**Deliverable 01- System Details and Performance Objectives**

**Hospital Queue Simulation System**

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**1.** **Problem Description Overview**

The Hospital Emergency Room Queue was the system I selected for this project. When I go to the hospital every time, I notice that there are many times when patients have to wait a long time to be seen by a doctor. The longer they wait, the less satisfied they will be with their care, and it could even lead to poor health outcomes. On the other hand, if doctors don’t work hard enough to utilize their training and skills, then they are not doing their jobs well.

My overall problem area is how to find a good balance between how long it takes to get to see a doctor and how much utilization doctors have from seeing patients. To help me explore this problem area, I developed a simulation model that simulates patients arriving at random times and doctors providing service to those patients as resources. Using this model, I will try to evaluate the system in various ways to better understand its performance, identify areas for improvement and optimize its performance.

**2.** **Identifying a Complex System**

The system I identified has measurable performance characteristics:

• **Complexity -** Patients arrive at random, multiple doctors provide services, a queue forms and the amount of time each patient spends receiving treatment varies.

**• Performance Measures**:

* Patient Waiting Time
* Total Throughput (Number of Patients Treated)
* Doctor Utilization

This system is complex enough to allow analysis of bottlenecked processes, throughput, resource utilization and latency in actual hospital operation settings.

**3.** **Performance Objectives**

My objectives are focused on the following performance measures:

• **Minimize Patient Wait Times:** Ensure all patients receive prompt medical attention.

• **Maximize Throughput:** Maximize the number of patients treated during the simulated time period.

• **Optimize Doctor Utilization:** Have Doctors utilized sufficiently to maximize their skills, yet not so heavily utilized that they make errors.

**• Identify Bottlenecks:** Determine when queues and delays occur and the conditions under which such queues and delays occur.

**4. Input Parameter Dataset**

I created synthetic data to imitate how patients arrive and are treated in a hospital, making the simulation more practical.

| **Parameter** | **Description** | **Example Values** | **Data Type** |
| --- | --- | --- | --- |
| Number of Doctors | Total number of doctors available | 2, 3 | Integer |
| Patient Arrival Interval | Average time (minutes) between patient arrivals | 2, 5, 8 | Float |
| Treatment Time | Average treatment duration per patient (minutes) | 5, 10 | Float |
| Simulation Time | Total runtime of the simulation | 100 | Integer |
| Wait Time (Output) | Time patient waits before treatment | Auto calculated | Float |
| Throughput (Output) | Number of patients treated | Auto calculated | Integer |

**5. GitHub Repository**

**Repository URL:**<https://github.com/FarhaFuard/hospital_queue_simulation>

**Repository Structure:**

* **Main Branch:** Contains the complete Python code used for the Case Study including all simulation scenarios, metrics calculation, and visualization scripts.
* **Deliverable\_01 Branch:** Contains the Word document for Deliverable 01
* **Note:** The course coordinator mentioned in **ILS 01** that we can use the system we developed for the CS as the initial component for the MP. I will continue the development of the Mini Project from this codebase, adding more realistic datasets and extending the analysis in future submissions.