ARİFE YURTSEVEN

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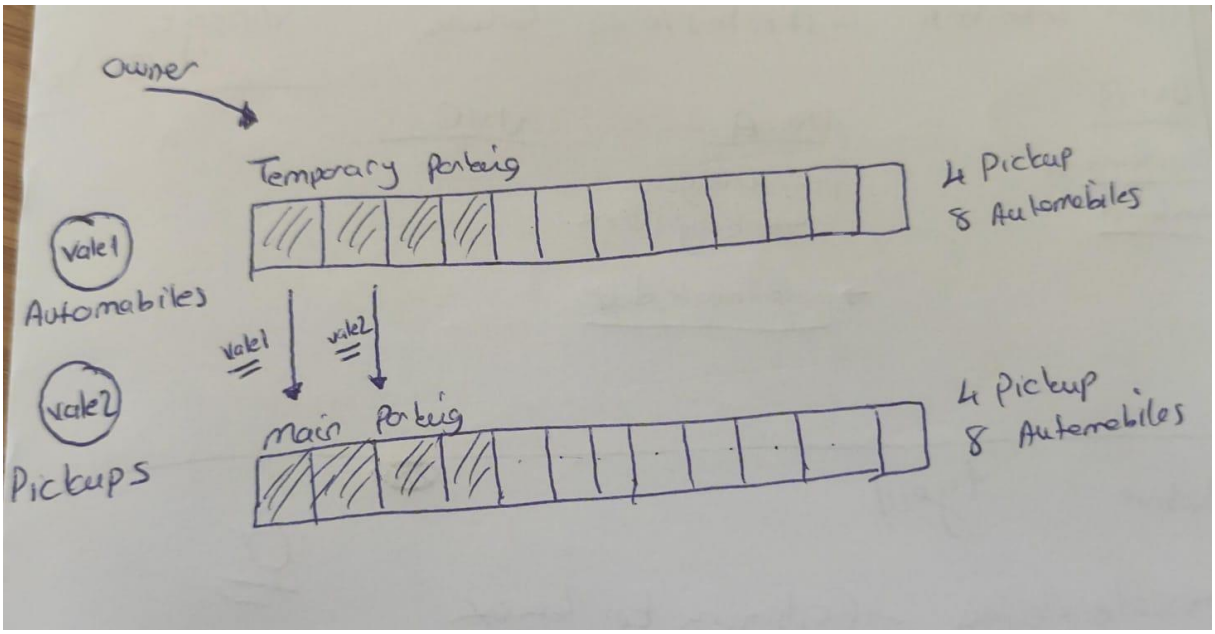
HW3

INTRODUCTION

I am developing a parking system in my program. I have a temporary parking lot with spaces for 4 pickups and 8 automobiles. Customers park their vehicles in this temporary parking lot. Additionally, there is a main parking lot with spaces for 4 pickups and 8 automobiles. Valet1 is responsible for automobile-type vehicles, and Valet2 is responsible for pickup-type vehicles. They transport the vehicles from the temporary parking lot to the main parking lot. Vehicle owners take between 1 to 3 seconds to bring their vehicles. The valets take between 3 to 7 seconds to synchronously transfer the vehicles from the temporary parking lot to the main parking lot. The program ends when the vehicle limit is reached. If the valets can't keep up and there is no space left in the temporary parking lot, the customer is informed and leaves the parking lot. If both the main parking lot and the temporary parking lot are full, this is also communicated to the customers, and the vehicle owners leave the parking lot.



Initialization of Semaphores::

```
sem_init(&newAutomobile, 0, 1);
sem_init(&newPickup, 0, 1);
sem_init(&inChargeforAutomobile, 0, 0);
sem_init(&inChargeforPickup, 0, 0);
```

In this step, I initialize the semaphores. The "newAutomobile" and "newPickup" semaphores are initialized with 1, which controls the entry of vehicles into the temporary parking lot at the start. The "inChargeforAutomobile" and "inChargeforPickup" semaphores are initialized with 0, indicating that the valets are initially on standby.

