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Gebze Technical University
Computer Engineering

SYSTEM PROGRAMMING

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Homework-3, May 2024

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May 19, 2024

Contents

1 General Notes

1. Feel free to call me or mail me for any problem: +905319346629, eyilmaz2019@gtu.edu.tr
2. **I included sample screenshots for testing in this report. Additionally, inside the zip file, you'll find some outputs as txt file. You can examine them, too.**
3. I must say that the program is written in a very understandable manner. If you examine the code, you will find comments on every line explaining what each operation is for. Special attention has been paid to ensure there is no confusion, especially regarding semaphore operations.
4. For realism, a thread is run for each vehicle owner, and a total of two threads are run for the valets of pickups and automobiles. I could have used a single thread with a loop to continuously generate carOwners, but I thought this wouldn't be a realistic practice. Each carOwner arrives with their own thread. I saw in the PDF that this aspect was left open, so I designed accordingly.
5. The permanent parking area designated for automobiles has 8 slots, while the permanent parking area designated for pickups has 4 slots.
6. The temporary waiting area designated for automobiles has 1 slot, and the temporary parking area designated for pickups also has 1 slot.
7. The parking slot areas mentioned in the two points above can be changed using macros at lines 16-17 and 19-20 in the code. The code works correctly in any case.
8. A total of 45 vehicles are expected to arrive at the parking lot, and the macro is set to this value by default. However, you can change this value using the expression on line 22.
9. I did not include screenshots of the code because it is simple enough to be easily examined and understood. Nonetheless, I have explained the implementation in detail to the best of my ability. By reviewing the code and reading the report, you will be able to understand it easily.
10. I adjusted the car counts to around 15-20 in the output examples to fit the screen. However, if you want to test it yourself, you can increase the number of cars.
11. **I write an additional thread to remove some cars from autopark's permanent slots. For this, I needed some additional semaphores.**
12. I sent a Valgrind output. You can see there is no memory leak. **However, if you want to test this yourself, you will need to wait a bit for the Valgrind process to finish. When there are many threads running, it takes a long time to get the Valgrind output. Please be patient. Regards and thank you.**
13. Best Regards.

2 How to Run

Use `make` command to compile. After that, type the command : `./main`.

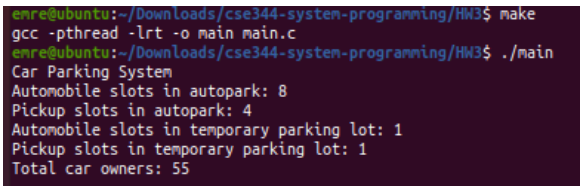


Fig-0: How to Run

3 Semaphores

3.1 newPickup

This semaphore is created for the available permanent slots of pickups in the parking lot. Its initial value is 4, as stated in the PDF.

3.2 newAutomobile

This semaphore is created for the available permanent slots of automobiles in the parking lot. Its initial value is 8, as stated in the PDF.

3.3 inChargeforPickup

This semaphore is created for the pickups waiting in the temporary parking area. Each time a new pickup enters the waiting area, this value is increased. It is used to synchronize between the valet and the customer. Its initial value is 0.

3.4 inChargeforAutomobile

This semaphore is created for the automobiles waiting in the temporary parking area. Each time a new automobile enters the waiting area, this value is increased. It is used to synchronize between the valet and the customer. Its initial value is 0.

3.5 waiting

This semaphore is created to prevent vehicles from entering the parking lot simultaneously. It defines the critical section and prevents two vehicles from being processed at the same time. Its initial value is 1. It can only get 2 values: 0 and 1.

This semaphore is also used to ensure that valets and car owners do not operate simultaneously. While parking in a temporary parking spot, valets are prevented from parking a vehicle in the permanent parking area. Thus, synchronization between valets and car owners is successfully achieved.

3.6 EXTRA - newPickUpBusy

This semaphore is the opposite of the `newPickUp` semaphore. While `newPickUp` indicates how many permanent slots are available, the `newPickUpBusy` semaphore shows how many of the permanent slots are occupied. It is used for synchronizing the `carAttendant` and `carRemover` threads when removing vehicles from the permanent parking lot.

This is not a requirement for the project; according to the assignment in the PDF, there is no information about what happens after the slots are full. However, I am trying to periodically free up permanent slots so that they are not always completely full. This is why this semaphore was created.

3.7 EXTRA - newAutomobileBusy

This semaphore is the opposite of the `newPickUpBusy` semaphore. While `newPickUp` indicates how many permanent slots are available, the `newPickUpBusy` semaphore shows how many of the permanent slots are occupied. It is used for synchronizing the `carAttendant` and `carRemover` threads when removing vehicles from the permanent parking lot.

This is not a requirement for the project; according to the assignment in the PDF, there is no information about what happens after the slots are full. However, I am trying to periodically free up permanent slots so that they are not always completely full. This is why this semaphore was created.

