CSE- 344 System Programing HW-3

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Algorithm Design:

There are 4 threads in the system.
vale1,vale2,carOwner1,carOwner2; Valets works the same function with a different argument that determines if this thread is an automobile valet or pickup valet. The carOwner thread also runs the same function with an argument that determines if this thread runs the function as an automobile or pickup. After creating the threads, in the main function, a loop will be run. In this loop we'll sem_post newAutomobile and newPickup semaphores in random order. According to their values, the carOwner function will run in an automobile or pickup role..

The carOwner function simulates car owners arriving at a parking lot, attempting to find parking spaces for either automobiles or pickups, based on the provided ownerType. The function operates in an infinite loop, where it first tries to acquire a semaphore (**newAutomobile** or **newPickup**) to check for available parking spaces. If no semaphore is available and the total number of cars has been processed, it exits the loop. Otherwise, it continues trying. When a semaphore is successfully acquired, the function enters a critical section protected by the **sem_mFree** semaphore to safely check and update the count of available parking spaces (**mFree_automobile** or **mFree_pickup**). If a space is available, it decrements the count, releases the semaphore, and signals a valet via the **inChargeforAutomobile** or **inChargeforPickup** semaphore. The valests are already waiting in **inChargeforAutomobile** and **inChargeforPickup** semaphores. When these are sem_posted, valets

will take their car and park to the inside one by one and make the same_wait for them and again wait for another signal.

The carAttendent function simulates the behavior of valet attendants responsible for parking either automobiles or pickups, based on the provided **vale** type. The function runs in an infinite loop where the valet waits for a signal from a car owner, indicated by the semaphores **inChargeforAutomobile** or **inChargeforPickup**. If the semaphore acquisition fails and all cars have been processed (**currentNum equals COMING_CAR_NUM**), the valet exits the loop. When a semaphore is successfully acquired, the valet enters a critical section protected by **sem_mFree** to safely update the count of available parking spaces (**mFree_automobile** or **mFree_pickup**). The valet then increments the respective parking space count (that means that one lot freed from empty park lot), releases the semaphore, and simulates parking the car by sleeping for 3 seconds. Messages are printed to indicate the valet's actions. This function ensures that valets only park cars when signaled by car owners (that means that a car came to the temp parking lot) and maintains proper synchronization and management of parking spaces. If the valet type is invalid, an error message is printed, and the function returns.

Critical Sections and Semaphores

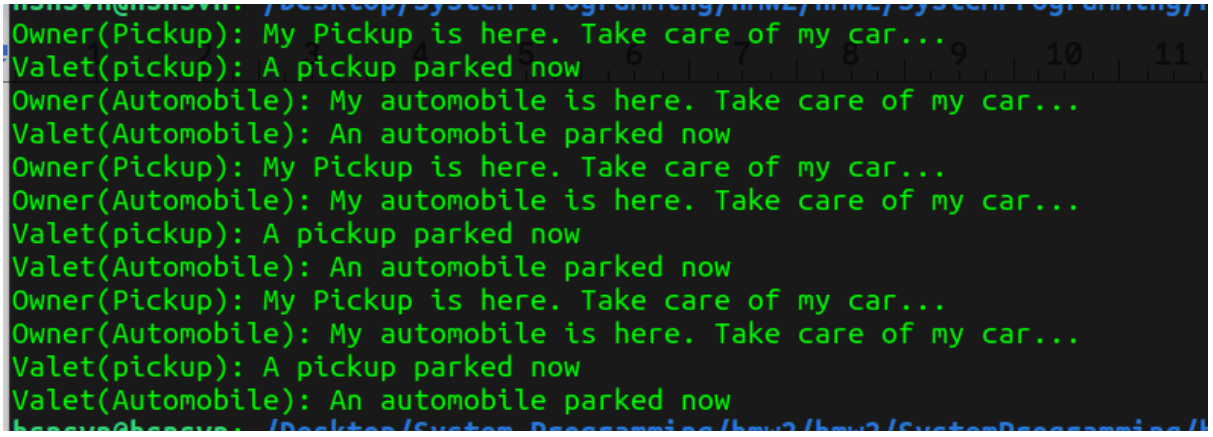
The semaphores **newAutomobile** and **newPickup** are initialized to zero and are used to signal the arrival of new automobiles and pickups, respectively. The semaphores **inChargeforAutomobile** and **inChargeforPickup**, also initialized to zero, are used by car owners to notify valet attendants that a car is ready to be parked. The **sem_mFree** semaphore acts as a mutex to control access to the shared variables **mFree_automobile** and **mFree_pickup**, which track the number of available

parking spaces for automobiles and pickups. By using sem_wait and sem_post operations on these semaphores, the code ensures that car owners and valets operate in a synchronized manner, preventing race conditions and ensuring that parking spaces are managed correctly. The use of sem_trywait allows the threads to check semaphore availability without blocking indefinitely, which is particularly useful for handling the dynamic arrival of cars and the termination condition when all cars have been processed.

It is assumed that the temporary parking lot has a max limit (8 automobiles and 4 pickups by default) . On the other hand, the inside parking area is limitless. (it is not defined clearly in the hw pdf)

Example Runs:

To examine the output easily tested with 5 temporary park lot (4 automobile, 1 pickup):



another run:

```
nshsvh@nshsvh:~/Desktop/SystemProgramming/hmw2/hmw2/SystemProgramming/hmw3$
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
```

With 8 automobile and 4 pickup temporary lots (15 total coming car):

```
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
```

With 4 automobile and 1 pickup temporary lots (15 total coming car), some carowner will not be able to enter the temp park lots:

```
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(pickup): A pickup parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Pickup): No temporary parking space for my Pickup, leaving...
Valet(pickup): A pickup parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Pickup): No temporary parking space for my Pickup, leaving...
Valet(pickup): A pickup parked now
Owner(Pickup): My Pickup is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Valet(pickup): A pickup parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Pickup): No temporary parking space for my Pickup, leaving...
Valet(pickup): A pickup parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Pickup): My Pickup is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Valet(pickup): A pickup parked now
Valet(Automobile): An automobile parked now
```

int this example run, all car types are set as automobile manually and result is below:

```
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): My automobile is here. Take care of my car...
Valet(Automobile): An automobile parked now
Owner(Automobile): My automobile is here. Take care of my car...
Owner(Automobile): No temporary parking space for my automobile, leaving...
Owner(Automobile): No temporary parking space for my automobile, leaving...
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
Valet(Automobile): An automobile parked now
```