CSCI Project 4 Simulation Data Report

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**Initial Problem**

For this project/program, we want to simulate Customer shopping events to determine the minimal number of registers that the supermarket can staff and maintain lines shorter than 2 people long. Beginning with the desired test data, we start off with just one open register, to determine how backed up the single line will get on a typical day. On average, the longest the line got for the single register was about 18-20 shoppers, so we’ll call the average an even 19. Obviously, we can see that this is way above a line of 2 shoppers and we will need more registers open. By slowly increasing the number of registers available and running repeated tests, we can identify a minimum register requirement to fit our desired line length.

**Continued Testing**

We began testing incrementing values for the register lines, moving from 2 to 3, 3 to 4, 4 to 5, and so forth. With each additional checkout line, we did not see a very large drop in the maximum line length. An expected 600 customer events grant the possibility of “business rushes,” with the registers being overwhelmed during peak traffic hours and increasing the maximum line length found throughout the day. As we approach 7 checkout lanes, we really start to see a difference in performance as the largest line detected falls to a length of 5. By just increasing the register count by 6 tills, we have already seen a drop in the longest line from 18 to 5. After a couple more increments, we finally arrive at our best answer on average, as produced by the simulation data; with a register count of 10, the supermarket can expect to never see a line grow longer than 2 customers, on a typical day.

**Data Discussion**

Although repeated runs of the simulation provided us with an average best-case scenario with 10 registers open, 8 registers, 9 registers, and occasionally 11 registers all produce similar or better results as the “best” option of 10 registers. This largely varies on how much of a crunch occurs during the peak of business, and how fast the customers are exiting the register. If it so happens that more customer objects are created with a higher-end checkout time, they will slow down the efficiency of the lines and cause the max length to grow at some point. Obviously, any value above 10 or 11 for the number of registers would be sufficient for maintaining a register queue of 2 or less, but we want to identify the smallest number of registers necessary, so we ignore all those values. Extending the hours of the supermarket affects performance slightly, typically needing at least an extra half hour to start raising the necessity for additional registers to be opened.

Shortening the business hours, to no surprise, helps only by limiting how early before close a customer can enter the checkout line, but shorter hours mean a more condensed rush hour period, leading to a higher spike in the maximum line length observed. By closing the store early, we typically need around at least 5 to 6 registers open to maintain quick dispersion of shoppers without unnecessarily adding registers. After running through all of the best-case scenarios for the proposed data and even some fringe cases to test validity, 10 register lanes provide the best customer experience by limiting (on average) register lines to at most 2 people at a time.