Creation of Threads:

```
// Create car attendant threads
for (int i = 0; i < 2; i++) {
    int* carType = malloc(sizeof(int));
    *carType = i;
    pthread_create(&attendantThreads[i], NULL, carAttendant, carType);
}

// Create car owner threads
for (int i = 0; i < TOTAL_VEHICLES; i++) {
    int* carType = malloc(sizeof(int));
    *carType = rand() % 2; // 0 for automobile, 1 for pickup
    pthread_create(&ownerThreads[i], NULL, carOwner, carType);
    sleep(rand() % 3 + 1); // Random delay to simulate car arrivals
}
```

I create 2 threads for the two valets. Valet_1 is created for automobiles (carType = 0), and Valet_2 is created for pickup vehicles (carType = 1). Threads are also created for vehicle owners. Each one is randomly designated as either an automobile or a pickup. I wanted to set the arrival times of the vehicles randomly. They will arrive at the temporary parking lot at random intervals between 1 and 3 seconds.

carOwner :

```
sleep(rand() % 3 + 1); // Random delay to simulate car arrivals

char* type = (carType == 0) ? "Otomobil" : "Pickup";

if (carType == 0) {
    sem_wait(&newAutomobile);
    if (mFree_automobile > 0) {
        mFree_automobile--;
        sem_post(&inChargeforAutomobile);
        printf("Car %d owner parked in temporary parking (%s). Valet is waiting.\n", localCarId, type);
        printf("Temp otoparkta otomobil için kalan yer= %d\n", mFree_automobile);
        printf("Temp otoparkta pickup için kalan yer= %d\n", mFree_pickup);
        printf("****************************************\n");
        sem_post(&newAutomobile);
```

The vehicle owner waits for the appropriate semaphore (sem_wait) according to the type of the vehicle (automobile or pickup).

If there is an available space in the temporary parking lot, they park the vehicle, increase the corresponding semaphore (sem_post), and indicate the status with outputs.

If there is no available space in the temporary parking lot, they indicate the status and release the semaphore.

carAttendant:

```
void* carAttendant(void* arg) {
    int carType = *(int*)arg;
    free(arg);
    char* type = (carType == 0) ? "Otomobil" : "Pickup";
    int attendantId = carType == 0 ? 1 : 2; // Valet 1 for Automobile, Valet 2 for Pickup

    printf("Valet %d started for %s.\n", attendantId, type);

    while (1) {
        int random_transport_time = rand() % 4 + 3; // Random time to simulate transport process

        if (carType == 0) {
            sem_wait(&inChargeforAutomobile);
            sem_wait(&newAutomobile);
            if (parkingFreeAutomobile > 0) {
                parkingFreeAutomobile--;
                mFree_automobile++;
```

The valet waits for the appropriate semaphore (sem_wait) according to the type of vehicle (automobile or pickup).

The valet then transports the vehicle from the temporary parking lot to the main parking lot within a random time frame.

If there is an available space in the main parking lot, they move the vehicle to the main parking lot, increase the available space in the temporary parking lot (sem_post), and indicate the status with outputs.

If there is no available space in the main parking lot, they indicate the status and terminate the loop.

Functions and Uses of Semaphores:

sem_t newAutomobile

Initial Value: 1

Usage: Controls the entry of automobile-type vehicle owners into the temporary parking lot.

Purpose: Ensures that only one automobile can enter the temporary parking lot at a time. This semaphore checks if there is an available space in the temporary parking lot and regulates the entry of automobiles.

sem_t newPickup

Initial Value: 1

Usage: Controls the entry of pickup-type vehicle owners into the temporary parking lot.

Purpose: Ensures that only one pickup vehicle can enter the temporary parking lot at a time. This semaphore checks if there is an available space in the temporary parking lot and regulates the entry of pickup vehicles.

sem_t inChargeforAutomobile

Initial Value: 0

Usage: Controls Valet 1 (for automobiles) transporting automobiles from the temporary parking lot to the main parking lot..

Purpose: Ensures that the valet takes action when there is an automobile in the temporary parking lot. This semaphore allows Valet 1 to transport an automobile parked in the temporary parking lot to the main parking lot.

sem_t inChargeforPickup

Initial Value: 0

Usage: Controls Valet 2 (for pickups) transporting pickups from the temporary parking lot to the main parking lot.

Purpose: Ensures that the valet takes action when there is a pickup in the temporary parking lot. This semaphore allows Valet 2 to transport a pickup parked in the temporary parking lot to the main parking lot.

Usage Scenario:

Temporary Parking Lot Control: Vehicle owners use the newAutomobile or newPickup semaphore when entering the temporary parking lot to prevent more than one vehicle from entering at the same time. This prevents excessive congestion in the temporary parking lot and controls the capacity for each type of vehicle.

