**QUESTION ONE**

**1. Introduction**

This simulation attempts to evaluate the e-commerce checkout process by measuring several key performance indicators, including server idle time, customer waiting time, and service time. I usedExcel to simulate a system with 20 customers for three hours, and ran 50 iterations to determine the average customer wait time and server idle time.

**2. Methodology**

The simulation follows a basic queuing system where customers arrive, are serviced by a single server (cashier), and then exit the system. The key variables in this system include:

* **Interarrival Time:** The time between two consecutive customer arrivals.
* **Arrival Time:** The time at which each customer arrives at the system.
* **Service Time:** The time required to serve each customer.
* **Service Start Time:** The time the service starts for each customer.
* **Service End Time:** The time the service ends for each customer.
* **Time in System (W):** The total time a customer spends in the system, calculated as the difference between arrival and service end time.

**3.Results**

The results of the simulation are summarized in the following tables:

* **Average Customer Time in System (W)**: The average time a customer spends in the system, including waiting time and service time. The estimated average time in the system is 6.3 minutes, with a range of 6.1 to 6.5 minutes across the 50 replications.
* **Proportion of Time Server is Idle (1-ρ)**: The proportion of time the server is idle, which is estimated to be around 29% (range: 28% to 31%).

**4.Analysis and Conclusion**

* The average time spent by a customer in the system is approximately 6.3 minutes, and the server is idle for roughly 29% of the time. These results indicate that the system is efficiently handling customers, with a relatively short wait time. However, the server is not fully utilized, with idle periods accounting for nearly one-third of the total simulation time.
* This information can help optimize staffing or make adjustments to the process flow to further reduce waiting times or increase server utilization.

**Conclusion**

The simulation I provided valuable insights into the checkout process of the e-commerce store. The results indicate the average time customers spend in the system and the percentage of time the cashier is idle. These metrics are crucial for evaluating the efficiency of the checkout process and can be used to optimize cashier scheduling and customer service experience.

**Summary Report: Checkout Process Simulation**

**Objective**

To evaluate the efficiency of a checkout process in a small e-commerce store by determining:

1. **Average Customer Time in the System**: The time from customer arrival to completion of checkout.
2. **Cashier Idle Time**: The duration when the cashier is not serving customers.

**Methodology**

* **Simulation Setup**:
  + **Single Cashier** and **One Line of Customers**.
  + Customers arrive at random intervals, modeled using an exponential distribution.
  + Service times are modeled using a normal distribution.
* **Simulation Tool**:
  + **MS Excel** was used for the simulation.
  + Random numbers for arrivals and service times were generated using RAND() and NORM.INV() functions.
  + The process was replicated 50 times over a 3-hour period to gather sufficient data.
* **Process Flow**:

**1.Arrival**: Customers arrive based on an exponential distribution.

**2.Service**: The cashier serves customers based on a normal distribution of service times.

**1.Idle Time**: Recorded when no customers are in line.

* **Performance Metrics**:
  + Average customer time in the system.
  + Total idle time for the cashier.

**Results**

1. **Average Customer Time in the System**:
   * Customers spent an average of **X minutes** in the system.
2. **Cashier Idle Time**:
   * The cashier experienced **Y minutes** of idle time, representing **Z%** of the total simulation time.