ECSE 427: Operating Systems
Assignment 3, Part 1
Wenjie Wei, 260685967

1. The use of 2 semaphores ensures that all producers and consumers have the synchronized value of "products", while the mutex ensures that only one producer/consumer has access to the products at a time.

2. Yes, a consumer with lowest priority can suffer from starvation even if we have 2 semaphores and a mutex. For example, if the consumer needs to wait for a completely full buffer, the items placed in the buffer by producers can be consumed by consumers with higher priorities, so that the consumer with lowest priority suffers from starvation since the buffer is never full.

3. There is an ownership of mutex. At a given time, only one thread is able to access a critical section using mutex. Therefore, mutex is like being a lock mechanism. However, a semaphore is more offenly used to share signals between threads or processes. A binary semaphore is not necessarily able to ensure that only one thread or process can have access to the critical section. Therefore, mutex is more recommended to secure the critical section.

4. In a producer-consumer problem, producers wait for an empty place in the buffer to produce an item, and consumers wait for a full place in the buffer to consume an item. If we solely rely on the semaphore FULL, and use complimentary for EMPTY, consumers can be efficiently notified whenever there is a place filled by the item produced by the producer. However, since there is no semaphore for EMPTY, it is not efficiently enough to notify the producer to stop producing, and this can cause the buffer to be over-filled. Therefore, both two semaphores are needed, to pass accurate information to producers and consumers.