3.8 EXTRA - Mutex

This mutex semaphore is used for synchronizing the `carRemover` and `carAttendant` threads. It prevents a new vehicle from being parked while another vehicle is being removed from the permanent section of the parking lot.

4 Threads

4.1 carOwner Threads

To make the application realistic, there is a `carOwner` thread for each customer arriving at the parking lot. `carOwner` threads do their job and terminates the thread. Pickups and automobiles use the same thread function. The vehicle type is distinguished using an if-else block.

It takes one parameter, which specifies the type of vehicle the carOwner thread owns.

4.1.1 Implementation

Firstly, the thread enters the critical section and downs the `waiting` semaphore. This prevents another vehicle from attempting to enter the parking lot at the same time. After entering the critical section, it checks the status of the vehicles in the temporary parking area. If there is space, the integer value indicating the number of vehicles in the temporary parking area is decreased, the semaphore indicating the number of vehicles parked in the temporary area is upped, and the thread exits the critical section. While parking in the temporary area, the necessary information and the status of the parking slots are printed to the screen. If there is no space in the temporary parking area, the thread exits the critical section and prints information indicating that the vehicle cannot be parked.

Also, it is also important to note that this implementation applies to both pickups and automobiles, and they are differentiated using an if block.

4.2 carAttendant Threads

It is assumed that there are two separate valets for pickups and automobiles. Therefore, the carAttendant thread is initialized twice: once for pickups and once for automobiles. These threads run continuously in a loop. But of course since they are using semaphores, they block when necessary. Pickups and automobiles use the same thread function. The vehicle type is distinguished using an if-else block.

4.2.1 Implementation

The first thing they try to do is down the semaphore `"inChargeforAutomobile"` which represents the number of vehicles in the temporary parking area. If there are no vehicles waiting in the temporary parking area, the process will block and efficiently wait for vehicles. If there are vehicles in this area, the semaphore will be successfully downed, and the necessary operations will begin.

Immediately after this, an attempt is made to down the `waiting` semaphore. This is related to whether a vehicle is currently in the process of parking in the temporary parking area. In other words, it ensures synchronization between car owners and valets. If a vehicle is trying to park in the temporary parking area, valets wait for this process to finish before starting to move a vehicle from the temporary parking area. This not only ensures synchronization but also ensures the accuracy of the information provided to the user.

Once it is determined that there are vehicles in the temporary parking area, the first action is to try to down the `"newCar"` or `"newPickup"` semaphores. These semaphores represent the available spaces in the permanent parking lot. If this down operation is successful, the integer value indicating the number of vehicles in the permanent parking lot is increased, and the integer value representing the vehicles waiting in the temporary area is decreased. If the down operation is unsuccessful, it means there are not enough spaces in the parking lot, and the process will block, waiting until space becomes available. Information about each waiting and parking operation is printed to the screen.

4.3 EXTRA - carRemover Threads

This thread is created to remove vehicles from the permanent parking area at specific times. There are two carRemover threads: one for pickups and one for automobiles. The purpose of writing this thread is to better test the assignment. Periodically freeing up the filled permanent slots can be useful to observe the parking of vehicles waiting in the temporary area. Let's continue with the details.

4.3.1 Implementation

The thread runs in an infinite loop. In each iteration, it checks the slots in permanent parking lots. If pickup or automobile slot is maxiumum, it removes a car from the system. While checking this slot number, initially, there is no semaphore operation. So, it looks unsynchronized. However, after deciding removal, it makes semaphore operations. So, the algorithm ensures that removal occurs when there are vehicles inside, **even if it may not remove EXACTLY vehicles when the parking slots are full**

Once it is decided to remove a vehicle from the parking lot, the `mutex` is locked first. This ensures that no other vehicle enters the parking lot while the vehicle is being removed, maintaining the critical section. Immediately afterward, the semaphore `newAutomobileBusy` or `newPickupBusy` is downed to check if there is a vehicle to be removed. If it is successfully downed, the integer showing the number of vehicles in the system is decreased, and the semaphore indicating the number of free slots in the parking lot is increased. If there is no vehicle to be removed from the parking lot, the mutex is unlocked, and the semaphore is attempted to be downed again, blocking the thread.

Although it may sound a bit complicated when described this way, the algorithm is easily understandable when the code is reviewed.

5 Synchronization Between carOwner and carAttandent

While explaining the threads, I also provided necessary information regarding synchronization, but it's worth going over it again.

