object due to a queue because the service is busy and occurs because of an imbalance between availability and a balanced need for service. Therefore, in the process of the queuing system, sometimes it often experiences problems, these problems arise due to the large number of queues that must be served. Apart from these problems, a number of customers who fall into the "technology savvy" category are currently facing great difficulties in keeping up with the times. They tend to be isolated from the increasingly advanced digital era and often feel left behind in adopting new technology, such as having difficulty buying tickets online.
PT. KAI Indonesia (PERSERO) is a State-Owned Enterprise that provides, regulates and manages transportation services and visitor business by prioritizing integrity, professionalism, safety, innovation and excellent service provided to customers. The train station is an area that cannot be separated from queuing activities, where many customers travel to a location such as a place of work or a destination.

2. Theoretical Basic

2.1 Meaning of Simulation

Queuing simulation is the use of simulation techniques to replicate and model queuing processes or queuing arrangements in a system. It involves creating mathematical or computer models that describe how entities or objects get into a queue, wait their turn, and receive service. Queuing simulation is used to understand, analyze and optimize queuing systems in various contexts, such as business, manufacturing, transportation, healthcare and others.
Queuing simulation is a valuable tool in optimizing queuing processes, increasing service efficiency, and reducing waiting times for customers or entities in a variety of applications. By using queuing simulation, organizations can make better decisions in planning and managing their queuing systems[1].

2.2 Meaning of Queue

In the context of queuing simulation, the term "queue" refers to mathematical or computer models used to model and analyze real queuing processes, such as customer queues at supermarket checkouts, vehicle queues at toll roads, or telephone call queues in call centers. Queuing simulation helps to understand the behavior and performance of this queuing system without having to carry out real-world experiments.
Queuing simulation helps organizations or researchers to optimize queuing systems, increase efficiency, reduce customer waiting times, and make better decisions in designing or managing queuing systems in real contexts. This modeling and simulation can be carried out using special software that allows users to determine the parameters of the queuing system and observe the simulation results.[2].

2.3 Queuing System

A queuing system is a system or process that regulates how entities or objects queue or wait their turn to get a particular service or process. Queuing systems are found in many aspects of everyday life, including business, transportation, customer service, scheduling, and more. Queuing systems are designed to manage the flow of entities so they can be served or processed efficiently.
Queuing systems are used to optimize efficiency, improve customer experience, manage resources, and manage entity flows in a variety of contexts. Queuing system analysis involves understanding parameters such as arrival rate, average service time, and queuing capacity to design better systems and make informed decisions in various industries and applications,[2].

2.4 Queue Component

The main components in the queuing system involve the elements involved in the queuing process, starting from the queued entity to the services provided. The following are the main components in a queuing system :
Entities: Entities in a queuing system are objects or entities that require service or processing. This could be a customer, order, vehicle, or other item that requires handling or service.
Queue (Queue): A queue is a structure or place where entities queue up and wait their turn to get service. Queues can be physical lines in stores, waiting lines at bus stations, or even virtual queues in computer systems.
Service: Service is an action or process provided to entities when they reach their turn. This could include selling products, processing orders, inspecting, repairing, or other actions appropriate to the type of queuing system in place.
Queue Source (Arrival Source): The queue source is the place of origin or source of entities before they enter the queue. For example, in a shop queuing system, the source of the queue is the customer who comes to the shop.
Queue Capacity: Queue capacity is the maximum number of entities that can be placed in a queue at one time. This capacity can be limited or unlimited depending on the queuing system design.
Priority: In some queuing systems, entities may be given certain priorities based on special characteristics or conditions. For example, more severe patients in the medical care system may be given higher priority.
Waiting Time: The time spent by an entity in the queue before getting service is called waiting time. Reducing waiting time is often a goal in designing queuing systems.
Time Variables: Time variables are used to measure and manage entity arrival time, service time, and waiting time. It helps in analysis and optimization of queuing systems.

Performance Indicators (Performance Metrics): Performance indicators are used to evaluate the performance of a queuing system, such as average waiting time, arrival rate, service level, and queue capacity.

