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CS1181 Lab

**Project 3**

Based on the simulation results for 3000 customers who arrive at the store, the mix of 4 express lanes and 8 regular lanes gives the smallest average waiting time of customers (43028.34 minutes), while the significantly largest time is 2261049.78 minutes. Simulating the file contains 452 customers, the mix of 4 express lanes and 1 regular lane also gives a pretty small average waiting time (0.017 minutes). Although when the store has 452 customers arrive, there are other better average waiting times (0 minute and 0.1 minutes), the mix of 4 express lanes and 1 regular lane is the smallest number of total lanes, and 0.017 minutes is an acceptably short time for a customer to wait in the lane.

In conclusion, I recommend that the store have 4 express lanes and 8 regular lanes. When the store is busy, the store can fully operate all lanes. However, the store can open 4 express lanes, 1 regular lane, and close 7 regular lanes for an optimal cost.

Two tables have been shown below containing the number of express lanes and regular lanes with associated the average minutes that customer waits to check out. The first table results from the file “arrival medium.txt,” which has 452 customers arrive, the second table is for the file “arrival.txt,” which has 3000 customers. In the table, the average wait time has been sorted from smallest to largest. Also, the recommended mix of regular and express and has been highlighted.

Arrival Medium.txt (452 customers)

|  |  |  |  |
| --- | --- | --- | --- |
| **Express Lanes** | **Regular Lanes** | **Total Lanes** | **Average Wait Time (minutes)** |
| 3 | 9 | 12 | 0 |
| 3 | 8 | 11 | 0 |
| 4 | 8 | 12 | 0 |
| 5 | 4 | 9 | 0 |
| 5 | 7 | 12 | 0 |
| 6 | 2 | 8 | 0 |
| 6 | 3 | 9 | 0 |
| 6 | 4 | 10 | 0 |
| 6 | 5 | 11 | 0 |
| 6 | 6 | 12 | 0 |
| 7 | 5 | 12 | 0 |
| 7 | 4 | 11 | 0 |
| 7 | 3 | 10 | 0 |
| 7 | 2 | 9 | 0 |
| 8 | 4 | 12 | 0 |
| 8 | 3 | 11 | 0 |
| 8 | 2 | 10 | 0 |
| 8 | 1 | 9 | 0 |
| 9 | 3 | 12 | 0 |
| 9 | 1 | 10 | 0 |
| 9 | 2 | 11 | 0 |
| 10 | 2 | 12 | 0 |
| 10 | 1 | 11 | 0 |
| 11 | 1 | 12 | 0 |
| 2 | 10 | 12 | 0.01 |
| 2 | 8 | 10 | 0.01 |
| 2 | 9 | 11 | 0.01 |
| 4 | 7 | 11 | 0.01 |
| 4 | 4 | 8 | 0.01 |
| 5 | 3 | 8 | 0.01 |
| 5 | 6 | 11 | 0.01 |
| 5 | 5 | 10 | 0.01 |
| 7 | 1 | 8 | 0.01 |
| 4 | 1 | 5 | 0.017 |
| 2 | 6 | 8 | 0.02 |
| 3 | 5 | 8 | 0.02 |
| 4 | 3 | 7 | 0.02 |
| 3 | 6 | 9 | 0.02 |
| 4 | 5 | 9 | 0.02 |
| 4 | 6 | 10 | 0.02 |
| 3 | 7 | 10 | 0.03 |
| 6 | 1 | 7 | 0.03 |
| 5 | 2 | 7 | 0.032 |
| 2 | 5 | 7 | 0.04 |
| 2 | 7 | 9 | 0.04 |
| 3 | 4 | 7 | 0.04 |
| 4 | 2 | 6 | 0.04 |
| 3 | 3 | 6 | 0.05 |
| 2 | 4 | 6 | 0.08 |
| 5 | 1 | 6 | 0.09 |
| 3 | 2 | 5 | 0.12 |
| 2 | 3 | 5 | 0.14 |
| 3 | 9 | 12 | 0.43 |
| 2 | 2 | 4 | 0.46 |
| 1 | 9 | 10 | 981.51 |
| 1 | 11 | 12 | 981.51 |
| 1 | 10 | 11 | 981.51 |
| 1 | 7 | 8 | 981.52 |
| 1 | 8 | 9 | 981.52 |
| 1 | 4 | 5 | 1152.13 |
| 1 | 6 | 7 | 1180.88 |
| 1 | 5 | 6 | 1180.9 |
| 1 | 3 | 4 | 1544.82 |
| 2 | 1 | 3 | 6816.05 |
| 1 | 2 | 3 | 9819.46 |
| 1 | 1 | 2 | 41762.38 |

