How semaphores manage the consumer producer

Problem On a Buffer Size of N

The problem with implementing other policies such as the sleep and wake policy with a consumer producer problem of buffer size n is that there is a potential for synchronization problems (such as losing wakeups in the sleep and wake policy). In a case where the buffer is empty and the producer attempts to wake up the consumer but the consumer has not yet entered into sleeping mode, the wakeup call gets lost. As a result, when consumer is resumed, it goes to sleep and is never awakened again because consumer is only awakened by producer when item count is equal to 1.

Semaphores solve the problem of lost wakeups because they synchronize the process of inserting into and consuming from the buffer.

In this proposed solution there are two groups of semaphore threads - empty and full – as well as a mutex thread for locking down the buffer array.

The empty semaphore thread must wait until the buffer is not full, lock down the buffer with a mutex thread, deposit its data, unlock the buffer and then notify the consumers that the buffer is not empty.

The full semaphore thread, on the other hand, must wait until the buffer is not empty, lock down the buffer with a mutex thread, retrieve a data item, unlock the buffer and then notify the producers that the buffer is not full.

Each time an item is added by the empty semaphore thread, the number of free slots is decremented. Each time an item is removed by the full semaphore thread, the number of free slots is incremented. The empty semaphore thread will wait for empty slots to become available, insert an item into the buffer and post to the empty buffer semaphore signaling item arrival. The full semaphore thread will wait for the semaphore containing the signal of item arrival and, upon waking up, remove an item from the buffer and signal that empty slots are available. Before a full or empty semaphore thread can have access to the buffer, it must lock the buffer, using the mutex thread. After a full or empty semaphore thread finishes using the buffer, it must unlock the buffer.