A good understanding of these components helps in designing, managing and optimizing queuing systems to meet specific goals, such as increasing efficiency, reducing waiting times and increasing customer satisfaction. Queuing system analysis also involves measuring and modeling these parameters to take the right decisions in various application contexts. [2].

2.5 Exponential Distribution

A The exponential distribution or negative exponential distribution is the probability distribution of the time between Poisson point events, which is a process in which events occur continuously and independently at a constant average rate. The exponential distribution is a special case of the gamma distribution with the form factor $\alpha = 1$ and $\beta = 1/\lambda$. This means that the probability of time is calculated between events or between successful events. An example of an event that represents an exponential distribution is queue theory.
Formula :

$$\mathbf{f\,(x, \lambda)} \begin{cases} \boldsymbol{\lambda e - \lambda x \; x \geq 0} \\ \boldsymbol{0} \; x < 0 \end{cases}$$

f (x, λ) = Probability density function.

λ = Rate parameters.

x = Random variable.[3].

2.6 Weibull Distribution

The Weibull distribution is a continuous probability. The advantage of the Weibull distribution is its easy functional form so it is easy to apply to several events. The Weibull distribution has scale and shape parameters. The Weibull distribution consists of 3 kinds of parameters, namely: shape, scale, and location. Two parameters that are often used in research are shape and scale. Various methods have been created to find estimated parameter values from the Weibull distribution.[4].

2.7 Random Variable

A random number generator is a number whose appearance occurs randomly and is expected to comply with a certain statistical distribution. A random number generator is a necessary tool in statistical computing, generally for simulations.

a.Exponential distribution of random numbers

Formula :
Generate U(0,1)
Calculate X = - 1/μ 1n(U)

b.Weibull random number distribution

Generate U(0,1)
Calculate X = -1/μ (-1n(U)).
Gygdh jgygd [2].

3. Results and discussion

3.1. Arrival Flowcharts

The arrival process is a process related to the arrival of customers to a queuing system, then waits in the queue until the waiter selects the customer according to the service discipline, and finally the customer leaves the queuing system after completing the service. The time between customer arrivals is random, then input arrivals with the weibull parameter, namely the average number of arrival distributions, the average distribution of services & the number of service servers. The arrival flowchart can be observed in the following visualization:

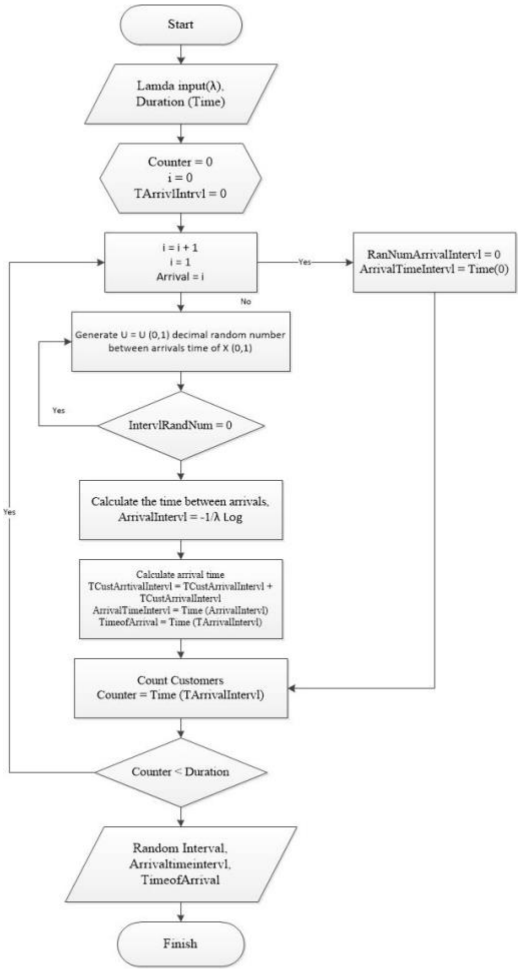

Fig. 1: Exponential Arrival Flowcharts

1.Arrival

Generating arrivals in a queue simulation system requires exponential discipline using random number intervals :-1/λ . log (U), for example like λ = 3 with a duration of 1 hour (60 minutes). Every minute applies for rounding down, the remaining decimal goes into seconds. As with the nth arrival time it is calculated using an equivalent formula. Counter = Number of arrival time intervals, if counter≥ duration then it is denoted finished, if counter< duration it will be raised with the next arrival.

