



DEPARTMENT OF COMPUTER SCIENCE

DCS UBIT

UNIVERSITY OF KARACHI

Project Title:

"Simulation of randomly generated arrival and service time with (M/M/1)"

Course name: Simulation and Modelling

Submitted by:

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Project Documentation

Introduction:

Our simulator comprises three distinct modules tailored for comprehensive analysis and simulation of queuing systems. These modules include

- 1) Deterministic Analysis
- 2) Stochastic Simulation
- 3) M/M/1 Priority Queue Simulation (recent addition)

Each component is meticulously crafted to address various aspects of queuing theory, enabling insightful exploration and evaluation of system performance.

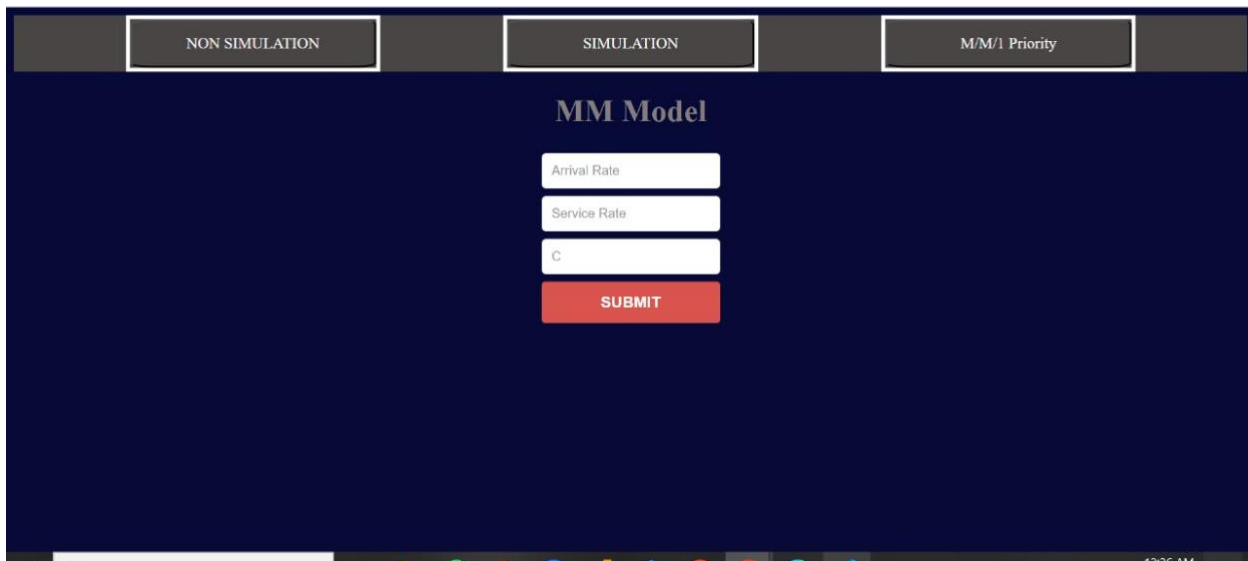
1. Deterministic Analysis:

In this segment, our focus lies on precisely computing essential queuing metrics such as the average number of customers in the system (L_s), the average number of customers in the queue (L_q), the average time a customer spends in the system (W_s), and the average time a customer spends waiting in the queue (W_q). We achieve this by leveraging established formulas tailored for M/M/n, M/G/n, and G/G/n queuing systems, given specific mean arrival and service times.

The screenshot displays a web-based interface for the 'MM' module. At the top, a dark blue header bar contains the text 'MM'. Below this, the main content area is divided into two sections: 'ARRIVAL' and 'SERVICE'. The 'ARRIVAL' section features a single input field labeled 'arrival rate'. The 'SERVICE' section contains two input fields: 'service rate' and 'no of servers'. At the bottom of the form, there is a prominent red 'Submit' button.

