**Introduction**

This report is directed to the board of directors of our supermarket chain from the research and development department. I was instructed to create a simulation program to gather data about the number of customers we expect in a day and how the different number of open registers will affect efficiency and the overall customer checkout experience. I have developed such a program that keeps track of the time it takes for the customer to shop, wait in the checkout queue, and the time it takes for them to check out. This program also highlights people who do not check out and just briefly visit the store.

**How it works**

The program I have built is customizable for different situations, which is good for finding the most efficient number of registers to keep open. A set of X customers enter and leave the store at random times throughout the business day. When the customer wants to leave, they look at the number of open registers and always join the shortest register line. This program, however, does not let the customer change lanes. If they join a line, they will stay in the line until they check out. When the closing time arrives, if a customer is in the line they will still be processed after closing time. When they get up to the register, they will start the checkout process. The prior research shows that it takes anywhere between 2 and 7 minutes to process. After the customer is done checking out they will leave the store and the person next in line will start checking out.

**Research**

The specific situation I was instructed to recreate was an expected number of customers of 600. With the business hours being our normal hours, 8 AM to 12 AM. It was up to me and my department to come up with the most efficient number of registers to be open without causing much harm to the end customer experience. I ran the simulation multiple times with multiple registers and kept track of key variables to compare and get the most efficient amount of open registers.

**Results**

The least efficient number of registers to be open was expected. When 1 register is open, it is the least efficient to get every customer out of the store on time. The average amount for people waiting to check out took about 10 and a half hours. The largest amount of people in the line at one point was 421 people. This is unacceptable and should not happen in real life. Having 2 registers open improves our checkout time efficiency 10 times as much but the average time for a customer to wait is still over 1 hour. The sweet spot with time seems to happen when 5 registers are open. The largest amount of people in line with 5 registers open was only 3 people. The average time it took for a person to checkout was only around 4 minutes and 15 seconds. With any amount of registers larger, the results slightly improve but do not affect the end customer experience that much. The average checkout time stays similar to its previous average.

**Conclusion**

The research and development department and I recommend that a minimum of 5 registers should be open if any store is expecting around 600 customers in the day. If the number of customers increase or vary, the number of registers should not have to be increased unless some emergency or a holiday/event. If the number of customers is significantly less than 600 then fewer registers should be required to be open. But, we should be careful tracking the expected number of customers because if an unexpected number shows up the end customer experience will be heavily affected by the increased waiting time.