1. The `carOwner` threads, which are trying to park vehicles, synchronize among themselves using the `waiting` semaphore. This prevents them from parking vehicles simultaneously.
2. The `carOwner` and `carAttendant` threads must be synchronized with each other. This is because, while a vehicle is parking in the temporary parking area, valets should not move vehicles from the temporary parking area to the permanent parking area. Therefore, the `waiting` semaphore is used. This semaphore takes values of 1 and 0, similar to a mutex. If a temporary parking operation is in progress, valets wait for this operation to complete. Similarly, if a vehicle in the temporary parking area is being moved, `carOwners` wait for this operation to complete before entering the temporary parking area. We can say that this semaphore is the most critical part.
3. The `carAttendant` threads continuously attempt to down the `inChargeforPickup` and `inChargeforAutomobile` semaphores and will block if there is no car in the temporary parking lot. This allows the threads to work efficiently without requiring an infinite loop and synchronizes them with the vehicles. When a vehicle successfully parks in the temporary area, these semaphores are upped, allowing the `carAttendants` to proceed with parking the vehicle in the permanent lot.
4. Finally, by using the `newAutomobile` and `newPickup` semaphores, `carAttendant` threads can check the capacity before parking vehicles in the permanent parking area. If there is no space, the processes will block, and the `carAttendant` threads will efficiently wait for the necessary space to become available by blocking until another process removes vehicles from the permanent parking area.

As seen, with the mentioned semaphores, both the `carOwner` threads (parking vehicles) and the `carAttendant` threads (performing valet service) can synchronize among themselves. Additionally, the `carOwners` and `carAttendants` can synchronize with each other as two separate working threads.

6 Synchronization Between carRemover and carAttandent

The synchronization between these two threads is achieved using a `mutex` semaphore and the `newPickUpBusy` and `newAutomobileBusy` semaphores as explained in section 3.3.1. With the `mutex`, it is ensured that while a vehicle is being removed from the parking lot, another vehicle is prevented from entering to permanent lots. The `"busy"` semaphores are used to check if there are vehicles to be removed, and the thread is blocked accordingly.

7 Output Results

The carRemover thread, which removes vehicles from the permanent part of the parking lot, has been activated and the examples were taken in this way. When carefully examined, there doesn't appear to be any issues.

In the submitted assignment, the carRemover thread is active but its frequency has been reduced. If you want to thoroughly examine the vehicle removal cases, I recommend running the program multiple times.

Note: Every output is from a different execution.

The working speed of `carOwners` and valets is completely random. Sometimes, you might see many `carOwners` arriving at the parking lot when there is no space available in the temporary parking area. In this case, they will all leave without being able to park. Other times, valets (`carAttendants`) may work very quickly, and every arriving vehicle can be parked in the permanent parking area immediately. These variations depend on the scheduler's decisions. For a clear observation, **I recommend running the program multiple times. As I mentioned at the beginning, you can also examine a few sample outputs in the text files within the zip.**

Note: You can see how many carOwners there are in outputs.

