**Brief Report on Simulation of Checkout Process in an E-Commerce Store**

**Objective:**

The objective of this simulation was to model the checkout process at a small gift shop with one cashier and one line of customers. The main performance measures evaluated were:

1. Average time a customer spends in the system (both waiting and being serviced).

2. Percentage of time that the cashier (server) is idle.

**Assumptions:**

- Interarrival Times: The time between customer arrivals is uniformly distributed between 1 and 15 minutes, rounded to the nearest whole minute.

- Service Times: The time required to service each customer is uniformly distributed between 1 and 8 minutes, rounded to the nearest whole minute.

**Methodology**

**1. Setup in Excel**:

The simulation was carried out using Microsoft Excel. A spreadsheet was created to simulate the checkout process for **20 customers** arriving over a period of **3 hours**.

Each customer's **interarrival time** and **service time** were generated using Excel's random number generation functions e.g., RANDBETWEEN, ensuring the uniform distribution as per the assumptions.

**2. Performance Metrics**

The performance measures, **Average Time in System (W)** and **Idle Percentage** (1-ρ), were calculated as follows:

* W (Average Time in System): This metric was calculated by summing up the time each customer spends waiting for service and the time they spend being serviced, then dividing by the total number of customers.
* Idle Percentage: The total time the cashier was idle was calculated by summing the intervals during which no customers were present, and then dividing by the total simulated time (180 minutes).

**3. Replications**

To account for variability, **50 replications** of the simulation were performed. Each replication represented a separate run of the simulation with different randomly generated interarrival and service times.

Excel’s **Data Table** functionality was used to automate the recalculations for each replication, which recalculated the random variables and performance metrics for each run.

**4. Data Analysis:**

- For each replication, the *Average Time in System (W)* and *Idle Percentage* were recorded.

- The results were analyzed across all 50 replications to assess the variability in performance and to derive the average results.

**Results**

The summary of the results across 50 replications is as follows:

- **Average Time in System (W)**: The average time a customer spent in the system across 50 replications was approximately **X minutes** (depending on my simulation output).

- **Idle Percentage**: The average idle time of the cashier across 50 replications was around Y% (depending on my simulation output).

**Conclusion**

The simulation provided insights into the operational performance of the checkout process. The average time in the system can help the store management understand customer waiting times, while the idle percentage gives an indication of the cashier's utilization.