Arrival 1 :

Num. Random = 0
Arrival time interval = 0
Arrival time = 0

Arrival to - 2
Generate U = U(0,1) = 0,2690.
Arrival interval = - 1/3 . log(0.2690) = 0.1710.
X = Arrival time interval*3600
= 0.1710*3600 = 615.6
Minutes = x/60 = 636.12/60 = 10.26 minutes.
Seconds = x mod 60 = mod 60 = 15.6 seconds.
Arrival Time = Call Time 1 + Inter Call Time 2
= 0 + 0.1710 = 0.1710.
X = Arrival Time*3600 = 0.1710 * 3600 = 615.6.
Minutes = x/60 = 615.6/60 = 10.26 minutes.
Seconds = x mod 60 = 615.6 mod 60 = 15.6 seconds.
If you go down, it gets bigger, if you go up, the value gets smaller

Arrival to - 3
Generate U = U(0,1) = 0,2198.
Arrival interval = - 1/3 . log(0.2198) = 0.1973.
X = Arrival time interval*3600
= 0.1973*3600 = 710.28.
Minutes = x/60 = 710.84 /60 = 11.84 minutes.
Seconds = x mod 60 = 710.28 mod 60 = 50.28 seconds.
Arrival Time = Call Time 1 + Inter Call Time 2
= 0.1710 + 0.1973 = 0.3683.
X = Arrival Time*3600 = 0.3683 * 3600 = 1325.88
Minutes = x/60 = 1325.88/60 = 22.10 minutes.
Seconds = x mod 60 = 1325.88 mod 60 = 5.88 seconds.

Arrival to - 4
Generate U = U(0,1) = 0,1513.
Arrival interval = - 1/3 . log(0.1513) = 0.2460.
X = Arrival time interval*3600
= 0.2460*3600 = 885.6 .
Minutes = x/60 = 885.4/60 = 14.76 minutes.
Seconds = x mod 60 = 885.4 mod 60 = 45.6 seconds.
Arrival Time = Call Time 5 + Inter Call Time 4
= 0.3683 + 0.2460 = 0.6143.
X = Arrival Time*3600 = 0.3256 * 3600 = 2211.48.
Minutes = x/60 = 2211.48/60 = 36.85 minutes.
Seconds = x mod 60 = 2211.48 mod 60 = 51.48 seconds.

Arrival to - 5
Generate U = U(0,1) = 0,1209.
Arrival interval = - 1/3 . log(0.1209) = 0.2752.
X = Arrival time interval*3600
= 0.2752*3600 = 990.72.
Minutes = x/60 = 990.72/60 = 16.51 minutes.
Seconds = x mod 60 = 990.72 mod 60 = 30.72 seconds.
Arrival Time = Call Time 1 + Inter Call Time 2
= 0.6143 + 0.2757 = 0.89.
X = Arrival Time*3600 = 0.89 * 3600 = 3.204.
Minutes = x/60 = 3.420/60 = 53.4 minutes.
Seconds = x mod 60 = 3.420 mod 60 = 3.20 seconds.

3.2. Servicing Flowcharts

The service process is an action or effort that occurs in direct interaction activities between a person and a customer or machine physically and provides customer quality in the service performance process which is usually carried out by an organizational institution or a particular company, such as at a train station which specifically provides maximum service. with the aim that customers or the public can get satisfaction with the services provided. The form of service provided certainly varies, depending on the sector being managed.