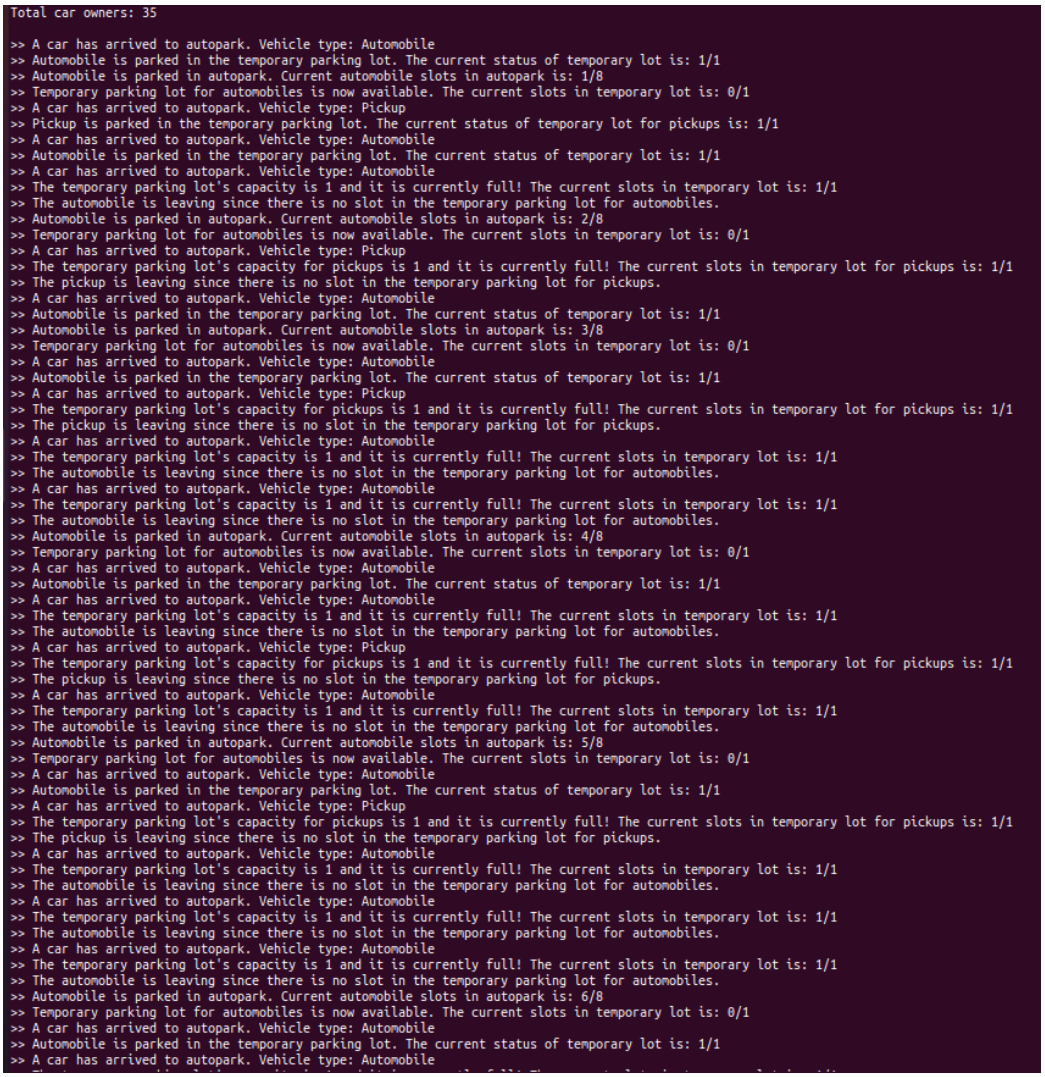


Fig-1: Example Output

If you carefully examine the results, you can see that the program works successfully. Vehicles that couldn't find a spot in the temporary area leave immediately, while those that found a spot are sequentially placed into the permanent parking areas. Once the permanent parking areas are full, those in the temporary area are blocked and begin waiting for a spot to become available. During this time, any new vehicles arriving must leave because the temporary parking area is also full.

