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Lab Number: Programming Project 2

Lab Title: Car Wash

Date: 10 May 2017

Before the Lab:

What I expect to learn: How to implement a queue in a real life situation, and simulate multiple steps using a separate simulation class.

Concepts I think the Lab explores: Implementing queues/ linked list, and how to control the simulation so that proper values will be outputted.

Java classes I expect to modify: LLQueue, Bay, Car, CarWashApplication, CarWashSimulation

Where I think there may be problems: calculating values such as average wait time from the simulation class.

After the Lab:

What I actually learned: A lot about simulation using for loops along with if and else conditions properly placed to output experimental values such as each car's individual wait time which was then averaged for the total wait time for all cars that arrived in a business day where cars arrived randomly every four minutes.

How well the Lab allowed me to explore the target concepts: The lab made me feel much more comfortable with queues and writing my own classes with constructors and methods from scratch.

What problems I encountered (or none) and how I handled them: I had a lot of problems with how to have the bay class increment the wait time, but I got help from my roommate who is a CS major, Raphael Wieland, who told me how to properly code the constructor and method for the bay class.

Things in the write up that confused me or were especially helpful: The part about the bay class was a bit confusing.

Additional Questions:

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| --- | --- | --- | --- | --- |
|  | **4-Minute Bay** | | **3-Minute Bay** | |
| **Avg. Wait (min)** | **# Cars With**  **10 Min Wait** | **Avg. Wait (min)** | **# Cars With**  **10 Min Wait** |
| Monday | 28.7 | 102 | 3.74 | 11 |
| Tuesday | 44.3 | 152 | 2.57 | 5 |
| Wednesday | 41.8 | 153 | 3.29 | 11 |
| Thursday | 29.6 | 151 | 2.44 | 4 |
| Friday | 27.4 | 107 | 5.73 | 40 |
| Saturday | 31.82 | 125 | 2.14 | 2 |
| Sunday | 16.26 | 104 | 2.63 | 6 |

Conclusions:

Assuming that cars arrive randomly at a rate of one arrival every four minutes, this simulation returns the average waiting time for all cars along with the number of cars that had to wait 10 or more minutes from their arrival time until they could be washed. In the program that runs this simulation, a queue is used to represent the line of cars waiting to be washed. A car is removed from the queue if it is first in line and the wash bay is open. A separate bay class is used to increment the amount of time until the bay is empty again. The first parameter of the Bay constructor represents the length of the wash in minutes and can be adjusted accordingly.

After running two separate simulations, one with a 3 minute wash time and the other with 4 minutes, the simulation shows that upgrading equipment to decrease wash time by one minute significantly decreases average wait time, and even more significantly decreases the number of cars with a 10+ minute wait.