However, this service process assumes that arriving customers are calculated by waiting time using random numbers. In the customer service process, waiting time in the system and the amount of customer time in the system are also calculated. Then for the next service it will be determined when the service process starts and pays attention to the arrival time of customers or customers in the system that ends in the previous service. For this reason, the service process can be observed or obtained in the flowchart in the following image:

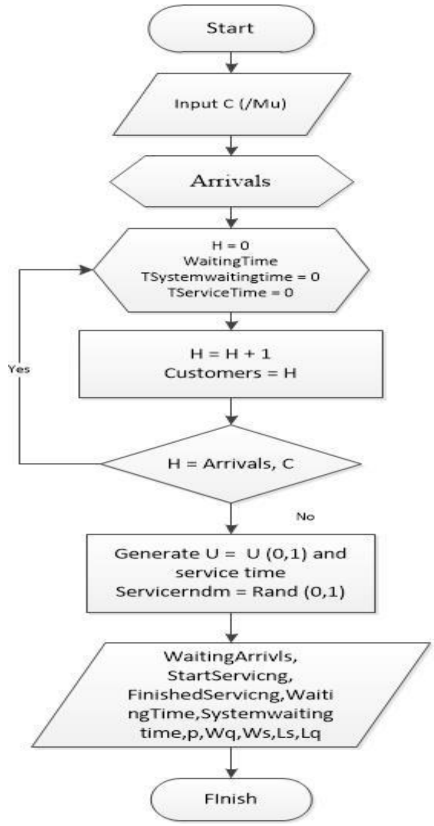

Fig. 2: Weibull Service Flowcharts

2.Servicing

Previously, after obtaining the number of arrivals using the exponential distribution, we would continue to generate arrival times using the Weibull distribution: $1/\mu$. (-In(U)) for example the number of arrivals $\lambda = 3$ and $\mu = 20$. If arrival time $\leq$ completion of previous customer service: start time = completion of previous customer or customer service. If if the arrival time > completed customer service or previous customer: start time = arrival time.

Customer - 1

Start time = Arrival Time = 0.
Generate U = U (0,1) = 0,0135.
Service time = $1/\mu$. (-ln(U)).
= 1/20 . (-ln(0.0135)) = 0.2152.
X = service time *3600 = 0.2152*3600 = 774.72.
Minutes = x/60 = 774.72/60 = 12.91 minutes.
Seconds = x mod = 774.72 mod 60 = 54.72 seconds.
Service End = Start time + Service time 1
= 0 + 0.2152 = 0.2152.
X = completed service*3600 = 0.2152*3600 = 774.72.
Minutes = x/60 = 774.72/60 = 12.91 minutes.
Seconds = x mod = 774.72 mod 60 = 54.72 seconds.
Queue waiting time = start time – arrival time = 0
X = queue waiting time*3600 = 0
Minutes = x/60 = 0
Seconds = x mod 60 = 0
System waiting time = completion of service 1 – arrival time 1.
= 0.1710 – 0 = 0.1710.
X = system timeout*3600 = 0.1710*3600 = 615.6.
Minutes = x/60 = 615.6/60 = 10.26 minutes.
Seconds = x mod = 615.6 mod 60 = 15.6 seconds.

Customer to - 2

Start time = compare the 2nd arrival time with the completion of the previous service, 0.1710 < 0.2152, then start time = 0.2152.
X = start time*3600 = 0.2152*3600 = 774.72.
Minutes = x/60 = 774.72/60 = 12.91 minutes.
Seconds = x mod = 774.72 mod 60 = 54.72 seconds.
Generate U = U(0,1) = 0.0130.
Service time = $1/\mu$. (-ln(U)).
= 1/20 . (-ln(0.0130)) = 0.2171.
X = service time*3600 = 0.2171*3600 = 781.56

