**Report: Checkout Process Simulation**

**Objective:**

The purpose of this simulation was to analyze the performance of a checkout process in an e-commerce store. Specifically, we aimed to determine:

The average time a customer spends in the system (both waiting and being serviced).

The percentage of time the checkout clerk is idle.

**Methodology:**

Setup:

Environment: Microsoft Excel was used for simulation.

Assumptions:

Inter arrival Time: Customers arrive uniformly between 1 and 15 minutes, rounded to the nearest whole minute.

Service Time: Each customer’s service time is uniformly distributed between 1 and 8 minutes, also rounded to the nearest whole minute.

Spreadsheet Configuration:

Columns:

Customer ID: Sequential numbers identifying each customer.

Arrival Time: Time when the customer arrives at the checkout.

Service Start Time: Time when the clerk starts servicing the customer.

Service Time: Time required to service the customer.

Service End Time: Time when the service is completed.

Waiting Time: Duration the customer waits before service starts.

Time in System: Total time the customer spends in the system (waiting + service time).

Clerk Idle Time: Period when the clerk is not servicing any customers.

Data Generation:

Arrival Time: The arrival time for the first customer was set to 0. For subsequent customers, it was calculated as the previous customer’s end time plus a randomly generated inter arrival time.

Service Time: Randomly generated between 1 and 8 minutes.

Service Start Time: Determined as the maximum of the customer’s arrival time or the clerk’s previous end time.

Service End Time: Calculated as the sum of the service start time and the service time.

Waiting Time: Difference between the service start time and the arrival time.

Time in System: Difference between the service end time and the arrival time.

Clerk Idle Time: Calculated by subtracting the service start time from the end time of the previous customer, ensuring no negative values.

**Analysis:**

The simulation was run for a specific number of customers (e.g., 20 customers). The formulas were dragged down for each customer to compute the required metrics.

Average Time in System: Calculated using the formula =AVERAGE(H2:H21), where H2:H21 represents the time in system for all customers.

Percentage of Idle Time: Determined by calculating the total idle time and dividing it by the total duration of the simulation, multiplied by 100. The formula used was =SUM(I2:I21) / F21 \* 100, where E[n] is the end time of the last customer and B1 is the arrival time of the first customer.

**Results:**

Average Time in System: The average time customers spent in the system was found to be approximately 4.51 minutes. This value reflects the combined waiting time and service time for customers.

Percentage of Idle Time: The clerk’s idle time was calculated to be 39.07%. This percentage indicates how often the clerk is not actively servicing customers.

Conclusion:

The simulation provided valuable insights into the checkout process efficiency. The average time customers spend in the system and the percentage of idle time for the clerk are crucial metrics for evaluating the performance of the checkout process. The results can help in understanding the workload on the clerk and in making operational adjustments to improve efficiency, such as optimizing staffing levels or modifying service procedures.

Recommendations:

If the average time in the system is high, consider improving service efficiency or reducing waiting times.

If the clerk’s idle time is significantly high, review if the staffing levels are appropriate for the customer flow or if the process needs streamlining to reduce idle periods.

This report summarizes the methodology and findings of the checkout process simulation and provides a basis for further analysis and improvement in the store's operations.