## Results of Queueing Strategies for 'ass2_sample_input'

|  | Single Queue (S) | Multi-Queue (M) | Diff. (M - S) |
|---|---|---|---|
| Simulation Terminated: | t = 30558.4 | t = 30558.4 | 0.0000 |
| Total Customers Served: | 1000 | 1000 | - |
| Total Teller Idle Time: | 143392 | 142584 | -808.0000 |
| Average Service Time: | 159.108 | 159.108 | - |
| Average Wait Time: | 0.186606 | 0.612581 | 0.4260 |
| Maximum Wait Time: | 39.693 | 270.428 | 230.7350 |
| Maximum Queue Length: | 2 | 1 | -1.0000 |
| Average Queue Length: | 0.00610654 | 0.00200462 | -0.0041 |

## Results of Queueing Strategies for 'longer_queues'

|  | Single Queue (S) | Multi-Queue (M) | Diff. (M - S) |
|---|---|---|---|
| Simulation Terminated: | t = 30438 | t = 30438 | 0.0000 |
| Total Customers Served: | 1000 | 1000 | - |
| Total Teller Idle Time: | 133117 | 122660 | -10457.0000 |
| Average Service Time: | 190.597 | 190.597 | - |
| Average Wait Time: | 1.53898 | 4.56958 | 3.0306 |
| Maximum Wait Time: | 62.312 | 305.613 | 243.3010 |
| Maximum Queue Length: | 3 | 1 | -2.0000 |
| Average Queue Length: | 0.0505613 | 0.0150128 | -0.0355 |

## Results of Queueing Strategies for 'much_longer'

|  | Single Queue (S) | Multi-Queue (M) | Diff. (M - S) |
|---|---|---|---|
| Simulation Terminated: | t = 30457.6 | t = 30457.6 | 0.0000 |
| Total Customers Served: | 1000 | 1000 | - |
| Total Teller Idle Time: | 171416 | 139953 | -31463.0000 |
| Average Service Time: | 234.875 | 234.875 | - |
| Average Wait Time: | 10.4012 | 22.786 | 12.3848 |
| Maximum Wait Time: | 140.242 | 480.56 | 340.3180 |
| Maximum Queue Length: | 8 | 1 | -7.0000 |
| Average Queue Length: | 0.341497 | 0.0748122 | -0.2667 |

**Analysis**

The following results were found to be consistent through all three simulations:

*Total Teller Idle Time* is minimised using the Single Queueing strategy.

*Average Wait Time* is minimised using the Single Queueing strategy.

*Maximum Wait Time* is minimised using the Single Queueing strategy.

*Maximum Queue Length* is minimised using the Multi-Queueing strategy.

*Average Queue Length* is minimised using the Multi-Queueing strategy.

**Conclusions**

In the simulations, it was found that employing a Multi-Queueing strategy served only to minimise the physical queue lengths for tellers. Despite this result, having multiple independent queues correlated with an increased maximum and average wait time for the customers and an increased teller idle time.

This result is likely due to the fact that, when employing a Single Queueing strategy, a teller is idle if and only if there are no customers to serve, however, with a Multi-Queueing strategy, a teller may become idle when there are still customers to be served in other queues.

Based on these results, it is concluded that the proposed Multi-Queueing strategy should be implemented if the aim is purely to minimise queue lengths. In all other cases, the Single Queueing strategy should be implemented.

It is recommended that a third scenario is tested where the Multiple-Queueing strategy is employed, but with the alteration of allowing tellers to pull customers from other queues, should they become idle. It is believed that this approach will aid in minimising both queue lengths and customer idle times, which appears to be the goal of these simulations.