**Supermarket Queue Simulation Report**

**1. Introduction** This report presents the results of a supermarket checkout simulation comparing two queue management policies:
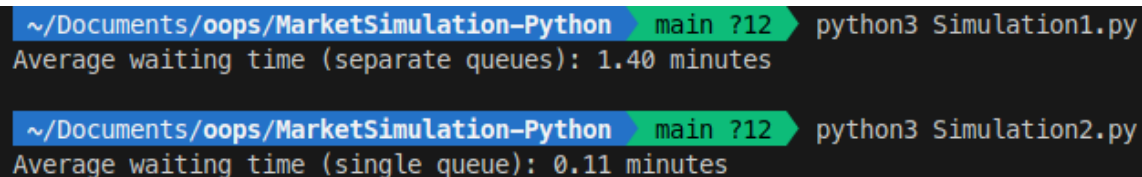
- **Separate Queues:** Each cash register has its own dedicated queue.
- **Single Queue:** A single shared queue feeds all available cash registers.

The goal of the simulation was to compute the average waiting time for customers under each policy and determine which approach minimizes wait times.

**2. Simulation Setup** The simulation was implemented using Python, modeling customers arriving at the supermarket. Each customer had an assigned arrival time and a required service time. The key parameters included:

- **Arrival Probability:** Determines the likelihood of a customer arriving each minute.
- **Number of Registers:** The total number of available checkout registers.
- **Total Duration:** The simulation ran for a set number of minutes.

**3. Simulation Results** The simulation was executed for both queue management policies, and the average waiting times were recorded. The results are shown below:

```
~/Documents/oops/MarketSimulation-Python  main ?12   python3 Simulation1.py
Average waiting time (separate queues): 1.40 minutes

~/Documents/oops/MarketSimulation-Python  main ?12   python3 Simulation2.py
Average waiting time (single queue): 0.11 minutes
```

- **Average Waiting Time (Separate Queues):** 1.40 minutes
- **Average Waiting Time (Single Queue):** 0.11 minutes

**4. Analysis and Conclusion** From the results, we observe that the **Single Queue** policy significantly reduces the average waiting time compared to the **Separate Queues** policy. This is likely due to better load balancing across registers, minimizing idle time for cashiers and reducing overall customer waiting time.

Based on the findings, supermarkets may benefit from implementing a **Single Queue** system, particularly during peak hours, to improve efficiency and customer satisfaction.

**5. Additional Considerations** Future improvements to the simulation could include:

- Modeling customer impatience (customers leaving if the queue is too long)
- Incorporating different service time distributions based on the number of items per customer
- Evaluating the impact of additional registers on queue performance

**6. Submission Details** This report was prepared as part of the Supermarket Queue Simulation Lab. The source code files are included in the submission as required.