

SKRIPSI

**ANALISIS SISTEM ANTRIAN PELANGGAN CUSTOMER SERVICE
MENGUNAKAN MODEL *RETRIAL QUEUE* $M/G/c/N$
DENGAN *DISCOURAGED CUSTOMERS***

*ANALYSIS OF A CUSTOMER SERVICE QUEUEING SYSTEM
USING AN $M/G/c/N$ RETRIAL QUEUE MODEL
WITH DISCOURAGED CUSTOMERS*



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**DEPARTEMEN MATEMATIKA
FAKULTAS SAINS DAN MATEMATIKA
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Diajukan untuk memenuhi salah satu syarat memperoleh derajat
Sarjana Matematika (S. Mat.)



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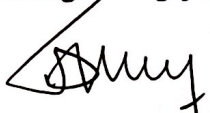
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ABSTRAK

ANALISIS SISTEM ANTREAN PELANGGAN *CUSTOMER SERVICE* MENGUNAKAN MODEL *RETRIAL QUEUE M / G / c / N* DENGAN *DISCOURAGED CUSTOMERS*

oleh

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Sistem antrean pada layanan *customer service* dapat dipengaruhi oleh keterbatasan kapasitas pelayanan, *discouraged customers*, dan *retrial*. Penelitian ini bertujuan mengembangkan model *retrial queue M / G / c / N*, dengan M menyatakan kedatangan Poisson, G waktu pelayanan berdistribusi umum, c jumlah server, dan N kapasitas maksimum sistem, pada layanan *customer service* GraPARI Telkomsel Semarang. Penelitian dilakukan melalui formulasi model matematis, analisis *steady-state*, dan analisis numerik menggunakan Python. Hasil penelitian menunjukkan bahwa model mampu merepresentasikan pelanggan yang melakukan percobaan ulang memperoleh pelayanan serta penurunan laju kedatangan ketika sistem semakin padat. Analisis *steady-state* menghasilkan ukuran kinerja berupa tingkat utilisasi server, rata-rata jumlah pelanggan dalam sistem, rata-rata waktu tunggu pelanggan, dan probabilitas sistem penuh. Hasil numerik menunjukkan tingkat utilisasi server sebesar 45,81% dan probabilitas sistem penuh sebesar 0,000001. Analisis sensitivitas menunjukkan bahwa laju kedatangan pelanggan merupakan parameter yang paling dominan memengaruhi ukuran kinerja sistem, dibandingkan laju pelayanan, jumlah server, dan laju *retrial*.

Kata kunci: Teori antrean, analisis *steady-state*, analisis sensitivitas, probabilitas *steady-state*, ukuran kinerja sistem.

ABSTRACT

ANALYSIS OF A CUSTOMER SERVICE QUEUEING SYSTEM USING AN $M/G/c/N$ RETRIAL QUEUE MODEL WITH DISCOURAGED CUSTOMERS

by

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Customer service queueing systems may be affected by limited service capacity, discouraged customers, and retrials, resulting in more complex queueing behavior. This study aims to develop an $M/G/c/N$ retrial queue model, where M denotes Poisson arrivals, G denotes a general service-time distribution, c represents the number of servers, and N represents the maximum system capacity, for the customer service system at GraPARI Telkomsel Semarang. The research was conducted through mathematical model formulation, steady-state analysis, and numerical analysis using Python. The results show that the developed $M/G/c/N$ retrial queue model with discouraged customers is able to represent customers who repeatedly attempt to obtain service and the decrease in arrival rates as the system becomes more congested. The steady-state analysis produced several performance measures, including server utilization, the average number of customers in the system, average customer waiting time, and the probability of a full system. The numerical results indicate a server utilization of 45.81% and a full system probability of 0.000001. Sensitivity analysis further reveals that the customer arrival rate is the most influential parameter affecting system performance compared with the service rate, the number of servers, and the retrial rate.

Keywords: Queueing theory, steady-state analysis, sensitivity analysis, steady-state probability, system performance measures.