CS 2200 Homework 10

Spring 2019

Instructions:

- Please print a **double-sided** copy of the assignment and hand write your answers. No electronic submissions are allowed. **There will be a 100 point penalty if you do not.**
- This is an individual assignment. You may discuss concepts but not the answers.
- Due Date: **4/10/19 – 6:00 PM** in recitation. Bring your BuzzCard. Show up on time.

Name:________________________________ **GT Username:**______________ **Section:**______

1. Refer to the code below. Please fill in the blanks using methods: **pthread_mutex_lock(), pthread_mutex_unlock(), pthread_cond_signal(), pthread_cond_wait()** to fix the code. ***Note:*** refer to documentation for proper function signatures! Assume buffer, lock, not_fill, and not_empty are all initialized.

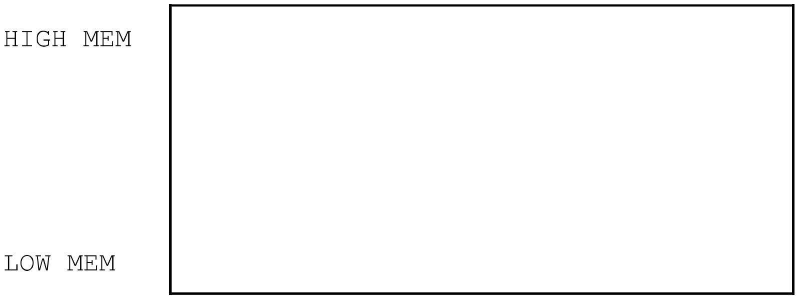
```
frame buffer[MAX_SIZE];
int buffer_size = 0;
pthread_mutex_t lock;
pthread_cond_t not_full;
Pthread_cond_t not_empty;

int producer(){
      ______________________________
      ______________________________
            _________________________________
      /* Code here adds a frame to the buffer */
      ++buffer_size;
      ______________________________
      ______________________________
}

int consumer(){
      ______________________________
      ______________________________
            ______________________________
      /* Code here consumes a frame from the buffer */
      --buffer_size;
      ______________________________
      ______________________________
}
```

   a. Ignoring the blanks and focusing on remaining content, why would there be a problem if we were to issue a thread for both the producer and consumer methods when both are trying access a shared buffer data structure (frame_buffer and buffer_size)

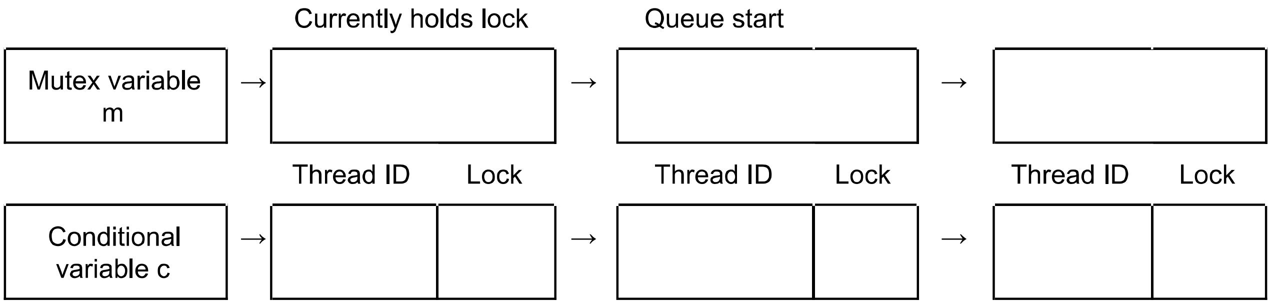
2. Please draw out a diagram of the memory footprint for a multi-threaded process with 4 threads in the rectangle below:



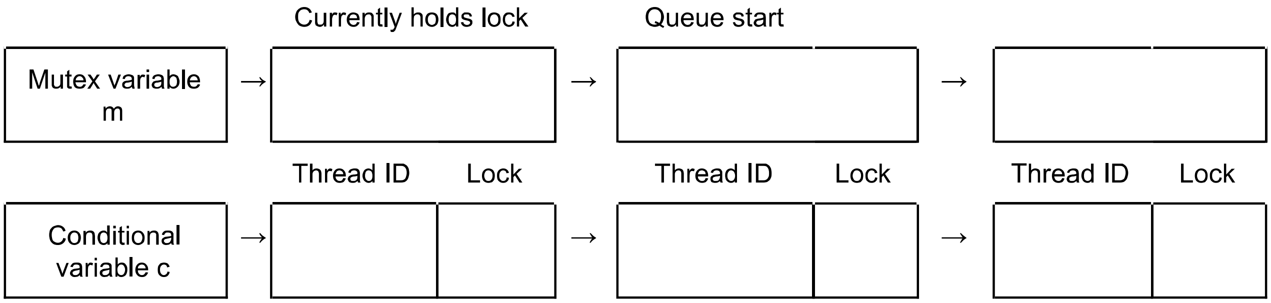
3. Given a mutex lock *m*, and a condition variable *c*, the following events happen in the order of occurrence shown below:
   - T1 executes mutex-lock(m); assume no one has the lock so T1 will win
   - T1 executes cond-wait(c, m)
   - T2 executes mutex-lock(m)
   - T2 executes cond-signal(c, m)
   - T3 executes mutex-lock(m)

   Show the waiting queues for *m* and *c* in the following scenarios:
   - Note: Clearly, show which thread is currently holding the mutex lock, and which threads are in the waiting queue for the lock.
   - Note: if a thread is waiting on a condition variable, you should also show the mutex lock it needs for resuming execution.

a. State of waiting queues before T2 executes cond-signal



b. State of waiting queues after T2 executes cond-signal


Currently holds lock
Queue start
Mutex variable m
→
→
→
Thread ID
Lock
Thread ID
Lock
Thread ID
Lock
Conditional variable c
→
→
→