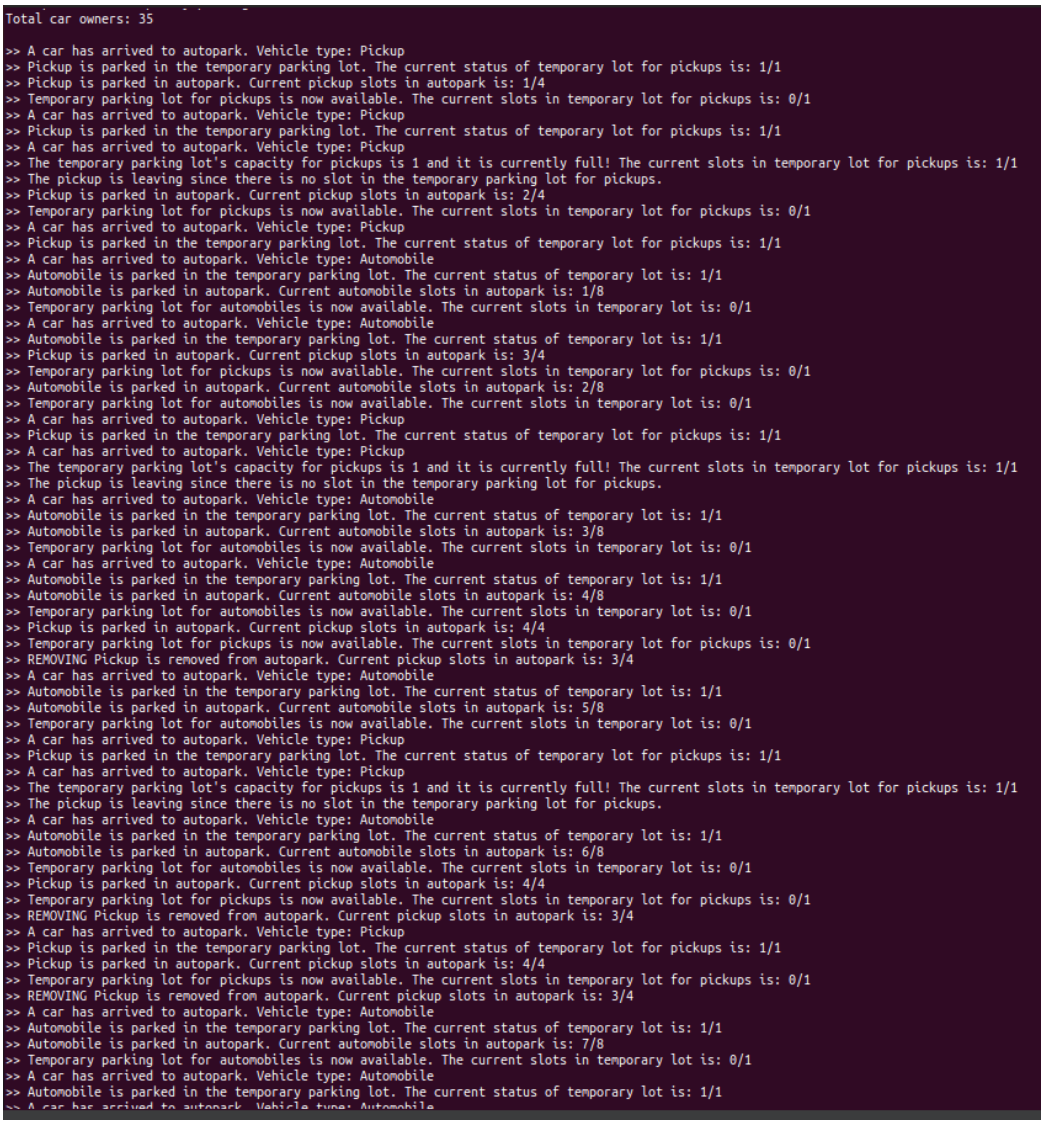
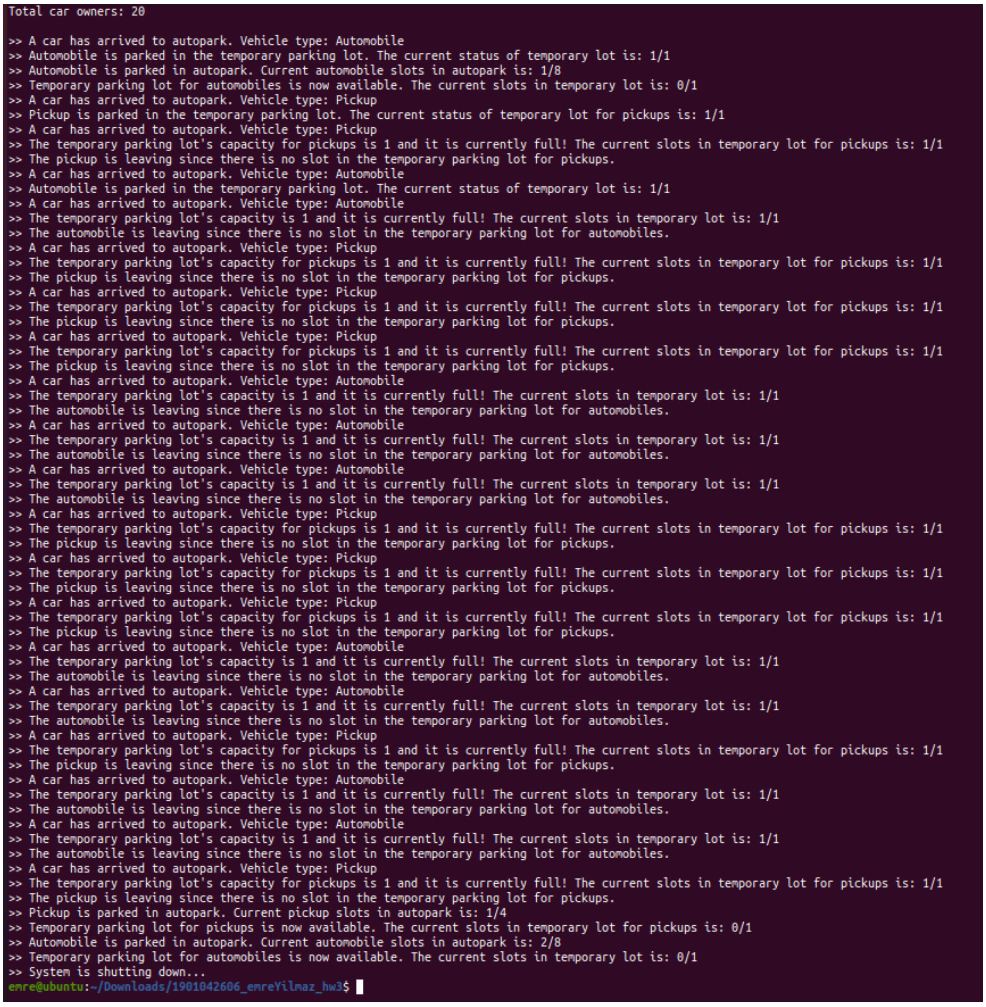


