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Assignment 5 - Chapter 7 Programming Projects

Report

The main core of this assignment was to design a programming solution to the producer-consumer problem using Pthreads and counting semaphores. First, the input from the user is validated that the number of arguments is equal to 4, and that the last three arguments are numeric values.

After that, the semaphores values are initialized, and a number of Pthreads equal to the arguments given by the user, is created for the producer and consumer threads. In the producer thread, the function generates a random item and tries to insert it in the shared buffer using three semaphores, empty, full, and mutex. The empty semaphore holds the number of the empty slots in the buffer, while the full semaphore holds the number of the full slots in the buffer, and the mutex works as a binary semaphore to handle locks.

Also, given that the buffer is circular. The inserted items by the producer are added to the next empty slot in the buffer mod the buffer size, given that there exists at least one empty slot, and otherwise, it reports an error. Using the same fashion, the removed items by the consumer are removed from the next full slot in the buffer mod the buffer size, given that there exists at least one full slot, and otherwise, it reports an error.

Also, I modified the given code skeleton, to add the printing statement in the critical section, in order not to confuse the observer, about the order of producing and consuming items.

To run the code, just run the makefile using the command make, the output file is produced. Then, type the command in the following format:

./main.out [sleepTime] [producerThreads] [ConsumerThreads]

Below, are examples of a running input:

```
osc@ubuntu:~/final-src-osc10e/ch7$ ./main.out 20 4 5
producer produced 36
producer produced 16
producer produced 25
consumer consumed 36
consumer consumed 16
producer produced 44
consumer consumed 25
producer produced 6
producer produced 24
consumer consumed 44
consumer consumed 6
consumer consumed 24
producer produced 13
consumer consumed 13
producer produced 48
consumer consumed 48
producer produced 26
consumer consumed 26
Exit the program
```

```
osc@ubuntu:~/final-src-osc10e/ch7$ ./main.out 20 7 4
producer produced 3
producer produced 1
consumer consumed 3
consumer consumed 1
producer produced 25
consumer consumed 25
producer produced 0
consumer consumed 0
producer produced 44
producer produced 5
producer produced 6
consumer consumed 44
producer produced 45
producer produced 15
consumer consumed 5
consumer consumed 6
consumer consumed 45
producer produced 10
consumer consumed 15
producer produced 29
consumer consumed 10
consumer consumed 29
Exit the program
```