



CSE344 HW3 REPORT

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CSE 344
HW3
REPORT

In my report, I explain the design and operation of a program that simulates moving vehicles from a temporary parking area to a permanent parking area. The program manages two types of vehicles, pickups and automobiles, and ensures these vehicles are moved from temporary parking spots to permanent ones. Thread synchronization and resource management are achieved effectively using threads and semaphores.

Running The Programme

```
acar@DESKTOP-IEVDRBN:/mnt/d/hw3$ make
gcc -Wall -g -c main.c
gcc -Wall -g main.o -o program
acar@DESKTOP-IEVDRBN:/mnt/d/hw3$ make run
```

General Structure of the Program

The program consists of three main components:

1. **Car Owner (carOwner):** Simulates vehicle owners parking their vehicles in temporary parking spots.
2. **Valet (carAttendant):** Valet threads take the vehicles from the temporary parking spots and move them to permanent parking spots.
3. **Main Function (main):** Creates, synchronizes, and controls the flow of threads in the program.

The structures I use are as follows :

```
#define MAX_PICKUP_SPOTS 4
#define MAX_AUTOMOBILE_SPOTS 8

// Semaphore declarations
sem_t newPickup, inChargeforPickup, newAutomobile, inChargeforAutomobile;

// Global variables for available parking spots
int mFree_pickup = MAX_PICKUP_SPOTS;
int mFree_automobile = MAX_AUTOMOBILE_SPOTS;
int perm_free_pickup = MAX_PICKUP_SPOTS;
int perm_free_automobile = MAX_AUTOMOBILE_SPOTS;
```

- **Semaphores (sem_t):** Used to control the presence of vehicles in temporary parking spots.
- **Global Variables:** Keep track of the available spots in temporary and permanent parking areas.

Functions and Operation

1. **carOwner Function:**

- Simulates vehicle owners arriving at the temporary parking spots.
- If the vehicle type is a pickup, it attempts to park in the temporary pickup parking spot.
- If the vehicle type is an automobile, it attempts to park in the temporary automobile parking spot.
- If the parking spot is full, the vehicle leaves.

2. **carAttendant Function:**

- Simulates valet threads taking vehicles from temporary parking spots and parking them in permanent spots.
- The valet waits for a semaphore signal and, upon receiving the signal, takes the vehicle from the temporary parking spot.
- The vehicle is then parked in a permanent spot.

3. **main Function:**

- Responsible for creating, synchronizing, and controlling the flow of threads.
- Initially, information about the availability of all parking spots is printed.
- Semaphores are initialized and valet threads are created.
- Car owner threads are created and synchronized.
- Valet threads are canceled and destroyed, and semaphores are destroyed.

To make the program more realistic, I added the **sleep** function to simulate the time it takes to park the vehicles. This helps to better model the time spent moving vehicles from the temporary parking area to the permanent parking area.

Output Analysis

```
Initial available temporary pickup spots: 4
Initial available temporary automobile spots: 8

[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 7
[Car Owner] Pickup arrived at the temporary parking area. Current available temporary pickup spots: 3
[Car Attendant] Pickup removed from the temporary parking area. Current available temporary pickup spots: 4
[Car Attendant] Pickup parked in the permanent parking area. Current available permanent pickup spots: 3
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 6
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 5
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 4
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 3
[Car Owner] Pickup arrived at the temporary parking area. Current available temporary pickup spots: 3
[Car Attendant] Pickup removed from the temporary parking area. Current available temporary pickup spots: 4
[Car Attendant] Pickup parked in the permanent parking area. Current available permanent pickup spots: 2
[Car Owner] Pickup arrived at the temporary parking area. Current available temporary pickup spots: 3
[Car Attendant] Pickup removed from the temporary parking area. Current available temporary pickup spots: 4
[Car Attendant] Pickup parked in the permanent parking area. Current available permanent pickup spots: 1
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 2
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 1
[Car Owner] Pickup arrived at the temporary parking area. Current available temporary pickup spots: 3
[Car Attendant] Pickup removed from the temporary parking area. Current available temporary pickup spots: 4
[Car Attendant] Pickup parked in the permanent parking area. Current available permanent pickup spots: 0
[Car Owner] Automobile arrived at the temporary parking area. Current available temporary automobile spots: 7
[Car Attendant] Automobile removed from the temporary parking area. Current available temporary automobile spots: 8
[Car Attendant] Automobile parked in the permanent parking area. Current available permanent automobile spots: 0
acar@DESKTOP-IEVDRBN:/mnt/d/hw3$
```

The program output shows each vehicle arriving at the temporary parking area, being parked, and then being taken by the valet to the permanent parking area. For example:

- An automobile arrives at the temporary parking area, reducing the number of available temporary parking spots to 7.
- The valet takes the automobile from the temporary parking spot, increasing the number of available temporary parking spots back to 8.
- The automobile is moved to the permanent parking area, reducing the number of available permanent parking spots from 7 to 6.

This process continues as the car owners and valets repeatedly perform these operations. When all car owners have completed their operations, the program terminates by **canceled** the valet threads.

The programme ends when the permanent parking area is full.