Joseph Juneau

Project 4 Supermarket Simulation Report

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# Summary

This research was conducted to find the right amount of registers needed to have a max of 2 customers in queue for each register. For this simulation, the store was open for 16 hours, from 8:00am to midnight. The simulation expected 600 customers to arrive during hours of operation, and none could enter the register queues after hours. On average, it was supposed to take 5 minutes and 45 seconds, and no customer would take less than 2 minutes to service.

# Procedure

Customer enter events were first generated using an expected value of 600 customers. The value for each run through the simulation was obtained using the Poisson distribution method with 600 as the basis for the distribution. The customer events were ordered by arrival time and were sent to the smallest available queue line. When the customer was at the front of the queue, they were given a new leave event, which specified the time at which they would leave the register. The total time customers spent at the front of the queue was recorded along with the average, minimum, and maximum time spent at the front of the queue. While the simulation was running, the largest line in front of the registers was being recorded. Before and after the simulation, the amount of registers could be changed, along with the speed of the simulation. Simulations were done 5 times for each case of register amounts ranging from 2-13, so a total of 60 simulations was done.

# Results

Starting with two registers, the average maximum length of the register lines was much too long to be useful. The average maximum length was 122.6 customers in the queue. Increasing the register count by 1 did not do much in terms of reaching our goal of having a maximum of 2 customers in line at a register. The average maximum length for 2 registers was 40.8. incrementing it one more time brought it slightly closer, but it still was much too high with an average of 7.4. incrementing it to having 5 registers was still not enough with an average of 4.2. when the simulation ran with 6 registers in place, it became very close to the goal, but it was slightly high with an average of 2.6. Finally, running the simulation with 7 registers provided the results that were sought after. Having a maximum of 2 customers in any one register line was obtained. However, to get it lower than 2 customers, the number of registers would need to be increase by almost double. 13 registers are where each register never had more than one customer in queue.

# Conclusion

Based on these results, the optimum number of registers for the requirement of having no more than 2 customers in queue, is 7 registers. 6 was slightly too little, while decreasing the amount customers in queue any more than 2 would require an inefficient amount of registers.

## Data for Simulations

Max length of register lines for each trial and register combination.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **trial 1** | **trial 2** | **trial 3** | **trial 4** | **trial 5** | **Average** |
| **2 Registers** | 125 | 137 | 128 | 123 | 105 | 123.6 |
| **3 Registers** | 38 | 45 | 41 | 35 | 45 | 40.8 |
| **4 Registers** | 7 | 9 | 6 | 7 | 8 | 7.4 |
| **5 Registers** | 4 | 4 | 4 | 4 | 5 | 4.2 |
| **6 Registers** | 3 | 3 | 3 | 2 | 2 | 2.6 |
| **7 Registers** | 2 | 2 | 2 | 2 | 2 | 2 |
| **8 Registers** | 2 | 2 | 2 | 2 | 2 | 2 |
| **9 Registers** | 2 | 2 | 2 | 2 | 2 | 2 |
| **10 Registers** | 2 | 2 | 2 | 2 | 2 | 2 |
| **11 Registers** | 2 | 2 | 1 | 2 | 2 | 1.8 |
| **12 Registers** | 2 | 2 | 1 | 1 | 2 | 1.6 |
| **13 Registers** | 1 | 1 | 1 | 1 | 1 | 1 |