Fig-2: Example Output 2



```
Total car owners: 20

>> A car has arrived to autopark. Vehicle type: Automobile
>> Automobile is parked in the temporary parking lot. The current status of temporary lot is: 1/1
>> Automobile is parked in autopark. Current automobile slots in autopark is: 1/8
>> Temporary parking lot for automobiles is now available. The current slots in temporary lot is: 0/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> Pickup is parked in the temporary parking lot. The current status of temporary lot for pickups is: 1/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> Automobile is parked in the temporary parking lot. The current status of temporary lot is: 1/1
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> Pickup is parked in autopark. Current pickup slots in autopark is: 1/4
>> Temporary parking lot for pickups is now available. The current slots in temporary lot for pickups is: 0/1
>> Automobile is parked in autopark. Current automobile slots in autopark is: 2/8
>> Temporary parking lot for automobiles is now available. The current slots in temporary lot is: 0/1
>> System is shutting down...
emre@ubuntu:~/Downloads/1901042606_emreYilmaz_hw3$
```

Fig-3: Example Output 3

```
Total car owners: 25

>> A car has arrived to autopark. Vehicle type: Automobile
>> Automobile is parked in the temporary parking lot. The current status of temporary lot is: 1/1
>> Automobile is parked in autopark. Current automobile slots in autopark is: 1/8
>> Temporary parking lot for automobiles is now available. The current slots in temporary lot is: 0/1
>> A car has arrived to autopark. Vehicle type: Automobile
>> Automobile is parked in the temporary parking lot. The current status of temporary lot is: 1/1
>> Automobile is parked in autopark. Current automobile slots in autopark is: 2/8
>> Temporary parking lot for automobiles is now available. The current slots in temporary lot is: 0/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> Pickup is parked in the temporary parking lot. The current status of temporary lot for pickups is: 1/1
>> A car has arrived to autopark. Vehicle type: Automobile
>> Automobile is parked in the temporary parking lot. The current status of temporary lot is: 1/1
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> Pickup is parked in autopark. Current pickup slots in autopark is: 1/4
>> Temporary parking lot for pickups is now available. The current slots in temporary lot for pickups is: 0/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> Pickup is parked in the temporary parking lot. The current status of temporary lot for pickups is: 1/1
```