Arrival.txt (3000 customers)

|  |  |  |  |
| --- | --- | --- | --- |
| **Express Lanes** | **Regular Lanes** | **Total Lanes** | **Average Wait Time (minutes)** |
| 4 | 8 | 12 | 43028.34 |
| 5 | 7 | 12 | 45323.57 |
| 6 | 6 | 12 | 46175.03 |
| 7 | 5 | 12 | 47508.15 |
| 3 | 9 | 12 | 48018.02 |
| 8 | 4 | 12 | 48664.63 |
| 9 | 3 | 12 | 49590.59 |
| 10 | 2 | 12 | 51417.1 |
| 11 | 1 | 12 | 52888.87 |
| 4 | 7 | 11 | 54545.76 |
| 3 | 8 | 11 | 56483.77 |
| 5 | 6 | 11 | 56707.93 |
| 6 | 5 | 11 | 57977.06 |
| 7 | 4 | 11 | 59558 |
| 8 | 3 | 11 | 60752.74 |
| 9 | 2 | 11 | 62818.81 |
| 10 | 1 | 11 | 64664.56 |
| 3 | 7 | 10 | 67787.11 |
| 4 | 6 | 10 | 69073.26 |
| 5 | 5 | 10 | 70971.16 |
| 6 | 4 | 10 | 73257.94 |
| 7 | 3 | 10 | 75141.68 |
| 8 | 2 | 10 | 77371.81 |
| 9 | 1 | 10 | 79324.77 |
| 2 | 10 | 12 | 82071.44 |
| 3 | 6 | 9 | 85867.35 |
| 2 | 9 | 11 | 87460.47 |
| 4 | 5 | 9 | 88145.45 |
| 5 | 4 | 9 | 91355.12 |
| 6 | 3 | 9 | 94553.43 |
| 2 | 8 | 10 | 96019.54 |
| 7 | 2 | 9 | 97414.87 |
| 8 | 1 | 9 | 99853.43 |
| 2 | 7 | 9 | 107886.14 |
| 3 | 5 | 8 | 117591.1 |
| 4 | 4 | 8 | 122495.91 |
| 5 | 3 | 8 | 124648.09 |
| 2 | 6 | 8 | 125396.22 |
| 6 | 2 | 8 | 127774.2 |
| 7 | 1 | 8 | 133381.28 |
| 2 | 5 | 7 | 159107.43 |
| 3 | 4 | 7 | 163337.2 |
| 4 | 3 | 7 | 168678.77 |
| 5 | 2 | 7 | 176412.88 |
| 6 | 1 | 7 | 182531.69 |
| 2 | 4 | 6 | 217340.28 |
| 3 | 3 | 6 | 232101.45 |
| 4 | 2 | 6 | 241560.22 |
| 5 | 1 | 6 | 251284.94 |
| 1 | 11 | 12 | 285489.63 |
| 1 | 10 | 11 | 291679.64 |
| 1 | 9 | 10 | 297158.99 |
| 1 | 8 | 9 | 305772.99 |
| 1 | 7 | 8 | 317497.85 |
| 1 | 6 | 7 | 335029.23 |
| 2 | 3 | 5 | 337141.24 |
| 3 | 2 | 5 | 349305.18 |
| 4 | 1 | 5 | 364950.54 |
| 1 | 5 | 6 | 368716.24 |
| 1 | 4 | 5 | 426948.1 |
| 2 | 2 | 4 | 550117.17 |
| 1 | 3 | 4 | 551259.7 |
| 3 | 1 | 4 | 575971.15 |
| 1 | 2 | 3 | 907716.22 |
| 2 | 1 | 3 | 1028880.47 |
| 1 | 1 | 2 | 2261049.78 |