Minutes = x/60 = 781.56/60 = 13.02 minutes.
Seconds = x mod = 781.56 mod 60 = 1.56 seconds.
Service completion = customer start time 2 + service time 2.
= 0.1710 + 0.2171 = 0.3881.
X = service completion time*3600 = 0.3381*3600 = 1397.16.
Minutes = x/60 = 1397.16/60 = 23.28 minutes.
Seconds = x mod 60 = 1397.16 mod 60 = 17.16 seconds.
Waiting time in queue = service start time 2 – arrival time 2.
= 0.2171 – 0.1710 = 0.0461.
X = waiting time in queue*3600 = 0.0461*3600 = 165.96
Minutes = x/ 60 = 165.96/60 = 2.76 minutes.
Seconds = x mod 60 = 165.96 mod 60 = 45.96 seconds.
Waiting time in the system = completion of service 2 – arrival time 2.
= 0.3381 – 0.0461 = 0.292.
X = waiting time in system*3600 = 0.292*3600 = 1051.2
Minutes = x/60 = 1051.2/60 = 17.52 minutes.
Seconds = x mod 60 = 1051.2 mod 60 = 31.2 seconds

Customer to - 3
Start time = compare arrival time 3 with previous service completion, 0.3683 < 0.3881. Then start time = 0.3881.
X = Service completion time 0.3881*3600 = 0.3881*3600 = 1397.18.
Minutes = x/60 = 1397.16/60 = 23.28.
Seconds = x mod 60 = 1397.16 mod 60 = 17.16.
Generate U = U(0,1) = 0.0103.
Service time = 1/μ. (-ln(U)).
= 1/20 . (-ln(0.0103)) = 0.2287.
X = service time*3600 = 0.2287*3600 = 823.32
Minutes = x/60 = 823.32/60 = 13.72 minutes.
Seconds = x mod 60 = 832.32 mod 60 = 43.32 seconds.
Finish Service = customer start time 3 + service time 3
= 0.3881 + 0.2287 = 0.6168.
X = completed service*3600 = 0.6168*3600 = 2220.48
Minutes = x/60 = 2220.48/60 = 37.01 minutes
Seconds = x mod 60 = 2220.48 mod 60 = 0.48 seconds
Waiting time in queue = service start time 3 – arrival time 3.
= 0.3881 - 0.2287 = 0.1594.
X = waiting time in queue 0.1594*3600 = 1004.22
Minutes = x/60 = 1004.22/60 = 16.73 minutes
Seconds = x mod 60 = 1004.22 mod 60 = 44.22 seconds
Waiting time in the system = completion of service 3 – arrival time 3.
= 0.6168 - 0.3683 = 0.2485.
X = waiting time in system*3600 = 0.2485*3600 = 894.6.
Minutes = x/60 = 894.6/60 = 14.91 minutes
Seconds = x mod 60 = 894.6 mod 60 = 54.6 seconds.

Customer to - 4
Start time = compare arrival time 4 with the previous service finish time, 0.6143 > 0.6168, then start time = 0.6168.
X = completed service*3600 = 0.6168*3600 = 2220.48
Minutes = x/60 = 2220.48/60 = 37.01 minutes
Seconds = x mod 60 = 2220.48 mod 60 = 0.48 seconds
Generate U = U(0,1) = 0.0027.
Service time = 1/μ .(-In(U)).
= 1/20 . (-In(0.0027) = 0.3037.
X = service time*3600 = 0.1314*3600 = 1064.52.
Minutes = x/60 = 1064.52/60 = 17.74 minutes.
Seconds = x mod 60 = 1064.52 mod 60 = 44.52 seconds.
Service completion = Customer start time 4 + service time 4
= 0.6168 + 0.3037 = 0.9205.
X = completed service*3600 = 0.9205*3600 = 3313.8.
Minutes = x/60 = 3313.8/60 = 55.23 minutes.
Seconds = x mod 60 = 3313.8 mod 60 = 13.8 seconds.
Waiting time in queue = service start time 4 – arrival time 4.
= 0.6168 – 0.3037 = 0.3131.
X = waiting time in queue*3600 = 0.3131*3600 = 1127.16
Minutes = x/60 = 1127.16/60 = 18.78 minutes.
Seconds = 1349.28 mod 60 = 1127.16 mod 60 = 47.16 seconds
Waiting time in the system = completion of service 4 – arrival time 4.
= 0.6168 - 0.6143 = 0.0025.
X = waiting time in system*3600 = 0.0025*3600 = 0.0025.
Minutes = x/60 = 0.0025/60 = 4.16 minutes

Seconds = x mod 60 = 0.0025 mod 60 = 0.28 seconds.

