**Question one**

**Brief Report**

The file contains two sheets with relevant information:

1. **Sheet1**: This includes detailed customer data for a checkout simulation, such as:

Customer ID, interarrival time, arrival time, service time, and service start/end times.

Additional metrics like waiting time, time spent in the system, and idle time of the cashier.

1. **Sheet2**: This sheet summarizes the simulation results across several replications, showing: Average customer time in the system, Percentage of idle time for the checkout clerk.

**Brief summary**

To get to these results for the e-commerce checkout simulation, I set up the scenario assuming there’s one cashier and a line of customers waiting to be served. The time between customer arrivals was randomly generated, ranging between 1 and 15 minutes, while the time it took to serve each customer was also random, between 1 and 8 minutes.

I simulated the entire process by tracking when each customer arrived, when they started being served, and when they left. This let me calculate the total time each customer spent in the system. At the same time, I could also figure out how much of the time the cashier wasn’t busy by noting the gaps between customers.

From there, I worked out the average time a customer spends in the system and how much of the time the cashier was idle. I used Excel to capture all the data, so the calculations for customer times and cashier idle times were done with formulas. By running multiple iterations, I ensured the results were as accurate as possible

**Summary of Metrics used and Their Impact**

Time in the System: Determines customer satisfaction; lower times indicate quicker service.

Idle Time: Measures cashier efficiency; lower idle times mean higher utilization.

Waiting Time: Key to customer experience; reducing waiting time improves satisfaction.

Service Utilization: Helps assess how effectively the cashier is being used.

**MS Excel spreadsheet showing simulation and replication**

**Sheet 1**

MS Excel spreadsheet to simulate the checkout process.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| customer ID | Interarrival time | arrival time | service time | service start time | service end time | Waiting time | time in system | idle time | 6.25 |
| 1 | 3 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 42.59259 |
| 2 | 3 | 3 | 7 | 6 | 13 | 3 | 10 | 0 |  |
| 3 | 7 | 10 | 6 | 13 | 19 | 3 | 9 | 0 |  |
| 4 | 4 | 14 | 1 | 19 | 20 | 5 | 6 | 0 |  |
| 5 | 15 | 29 | 5 | 29 | 34 | 0 | 5 | 9 |  |
| 6 | 13 | 42 | 7 | 42 | 49 | 0 | 7 | 8 |  |
| 7 | 9 | 51 | 4 | 51 | 55 | 0 | 4 | 2 |  |
| 8 | 11 | 62 | 4 | 62 | 66 | 0 | 4 | 7 |  |
| 9 | 7 | 69 | 1 | 69 | 70 | 0 | 1 | 3 |  |
| 10 | 11 | 80 | 1 | 80 | 81 | 0 | 1 | 10 |  |
| 11 | 6 | 86 | 7 | 86 | 93 | 0 | 7 | 5 |  |
| 12 | 11 | 97 | 5 | 97 | 102 | 0 | 5 | 4 |  |
| 13 | 13 | 110 | 1 | 110 | 111 | 0 | 1 | 8 |  |
| 14 | 10 | 120 | 5 | 120 | 125 | 0 | 5 | 9 |  |
| 15 | 9 | 129 | 7 | 129 | 136 | 0 | 7 | 4 |  |
| 16 | 6 | 135 | 8 | 136 | 144 | 1 | 9 | 0 |  |
| 17 | 3 | 138 | 5 | 144 | 149 | 6 | 11 | 0 |  |
| 18 | 4 | 142 | 2 | 149 | 151 | 7 | 9 | 0 |  |
| 19 | 6 | 148 | 7 | 151 | 158 | 3 | 10 | 0 |  |
| 20 | 6 | 154 | 4 | 158 | 162 | 4 | 8 | 0 |  |

**Sheet 2**

Data Table to generate 50 replications of the simulation.

|  |  |  |
| --- | --- | --- |
| Replications | Average | Percentage idle |
| 1 | 6.25 | 42.59259259 |
| 2 | 4.6 | 56.71641791 |
| 3 | 4.7 | 50.81967213 |
| 4 | 14.7 | 2.083333333 |
| 5 | 5.85 | 39.84962406 |
| 6 | 11.7 | 27.46478873 |
| 7 | 6.7 | 37.73584906 |
| 8 | 8.25 | 29.03225806 |
| 9 | 5.4 | 37.98449612 |
| 10 | 5.85 | 37.41935484 |
| 11 | 5.2 | 40 |
| 12 | 5.6 | 46.62162162 |
| 13 | 5.35 | 44.69273743 |
| 14 | 5 | 42.33576642 |
| 15 | 4.2 | 59.30232558 |
| 16 | 5.7 | 39.375 |
| 17 | 5.05 | 48 |
| 18 | 4.8 | 56.31578947 |
| 19 | 5.55 | 41.52046784 |
| 20 | 4.55 | 44.68085106 |
| 21 | 5.45 | 44.38202247 |
| 22 | 5.55 | 49.18918919 |
| 23 | 4.85 | 53.0726257 |
| 24 | 6.45 | 46.82080925 |
| 25 | 5.7 | 45.18072289 |
| 26 | 6.15 | 45.56213018 |
| 27 | 7.55 | 30.37974684 |
| 28 | 6 | 32.67973856 |
| 29 | 4.65 | 51.66666667 |
| 30 | 7.6 | 33.72781065 |
| 31 | 5.35 | 35.81081081 |
| 32 | 7.25 | 35.83815029 |
| 33 | 5.15 | 30 |
| 34 | 7 | 31.67701863 |
| 35 | 5.3 | 42.51497006 |
| 36 | 7.3 | 30.86419753 |
| 37 | 6.4 | 49.72972973 |
| 38 | 8.1 | 24.16107383 |
| 39 | 5.15 | 51.32275132 |
| 40 | 5.1 | 41.37931034 |
| 41 | 6.35 | 34.61538462 |
| 42 | 8.2 | 24.3902439 |
| 43 | 5.5 | 39.04109589 |
| 44 | 4.95 | 39.71631206 |
| 45 | 6.85 | 22.48062016 |
| 46 | 4.7 | 50 |
| 47 | 4.95 | 44.37869822 |
| 48 | 6.35 | 40.33149171 |
| 49 | 5.2 | 46.30872483 |
| 50 | 5.45 | 36.47798742 |