

GEBZE TECHNICAL UNIVERSITY

CSE344

System Programming

Homework 3 Report

1. HOW TO RUN?

Open the terminal and navigate to the source directory. Then, compile the program by typing “**make**” and execute it using “**./parking_lot_simulation**”. Once executed, the program will produce output as specified by its functionality. To clean up generated files, use “**make clean**”, which will remove the executable file.

2. METHODS AND COMPONENTS USED IN THE CODE

1. Mutexes

We use two mutexes, **carSpotLock** and **pickupSpotLock**, to protect the shared counters **availableCarSpots** and **availablePickupSpots**, respectively. This ensures that only one thread can access and modify these counters at a time, preventing race conditions and ensuring data consistency.

```
// Mutexes for accessing shared variables  
pthread_mutex_t automobile_lock;  
pthread_mutex_t pickup_lock;
```

2. Semaphores

Four semaphores are used:

- **pickupSemaphore** and **carSemaphore**: Signal when a pickup or car owner has arrived and is ready for the attendant to park the vehicle.
- **pickupHandlerSemaphore** and **carHandlerSemaphore**: Signal when the attendant has finished parking the pickup or car.

```
// Semaphores
sem_t newPickup;
sem_t inChargeforPickup;
sem_t newAutomobile;
sem_t inChargeforAutomobile;
```

3. Thread Creation and Management

We create two threads for each vehicle: one for the vehicle owner (**vehicleOwner**) and one for the attendant (**parkingAttendant**). These threads are synchronized using semaphores and mutexes to ensure that they operate correctly without interfering with each other.

```
// Initialize mutexes
pthread_mutex_init(&automobile_lock, NULL);
pthread_mutex_init(&pickup_lock, NULL);
/**** mutex and semaphore operations ****/
// Destroy mutexes
pthread_mutex_destroy(&automobile_lock);
pthread_mutex_destroy(&pickup_lock);
```

4. Shared Counters

Two integer variables, **availableCarSpots** and **availablePickupSpots**, are used to track the available parking spots for cars and pickups. These counters are protected by mutexes to ensure thread-safe access and modification.

```
// Shared counters for free spots
int mFree_automobile = 8;
int mFree_pickup = 4;
```

3. OUTPUT

```
PROBLEMS  OUTPUT  TERMINAL  PORTS  COMMENTS  DEBUG CONSOLE

● ayseguldemirbilek@Ayses-MacBook-Pro Homework3 % ./parking_lot_simulation
Creating threads for a car
Car owner arrives. Available car spots before: 8
Car owner parks. Available car spots after: 7
Car parked by attendant.
Attendant parks the car. Available car spots before: 7
Attendant finishes parking the car. Available car spots after: 8
Creating threads for a pickup
Pickup owner arrives. Available pickup spots before: 4
Pickup owner parks. Available pickup spots after: 3
Pickup parked by attendant.
Attendant parks the pickup. Available pickup spots before: 3
Attendant finishes parking the pickup. Available pickup spots after: 4
Creating threads for a pickup
Pickup owner arrives. Available pickup spots before: 4
Pickup owner parks. Available pickup spots after: 3
Pickup parked by attendant.
Attendant parks the pickup. Available pickup spots before: 3
Attendant finishes parking the pickup. Available pickup spots after: 4
Creating threads for a pickup
Pickup owner arrives. Available pickup spots before: 4
Pickup owner parks. Available pickup spots after: 3
Pickup parked by attendant.
Attendant parks the pickup. Available pickup spots before: 4
Attendant finishes parking the pickup. Available pickup spots after: 4
Creating threads for a pickup
Pickup owner arrives. Available pickup spots before: 4
Pickup owner parks. Available pickup spots after: 3
Pickup parked by attendant.
Attendant parks the pickup. Available pickup spots before: 3
Attendant finishes parking the pickup. Available pickup spots after: 4
Creating threads for a pickup
Pickup owner arrives. Available pickup spots before: 4
Pickup owner parks. Available pickup spots after: 3
Pickup parked by attendant.
Attendant parks the pickup. Available pickup spots before: 3
Attendant finishes parking the pickup. Available pickup spots after: 4
^C
Goodbye
○ ayseguldemirbilek@Ayses-MacBook-Pro Homework3 %
```