Customer to - 5
Start time = compare arrival time 5 with previous service completion, 0.89 < 0.9205, then start time = 0.9205.
X = finish start*3600 = 0.9205*3600 = 3285.
Minutes = x/60 = 3313.8/60 = 13.8 minutes.
Seconds = x mod 60 = 3313.8 mod 60 = 55.23 seconds.
Generate U = U(0,1) = 0.0979.
Service time = 1/μ .(-In(U)).
= 1/20 . (-In(0.0979) = 0.1161.
X = service time*3600 = 0.1161*3600 = 417.96.
Minutes = x/60 = 417.96/60 = 6.96 minutes.
Seconds = x mod 60 = 417.96 mod 60 = 57.96 seconds.
Service completion = service start time 5 + service time 5
= 0.9205 + 0.1161 = 1.0366.
X = completed service*3600 = 1.0366*3600 = 3731.76.
Minutes = x/60 = 3731.76/60 = 62.19 minutes.
Seconds = x mod 60 = 3731.76 mod 60 = 11.76 seconds.
Waiting time in queue = service start time 5 – service time 5.
= 0.9205 – 0.1161 = 0.8044.
X = waiting time in queue*3600 = 0.8044*3600 = 2895.84.
Minutes = x/60 = 2895.84/60 = 48.26 minutes.
Seconds = x mod 60 = 2895.84 mod 60 = 16.84 seconds.
Waiting time in the system = completion of service 5 – arrival time 5
= 1.0366 - 0.89 = 0.1466.
X = waiting time in the system = 0.1466*3600 = 527.76
Minutes = x/60 = 527.76/60 = 8.71 minutes.
Seconds = x mod 60 = 527.76 mod 60 = 47.76 seconds.

Table 1: Arrivals

Arrival to -	Acak Rand()	Arrival Time Interval	Time of Arrival
1	0	0	0
2	0,2690	0,1710	0,1710
3	0,2198	0,1973	0,3683
4	0,1513	0,2460	0,6143
5	0,1209	0,2752	0,89

Table 2: Arrivals in units of times

Arrival to -	Acak Rand()	Arrival Time Interval	Time of Arrival
1	0	00:00	00:00
2	0,2690	10:30	10:30
3	0,2198	11:50	22:05
4	0,1513	14:45	36:51
5	0,1209	16:30	53:03

Table 3: Servicing

Costumer	Time of Arrival	Start Time	Random Number	Service Time	Finished Service	Waiting Time in Queue	Waiting Time in System
1.	0	0	0,0135	0,2152	0,2152	0	0,1710
2.	0,1710	0.2152	0,0130	0,2171	0,3881	0,0461	0,292
3.	0,3683	0,3881	0,0103	0,2287	0,6168	0,1594	0,2485
4.	0,6143	0,6181	0,0027	0,3037	0,9205	0,3131	0,0025
5.	0,89	0,9205	0,0979	0,1161	1,0366	0,8044	0,1466

Table 4: Servicing

Costumer	Time of Arrival (mm : dd)	Start Time (mm : dd)	Random Number	Service Time (mm : dd)	Finished Service (mm : dd)	Waiting Time in Queue (mm : dd)	Waiting Time in System
1.	00:00	00:00	0,0135	12:54	12:54	00:00	10:15
2.	10:30	12:54	0,0130	13:01	23:17	02:45	17:31
3.	11:50	37:04	0,0103	13:43	37:01	16:44	14:54
4.	14:45	55:13	0,0027	17:44	55:13	18:47	04:00
5.	16:30	48:16	0,0979	06:55	62:11	48:16	08:47

3.3. Simulation Results

The results of the simulation obtained will be added up using the following formula :