2. Stochastic Simulation:

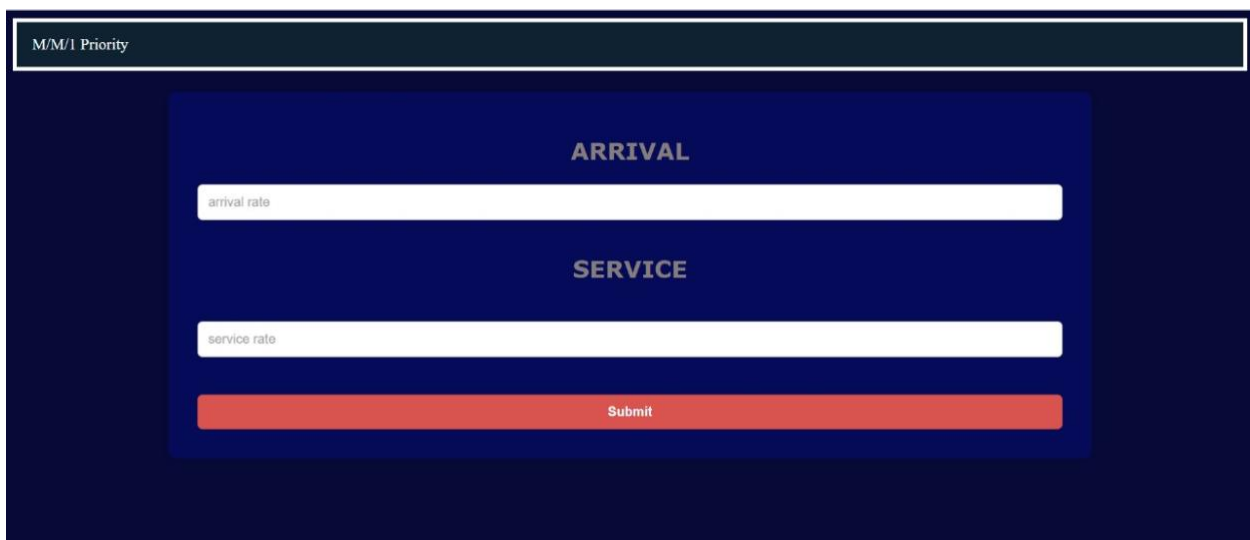
The Stochastic Simulation module offers a dynamic approach to queuing analysis by employing random arrivals and service times. Through this simulation, we effectively emulate real-world scenarios, facilitating a deeper understanding of system behavior under varying conditions. By generating random values, we derive insights into queuing performance for M/M/n, M/G/n, and G/G/n systems, considering mean arrival and service times as input parameters.



The screenshot shows a web interface for the 'MM Model'. At the top, there are three tabs: 'NON SIMULATION', 'SIMULATION' (which is selected), and 'M/M/1 Priority'. Below the tabs, the title 'MM Model' is centered. Underneath the title, there are three input fields stacked vertically: 'Arrival Rate', 'Service Rate', and 'C'. Below these fields is a red 'SUBMIT' button. The background is dark blue. At the bottom right, there is a timestamp '12:26 AM'.

3. M/M/1 Queue Simulation:

The latest addition to our simulator repertoire, the M/M/1 Queue Simulation module, addresses the intricacies of priority-based queuing. By implementing the M/M/1 priority queue model, we introduce a nuanced dimension to queuing analysis. Leveraging a Linear Congruential Generator (LCG) for generating random values, this module enables the simulation of priority queues, offering insights into system dynamics and performance metrics tailored to priority-based scenarios.



The screenshot shows a web interface for the 'M/M/1 Priority' simulation. At the top, there is a tab labeled 'M/M/1 Priority'. Below the tab, the title 'ARRIVAL' is centered. Underneath the title, there is a long white input field labeled 'arrival rate'. Below this, the title 'SERVICE' is centered. Underneath the title, there is a long white input field labeled 'service rate'. At the bottom, there is a red 'Submit' button. The background is dark blue.

Conclusion:

Collectively, our simulator empowers users to delve into the complexities of queuing theory through deterministic analysis, stochastic simulation, and now, the specialized domain of priority queuing. By providing a comprehensive toolkit for queuing analysis, our simulator serves as a valuable resource for academia, research, and practical applications, facilitating informed decision-making and system optimization in diverse queuing environments.

Note:

- We have used Django at the backend (framework of python) and (HTML,CSS,JS) at the frontend.
- M/M/1 priority queue model and stochastic simulation also generate the results and a graph for better understanding.
- GitHub Link: <https://github.com/SMAhmer17/Priority-Simulation-Project>