Event Driven Simulation

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1 Details of Program

1.1 How to Run It and Directory Structure

unzip 2018CS10395.zip to get 2018CS10395_assignment6
Internal Directory Structure of 2018CS10395_assignment6
src/ - contains the source file qsim.c
include/ - contains the header file structures which have all the strcuts use in the code
To compile and link run make command, it will create a object file in obj/ directory and an
executable named qSim in bin/ directory

To run the executable :

```
bin/qSim #customers #tellers simulationTime averageServiceTime
```

This will give the output on console which will contain the statistics of One Queue per Teller
and Single Queue and also no. of times function pointers are used.

Another file will be generated in output/ with name compare.png which will contain the
plot of Average time spend by a customer in bank vs No. of tellers for Single Queue Model.

1.2 Summary of the Program

First two LinkedLists of allcustomers and alltellers are created separately. Then the corresponding events are created for each customer and teller. Each event has an associated
action, in my implementation all these actions are functions and they are given value by
function pointers. Then the simulate function is called which invokes the actions of event
for different types.
For new customer event, new customer is added to the shortest teller queue in queue per
teller model and to the common queue in case of single queue model.
For a teller event if there is no customer waiting in any queue, teller is given some idle time.
If a customer is found then the service of that customer is started at two events are generated
one for teller event and other customer exit event
For customer exit event - statistics about waiting time and serving time is collected

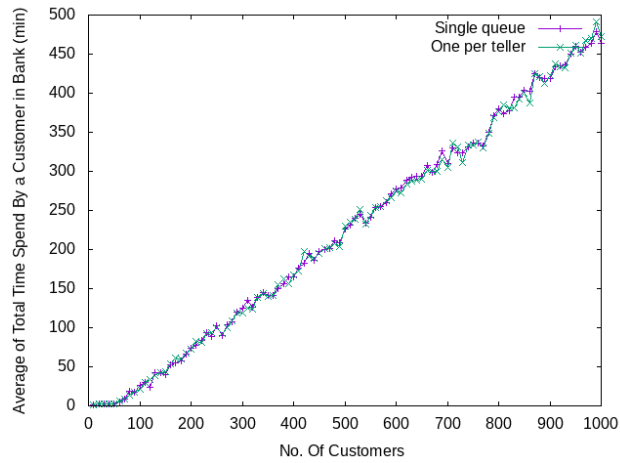# 2   Analysis of Single Queue vs One Queue per Teller

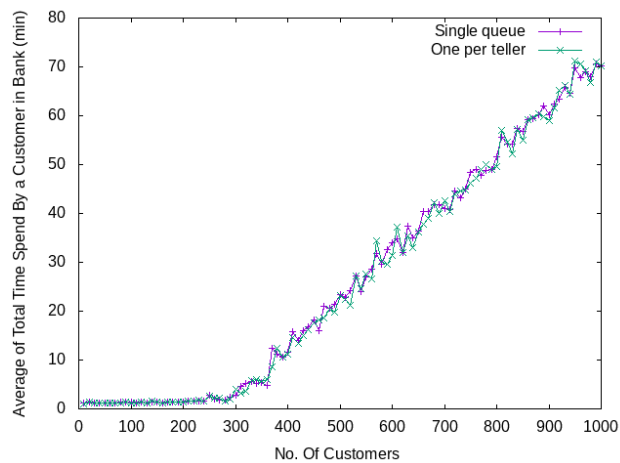Figure 1: No. of tellers = 1 and Simulation time = 60 mins

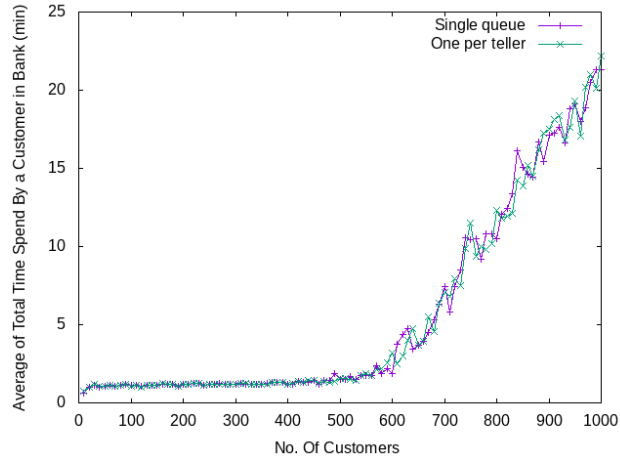Figure 2: No. of tellers = 5 and Simulation time = 60 mins

