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Sleeping Barber Problem

The sleeping barber problem is a classic problem in concurrency and synchronization. It is a problem that models a barber shop with one barber and n customers. The barber sleeps when there are no customers and wakes up when a customer arrives. The customers wait in a queue if all the chairs are occupied and leave the shop if all the chairs are occupied and the barber is sleeping.

The goal of this project is to implement a solution for the sleeping barber problem using Pthreads, mutex and condition variables for synchronization. The solution should be deadlock-free and should allow for maximum concurrency.

The program should take command line arguments:

num_customer: number of regular customers that the barber has.

max_arrival_time: maximum time passes between each arrival of a specific customer.

max_haircut_duration: maximum time it takes to cut a customer hair.

haircut_repetition: how many times a customer will have a haircut.

The program should spawn customer threads and a main thread, which is not a customer. The main thread should use `pthread_create()` to create the customer threads and `pthread_join()` to wait for them to complete. The program uses a mutex to protect the shared data and condition variables to synchronize the barber and customers.

The barber thread should wait on a condition variable when there are no customers and signal the condition variable when a customer arrives. The customer threads should wait on a condition variable when there are no available chairs, and signal the condition variable when a chair becomes available. The program should stop when all customers have had the specified number of haircuts. You can use monitor-based solutions or semaphores that are deadlock free to solve this problem.

I measured the Total waiting time for each customers.

```
./barber 5 100 500 10
```

Total waiting time for 0 customer: 2030907

Total waiting time for 1 customer: 133830

Total waiting time for 4 customer: 522969

Total waiting time for 3 customer: 80928

Total waiting time for 2 customer: 21244