CMSC330 Spring 2012 Quiz #4

Name ________________________________

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<th>Discussion Time</th>
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<tr>
<td>TA Name (circle):</td>
<td>Tammy</td>
<td>Tammy</td>
<td>Jane</td>
<td>Jane</td>
<td>Tim</td>
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Instructions

- Do not start this test until you are told to do so! You have 20 minutes for this quiz.
- This is a closed book exam. No notes or other aids are allowed.
- Answer essay questions concisely in 2-3 sentences. Longer answers are not needed.
- For partial credit, write neatly & show all of your work.

1. (8 pts) Locks and synchronization
   a. (2 pts) When are condition variables needed in multithreaded programs?

b. (3 pts) Why must condition variables be associated with a lock variable?

c. (3 pts) When would multiple condition variables be associated with the same lock variable?
2. (12 pts) Multithreading

Consider the following multithreaded Java 1.4 code:

```java
class Buffer {
    Buffer ( ) {
        Object buf = null;
        boolean empty = true;
    }

    void produce(o) {
        synchronize (buf) {
            1. if (!empty) wait ( );
            2. empty = false;
            3. notifyAll ( );
            4. buf = o;
        }
    }

    Object consume( ) {
        synchronize (buf) {
            5. if (empty) wait ( );
            6. empty = true;
            7. notifyAll( );
            8. return buf;
        }
    }
}

void t1 = Thread.run { produce(1); }
void t2 = Thread.run { produce(2); }
void t3 = Thread.run { produce(3); }
void t4 = Thread.run { x = consume( ); }
void t5 = Thread.run { y = consume( ); }
```

Assume thread schedules are given as a list of thread name/line number/range pairs, e.g., (t1, 1), (t4, 5-8), would mean thread 1 executed line 1, followed by thread 4 executing lines 5-8.

For each of the following schedules, determine whether the schedule is possible. If it is, determine what values are assigned to x & y. If the schedule is not possible, explain why.

a. (3 pts) (t1, 1-4), (t5, 5-8), (t3, 1-4), (t4, 5-8), (t2, 1-4)

b. (3 pts) (t1, 1-4), (t2, 1), (t3, 1), (t4, 5-8), (t5, 5), (t2, 2-4), (t5, 6-8), (t3, 2-4)

c. (3 pts) (t1, 1-4), (t2, 1), (t3, 1), (t4, 5-7), (t2, 2-4), (t4, 8), (t5, 5-8), (t3, 2-4)

d. (3 pts) (t4, 5), (t5, 5), (t2, 1-4), (t5, 6-8), (t4, 6-8), (t1, 1-4), (t3, 1)