- Average Waiting Time in Queue (Wq)

  Wq $= \Sigma \frac{costumer\ waiting\ time\ in\ queue}{number\ of\ customers}$

  $= \Sigma \frac{0+0{,}0461+0{,}1594+0{,}3131+0{,}8044}{3}$

  = 0,441.
- Average Waiting Time in System(Ws)

  Ws $= \Sigma \frac{Waiting\ time\ in\ system}{number\ of\ customers}$

  $= \Sigma \frac{0{,}1710+0{,}292+0{,}2485+0{,}0025+0{,}1466}{3}$

  = 0,2869.
- Average Number of Customers in Queue (Lq)

  Lq $=\Sigma \frac{customer\ waiting\ time\ in\ the\ queue}{time\ duration}$

  $=\Sigma \frac{0+0{,}0461+0{,}1594+0{,}3131+0{,}8044}{60}$

  = 0,0220.
- Average Number of Customers in System (Ls)

  Ls $= \Sigma \frac{customer\ waiting\ time\ in\ the\ system}{time\ duration}$

  $=\Sigma \frac{0{,}1710+0{,}292+0{,}2485+0{,}0025+0{,}1466}{60}$

  = 0,0143.
- Busy Server Probability (ρ)

  ρ $= \Sigma \frac{service\ time}{many\ servers + time\ duration}$

  $=\Sigma \frac{0{,}2152+0{,}2171+0{,}2287+0{,}3037+0{,}1161}{1*60}$

  = 0,0180.

Table 5: Service Results

Simulation Results	Wq(Σ WaitingTime/3)	Ws(ΣSystemWaitingTime/3)	Lq(ΣWaitingTime/60)	Ls(ΣSystemWaitingTime/60)	ρ
	0,441	0,2869	0,0220	0,0143	0,0180

From the results table above it can be concluded using λ = 3 and μ = 20 obtained from the simulation results table as follows.
ρ = 0.0180 x 100% = 1.80 %
Wq = 0.441.
X = Wq*3600 = 1587.6.
Minutes = x/60 = 26.46 Minutes.
Seconds = x mod 60 = 27.6 Seconds.
Ws = 0.2869.
X = Ws*3600 = 1032.84.
Minutes = x/60 = 17.21 Minutes.
Seconds = x mod 60 = 12.84 Seconds.
From the sum results, it can be observed that the probability of the server being busy is 1.80%. By denoting the average waiting time in the queue, namely 0.441 or 26 minutes 27 seconds with an average waiting time of 0.2869 or equal to 17 minutes 12 seconds in the queue. Judging from the conclusion of a server that can serve all customers or customers correctly, therefore the probability that the server is not too busy because the probability value has not passed the value 1 and the average wait is not too long in waiting and can still be overcome by one server only.

4. Conclusion

This study describes a queue simulation at the Binjai train ticket booth using the Weibull service distribution. Based on the research results, several conclusions can be drawn:

Weibull Service Distribution : The research results show that the use of Weibull service distribution in the Binjai train ticket counter queue simulation is relevant and provides reliable results. The Weibull distribution is able to reflect variations in service time well.
Waiting Time and Counter Capacity : This simulation identifies the average waiting time at Binjai train ticket counters, which can be used as a basis for improving service efficiency. In addition, counter capacity can be further evaluated to reduce waiting times and increase customer satisfaction.
Process Optimization : This simulation provides a better understanding of how to optimize the service process at the Binjai train ticket counter. This can help management to make better decisions regarding increased efficiency and better service to customers.
Improvement Recommendations : Based on the simulation results, concrete improvement recommendations can be proposed, such as increasing the number of counters, increasing officer training, or adjusting operating hours. This can help in overcoming queue problems and improve service quality at the Binjai train ticket counter.
Thus, this research provides an important contribution in understanding and improving queue management at the Binjai train ticket counter, with a focus on the use of Weibull service distribution as an effective analytical tool. These results can be the basis for better decision making and improvement efforts in customer service.

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