Valet Operations: Valets spring into action when there are vehicles waiting in the temporary parking lot (triggered by increasing the inChargeforAutomobile or inChargeforPickup semaphores) and transport the vehicles from the temporary parking lot to the main parking lot. This ensures that valets only work when there are vehicles in the temporary parking lot and they monitor the capacity of the main parking lot.

Note: Since valets transport vehicles from the temporary parking lot to the main parking lot at random intervals, sometimes they may not be able to keep up, and as a result, some customers may be turned away because the temporary parking lot is full, even though there might be space in the main parking lot.

In my algorithm, the program ends based on the number of vehicles. Currently, I have set this number to 30 for my assignment, but it can be changed.

MAKEFILE:

1- make
2- ./main

```
arife@LAPTOP-SRROEDP3:~/hw4$ ./main
Valet 1 started for Automobile.
Valet 2 started for Pickup.
Car 1 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 7
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 7
Remaining spaces in main parking for pickups= 4
Remaining spaces in temporary parking for automobiles= 8
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 2 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 8
Remaining spaces in temporary parking for pickups= 3
****************************************
Valet 2 parked Pickup.
Remaining spaces in main parking for automobiles= 7
Remaining spaces in main parking for pickups= 3
Remaining spaces in temporary parking for automobiles= 8
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 3 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 7
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 6
Remaining spaces in main parking for pickups= 3
Remaining spaces in temporary parking for automobiles= 8
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 4 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 7
Remaining spaces in temporary parking for pickups= 4
****************************************
```

```
Car 5 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 6
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 5
Remaining spaces in main parking for pickups= 3
Remaining spaces in temporary parking for automobiles= 7
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 6 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 6
Remaining spaces in temporary parking for pickups= 3
****************************************
Car 7 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 6
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 2 parked Pickup.
Remaining spaces in main parking for automobiles= 5
Remaining spaces in main parking for pickups= 2
Remaining spaces in temporary parking for automobiles= 6
Remaining spaces in temporary parking for pickups= 4
****************************************
```

```
Car 8 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 4
Remaining spaces in main parking for pickups= 2
Remaining spaces in temporary parking for automobiles= 6
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 9 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 10 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 11 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 3
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 12 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 3
Remaining spaces in temporary parking for pickups= 3
****************************************
Valet 2 parked Pickup.
Remaining spaces in main parking for automobiles= 4
Remaining spaces in main parking for pickups= 1
Remaining spaces in temporary parking for automobiles= 3
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 3
Remaining spaces in main parking for pickups= 1
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 4
****************************************
```

```
Car 13 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 3
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 2
Remaining spaces in main parking for pickups= 1
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 14 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 3
****************************************
Valet 2 parked Pickup.
Remaining spaces in main parking for automobiles= 2
Remaining spaces in main parking for pickups= 0
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 4
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 1
Remaining spaces in main parking for pickups= 0
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 4
****************************************
Car 15 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 3
****************************************
Car 16 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 3
****************************************
```

```
No space left for Pickup in main parking. Valet 2 can't take more cars.
****************************************
Valet 1 parked Automobile.
Remaining spaces in main parking for automobiles= 0
Remaining spaces in main parking for pickups= 0
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 3
****************************************
Car 17 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 2
****************************************
Car 18 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 5
Remaining spaces in temporary parking for pickups= 1
****************************************
No space left for Automobile in main parking. Valet 1 can't take more cars.
****************************************
```

```
Car 19 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 1
****************************************
Car 20 owner parked in temporary parking (Pickup). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 4
Remaining spaces in temporary parking for pickups= 0
****************************************
Car 21 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 3
Remaining spaces in temporary parking for pickups= 0
****************************************
Car 22 owner (Pickup) couldn't park in temporary parking. No space left.
****************************************
Car 23 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 2
Remaining spaces in temporary parking for pickups= 0
****************************************
Car 24 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 1
Remaining spaces in temporary parking for pickups= 0
****************************************
Car 25 owner (Pickup) couldn't park in temporary parking. No space left.
****************************************
Car 26 owner parked in temporary parking (Automobile). Valet is waiting.
Remaining spaces in temporary parking for automobiles= 0
Remaining spaces in temporary parking for pickups= 0
****************************************
Car 27 owner (Automobile) couldn't park in temporary parking. No space left.
****************************************
Car 28 owner (Automobile) couldn't park in temporary parking. No space left.
****************************************
Car 29 owner (Pickup) couldn't park in temporary parking. No space left.
****************************************
Car 30 owner (Automobile) couldn't park in temporary parking. No space left.
```