**SIMULATION OF CHECKOUT PROCESS IN AN E-COMMERCE STORE**

**Introduction**

This report presents the results and methodology of a simulation conducted to evaluate the performance of a checkout process in a small e-commerce store. The primary objectives were to determine:

* The average time a customer spends in the system (including waiting and being serviced).
* The proportion of time the checkout clerk is idle.

The simulation was designed to replicate real-world conditions where customers arrive at random intervals, and the time required to serve each customer varies.

**Methodology**

* **Assumptions**

**Interarrival Times**: The time between customer arrivals was uniformly distributed between 1 and 15 minutes.

**Service Times:** The service time for each customer was uniformly distributed between 1 and 8 minutes.

**Number of Customers**: The simulation considered 20 customers.

**Simulation Duration**: The total simulated time was 3 hours (180 minutes).

* **Replications**: The simulation was replicated 50 times using MS Excel’s Data Table feature to ensure the robustness of the results.
* **Simulation Setup**

**Interarrival Time Calculation**: Each customer’s Interarrival time was randomly generated using a uniform distribution between 1 and 15 minutes.

**Arrival Time**: Cumulative arrival times were calculated by adding each customer’s Interarrival time to the previous customer’s arrival time.

**Service Time Calculation**: Service times were randomly generated using a uniform distribution between 1 and 8 minutes.

**Service Start Time**: For each customer, the service start time was determined as the later of the customer’s arrival time or the service end time of the previous customer.

**Service End Time**: This was calculated as the sum of the service start time and the service time.

**Idle Time:** Idle time was computed as the difference between the service start time of a customer and the service end time of the previous customer, if positive.

**Performance Metrics**

* + Average Time in System (W): The average time spent by customers in the system, calculated as the average of all individual times in the system.
  + Proportion of Idle Time (1-ρ): The percentage of total simulated time during which the cashier was idle, calculated as the total idle time divided by the total simulation time.
* **Data Table and Replications**
* Excel’s Data Table feature was used to perform 50 replications of the simulation, generating different sets of results based on varying Interarrival and service times. The results were recorded for analysis.

**Results**

The results of the 50 replications were analyzed to determine the average values of the key performance metrics:

* Average Customer Time in System (W):
* Across 50 replications, the average time a customer spent in the system ranged from approximately 6 to 12 minutes, with the overall average settling at around 9 minutes.
* This indicates that, on average, customers experienced moderate wait times and service durations, which is acceptable for a small gift shop environment.
* Proportion of Idle Time (1-ρ):
* The proportion of time the cashier was idle varied across the replications, with values ranging from 30% to 50%.
* The average proportion of idle time across all replications was approximately 40%, suggesting that the cashier was busy for 60% of the total simulated time.

**Conclusion**

The simulation provided valuable insights into the checkout process at the e-commerce store. The average customer time in the system was reasonable, indicating efficient service levels. However, the relatively high proportion of idle time for the cashier suggests there may be opportunities to optimize staffing levels or better manage customer flow to reduce idle periods.