Fig-4: Example Output 4

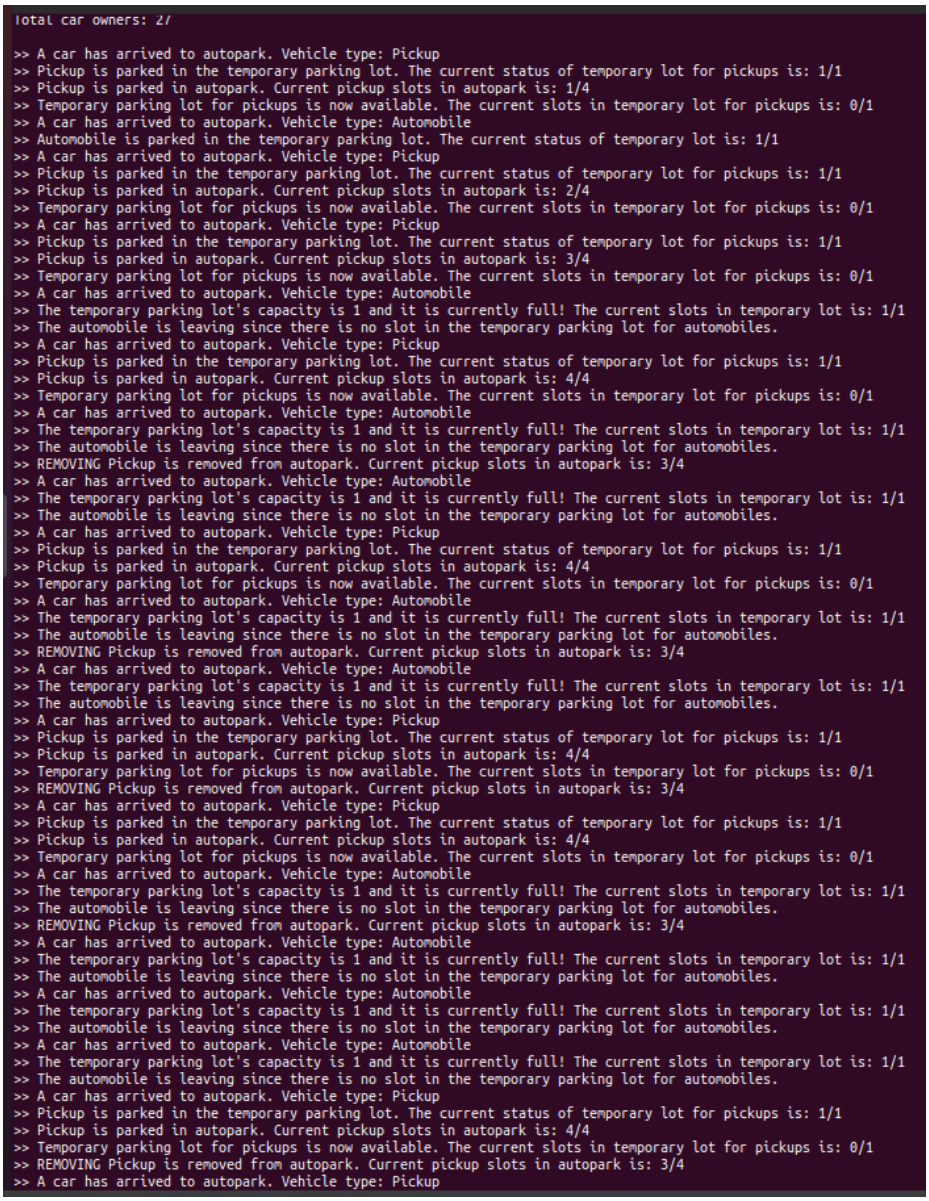


Fig-5: Example Output 5

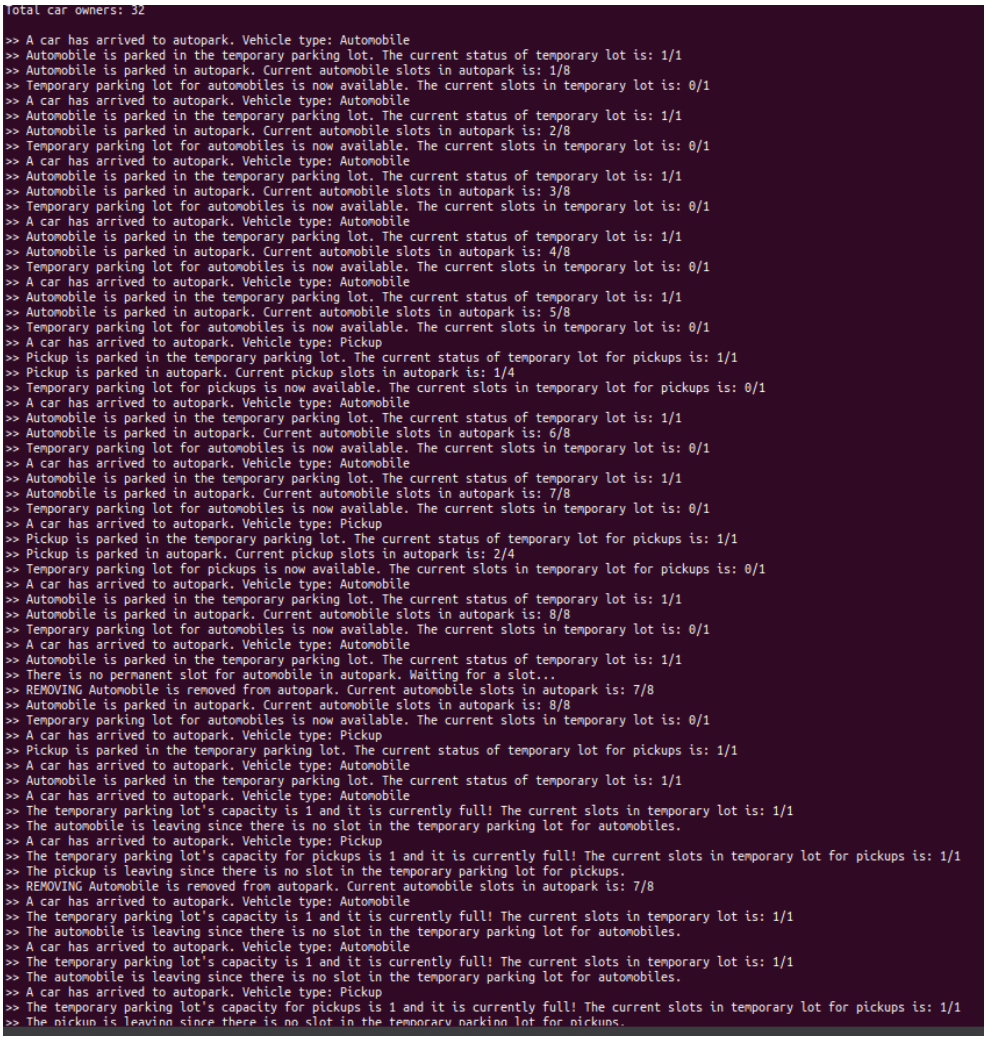


Fig-6: Example Output 6

```
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> Automobile is parked in autopark. Current automobile slots in autopark is: 5/8
>> Temporary parking lot for automobiles is now available. The current slots in temporary lot is: 0/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> Automobile is parked in the temporary parking lot. The current status of temporary lot is: 1/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Pickup
>> The temporary parking lot's capacity for pickups is 1 and it is currently full! The current slots in temporary lot for pickups is: 1/1
>> The pickup is leaving since there is no slot in the temporary parking lot for pickups.
>> A car has arrived to autopark. Vehicle type: Automobile
>> The temporary parking lot's capacity is 1 and it is currently full! The current slots in temporary lot is: 1/1
>> The automobile is leaving since there is no slot in the temporary parking lot for automobiles.
>> Pickup is parked in autopark. Current pickup slots in autopark is: 3/4