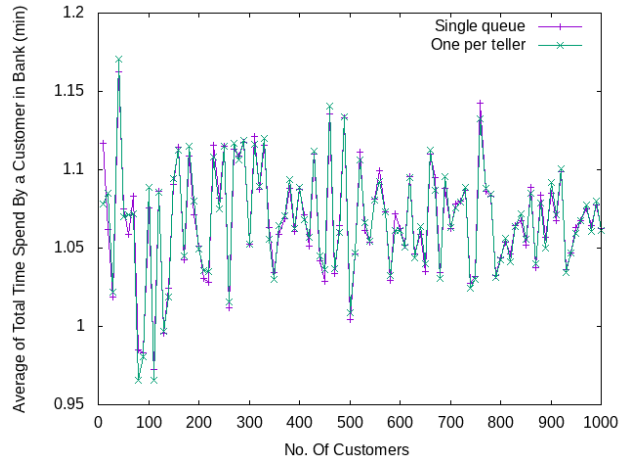Figure 3: No. of tellers = 10 and Simulation time = 60 mins

Figure 4: No. of tellers = 20 and Simulation time = 600 mins

All four figures plot Avg Time spend by a customer in bank for two different models (one queue per teller and single queue) for fixed no. of tellers.

All the four figures indicate that the avg time spend by a customer in both models are almost same.
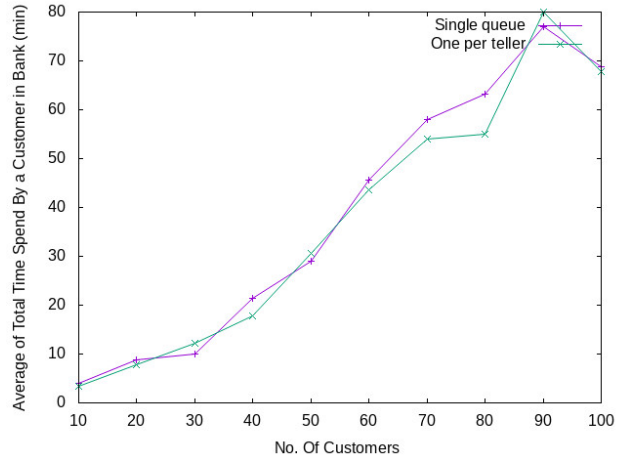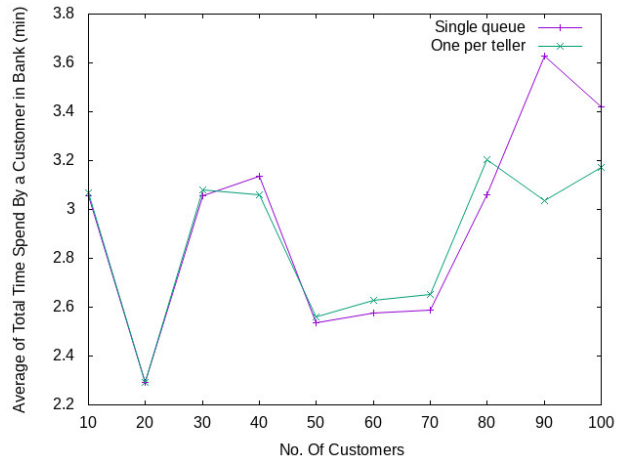
Figure 5: No. of tellers = 1 and Simulation time = 60 mins

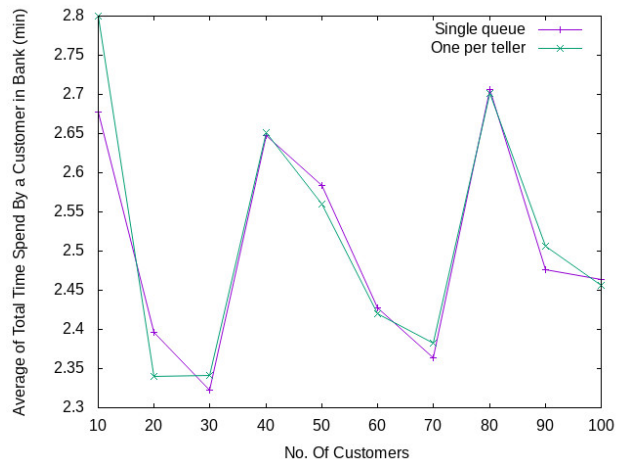Figure 6: No. of tellers = 5 and Simulation time = 60 mins

