

ICS'13 Homework 10 Solution

Problem 1: Concurrency basic

(a)

Problem 2: Producer-consumer problem

A **Yes**, the mutex semaphore is necessary because the producer and consumer can concurrently access the buffer.

B. **No**, the mutex semaphore is not necessary in this case, because a nonempty buffer is equivalent to a full buffer. When the buffer contains an item, the producer is blocked. When the buffer is empty, the consumer is blocked. So at any point in time, only a single thread can access the buffer, and thus mutual exclusion is guaranteed without using the mutex.

C. **No**, the mutex semaphore is not necessary in this case either, by the same argument as the previous case.

Problem 3: Dead Lock

Thread 1 holds mutex pairs (a, b) and (a, c) simultaneously, but not mutex pair (b,c), while Thread 2 holds mutex pair (c,b) simultaneously, not the other two. Since the sets are disjoint, there is **no deadlock potential**, even though Thread 2 locks its mutexes in the wrong order.

Problem 4: Race

No, the mutex protects the assignment of myid

Problem 5: Virtual Memory

Isolation, larger memory space, etc.