>> Temporary parking lot for pickups is now available. The current slots in temporary lot for pickups is: 0/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> Pickup is parked in the temporary parking lot. The current status of temporary lot for pickups is: 1/1
>> Pickup is parked in autopark. Current pickup slots in autopark is: 4/4
>> Temporary parking lot for pickups is now available. The current slots in temporary lot for pickups is: 0/1
>> Automobile is parked in autopark. Current automobile slots in autopark is: 6/8
>> Temporary parking lot for automobiles is now available. The current slots in temporary lot is: 0/1
>> A car has arrived to autopark. Vehicle type: Pickup
>> Pickup is parked in the temporary parking lot. The current status of temporary lot for pickups is: 1/1
>> REMOVING Pickup is removed from autopark. Current pickup slots in autopark is: 3/4
>> Pickup is parked in autopark. Current pickup slots in autopark is: 4/4
>> Temporary parking lot for pickups is now available. The current slots in temporary lot for pickups is: 0/1
>> System is shutting down...
emre@ubuntu:~/Downloads/1901042606_emreYilmaz_hw3$
```

Fig-7: Example Output 7 with 36 Car Owner

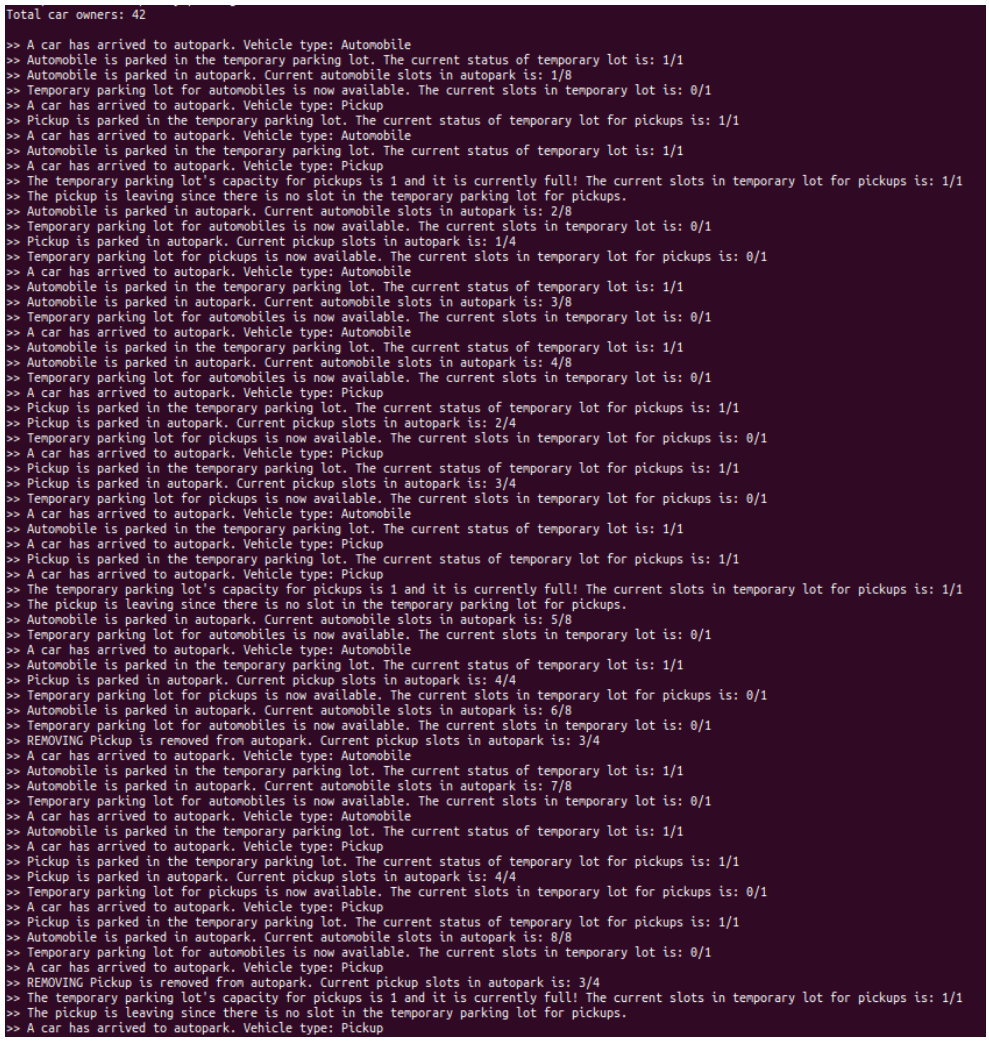


Fig-8: Example Output 8