

CW Part 01: Individual Assignment with Viva

CM 2605: Simulation and Modeling Techniques

2024/25 Semester 2

Simulation and Analysis of Customer Queuing System in a Bank Using R

Scenario

A well-established bank is experiencing high customer footfall, leading to long queues and increased waiting times. The bank management wants to optimize the service process by simulating the current queuing system and predicting future performance under different scenarios.

Problem Statement

The bank operates with:

- **Two service counters**, each with a single server.
- **Customer arrivals** following a **Poisson distribution** with an average rate of 10 customers per hour.
- **Service times** following an **Exponential distribution** with an average service time of 5 minutes per customer.
- Customers are served on a **first-come, first-served (FCFS)** basis.
- The bank manager is considering hiring an additional counter if the average waiting time exceeds **15 minutes**.

Tasks

1. Model Development

- Formulate the bank's queuing system using appropriate probabilistic models.
- Implement the simulation in **R**, using suitable packages such as **queueing** or custom functions.
- Simulate the system for an 8-hour workday (480 minutes).

2. Analysis and Interpretation (500 words)

- Analyze the performance of the current system, calculating key performance metrics such as:

- Average queue length
 - Average waiting time
 - Server utilization
- Evaluate the impact of adding an additional counter.
 - Discuss the implications of the findings for the bank’s operational strategy.

3. Visualization and Reporting (500 words)

- Provide appropriate visualizations such as histograms and line charts.
- Prepare a concise report summarizing the methodology, results, and recommendations.

Assignment Guidelines

- The coursework deadline is **15th April, 2025, 11:59 p.m. (IST)**.
- You can complete the assignment in a single R Markdown file using RStudio and submit it as a PDF document.
- Write up your work in an `.Rmd` file and “knit” the results to a PDF or Word file.
- Between R chunks, you can use LaTeX to write text or mathematical equations.
- Coursework received late without a valid reason shall not be accepted and will receive no grade.
- Submit at least 2-3 hours before the due time to avoid connection issues.
- No second chance will be given for missed parts in submissions.
- **Plagiarism (except for code) should be less than 15%.**
- The word limit (excluding code) is **1000 words**.
- If you have any questions, contact a module team member before the due date.

Rubric for Evaluation (Total Marks: 100)

- All sections of the rubric will be evaluated through individual viva assessments.

			Satisfactory	Needs
Criterion	Excellent (25)	Good (20)	(10)	Improvement (5)
Model Development (25 Marks)	Correct and optimized model, well-documented	Mostly correct, minor issues	Basic model with gaps	Incorrect or missing model

Criterion	Excellent (25)	Good (20)	Satisfactory (10)	Needs Improvement (5)
Code Implementation (25 Marks)	Efficient and error-free code, clear comments	Minor inefficiencies or issues	Basic implementation	Poor or incomplete code
Analysis & Interpretation (25 Marks)	Deep insights, well-structured explanations	Good insights, minor gaps	Basic analysis	Minimal analysis, lacks depth
Visualization (25 Marks)	Clear, relevant, and well-labeled charts	Good but minor flaws	Basic charts, lacks clarity	Poor or missing visuals

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