



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) Dennis van Ee	Project Number J1421
Project Title Cashier Strategies	
Abstract Objectives/Goals Determine which cashier strategy is most efficient. In this case, the strategy that results in the shortest average waiting time in the queue is the most efficient. I considered two cashier strategies: single-line and multi-line; the single-line strategy uses a single queue for all registers, and the multi-line strategy uses a single queue per register. Methods/Materials The experiment is performed by simulating a shop. To be able to do this, you need a computer and a C# development environment (I used Microsoft Visual Studio 2008). You also need the react.NET library for C# which provides basic functions for discrete simulations. I created three different classes: Shop, Customer, and Register. A single instance (object) of the Shop class creates instances of both the Register and the Customer class. A Register object is created for each simulated register at the start of the simulation and Customer objects are created with a delay from an exponential distribution to simulate the arrival of customers in the simulated shop. For each Customer object, the simulation waits the browsing time (from a uniform distribution) before putting the Customer object in a queue where it waits for an available Register object. Register objects wait the serving time (from a uniform distribution) for each customer before releasing that customer. The Customer object then records its browsing time, waiting time and serving time. Each Register object records its idle time. Results In all 12 trials that I have conducted, the single-line method had a lower average waiting time than the multi-line method. These differences were sometimes very subtle, but some showed a large difference in average waiting time. The register idle time for the single-line method turned out to be lower than for the multi-line method; except in two of the trials. Conclusions/Discussion By observing the data, I conclude that the single-line method triumphs over the multi-line method in efficiency because the single-line method has a smaller average waiting time (a reduced average waiting time does not imply the waiting time using the single-line method is less for each individual simulated customer). Moreover, I conclude that the reduced average waiting time is caused by a reduced average register idle time with the single-line method. Further study is required to determine why the idle time was longer for the single-line method in two of the trials.	
Summary Statement Using a computer simulation, determine which cashier strategy, the multi-line or the single-line method, is more efficient.	
Help Received My father helped with the C# program.	