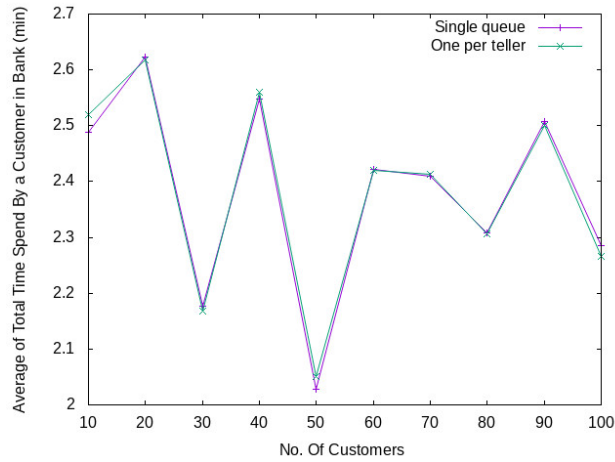Figure 7: No. of tellers = 10 and Simulation time = 60 mins

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Figure 8: No. of tellers = 20 and Simulation time = 60 mins

Although for both the models average time spent by customer is almost same, but if one has to take into account very small difference it can be said that as no. of customers increases One queue per teller is slightly better than single common queue.

3   Test Cases

```
bin/qSim 100 10 600 1.5
```

Number of Customers Served: 100
Total time serve all the customers: 135.824066
No. of Tellers: 10
One Queue per Teller
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Customer Stats
Max Wait Time of Customer: 0.554810
Mean Total Time of Customer: 1.472519
Std Deviation of Total Time of Customer: 0.875122
Teller Stats
Total Service Time of All Tellers: 135.824081
Total Idle Time of All Tellers: 5871.837891
Average Service Time of All Tellers: 13.582408
Average of Idle Time of All Tellers: 587.183777
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Single Queue
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Customer Stats
Max Wait Time of Customer: 0.508408
Mean Total Time of Customer: 1.486486
Std Deviation of Total Time of Customer: 0.893536

Teller Stats
Total Service Time of All Tellers: 135.824066
Total Idle Time of All Tellers: 5871.644531
Average Service Time of All Tellers: 13.582407
Average of Idle Time of All Tellers: 587.164429

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```
bin/qSim 10 2 60 1.5
```

Number of Customers Served: 10
Total time serve all the customers: 16.866501
No. of Tellers: 2
One Queue per Teller

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Customer Stats
Max Wait Time of Customer: 1.884289
Mean Total Time of Customer: 2.490756
Std Deviation of Total Time of Customer: 1.178594
Teller Stats
Total Service Time of All Tellers: 16.866501
Total Idle Time of All Tellers: 104.403656
Average Service Time of All Tellers: 8.433250
Average of Idle Time of All Tellers: 52.201828

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Single Queue

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Customer Stats
Max Wait Time of Customer: 1.201695
Mean Total Time of Customer: 2.125069
Std Deviation of Total Time of Customer: 1.189760
Teller Stats
Total Service Time of All Tellers: 16.866501
Total Idle Time of All Tellers: 104.362839
Average Service Time of All Tellers: 8.433250
Average of Idle Time of All Tellers: 52.181419

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```
bin/qSim 100 15 600 3.5
```

Number of Customers Served: 100
Total time serve all the customers: 344.314453
No. of Tellers: 15
One Queue per Teller

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Customer Stats
Max Wait Time of Customer: 0.435028
Mean Total Time of Customer: 3.534641
Std Deviation of Total Time of Customer: 1.866675
Teller Stats
Total Service Time of All Tellers: 344.314453
Total Idle Time of All Tellers: 8670.770508
Average Service Time of All Tellers: 22.954296
Average of Idle Time of All Tellers: 578.051392

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Single Queue

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Customer Stats
Max Wait Time of Customer: 0.560760
Mean Total Time of Customer: 3.530792
Std Deviation of Total Time of Customer: 1.876182
Teller Stats
Total Service Time of All Tellers: 344.314484
Total Idle Time of All Tellers: 8669.548828
Average Service Time of All Tellers: 22.954298
Average of Idle Time of All Tellers: 577.969910

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