# CS162 Section 3 (9/20/2012)

**True/False**

1. Changing the order of semaphores' operations in a program does not matter.
2. Apple was the first company to develop mice and overlapping windows.
3. If the banker's algorithm finds that it's safe to allocate a resource to an existing thread, then all threads will eventually complete.

**Short Answers**

1. List the four requirements for deadlock.

**Deadlock**

Consider a system with four processes P1, P2, P3, and P4, and two resources, R1, and R2, respectively. Each resource has two instances. Furthermore:

- P1 allocates an instance of R2, and requests an instance of R1;
- P2 allocates an instance of R1, and doesn't need any other resource;
- P3 allocates an instance of R1 and requires an instance of R2;
- P4 allocates an instance of R2, and doesn't need any other resource

a. Draw the resource allocation graph.
b. Is there a cycle in the graph? If yes name it.
c. Is the system in deadlock? If yes, explain why. If not, give a possible sequence of executions after which every process completes.

**Producer and Consumer**

Consider the following two functions implementing a producer and consumer by using monitors:

```
void send(item) {
  lock.acquire()
  enqueue(item);
  printf("before signal()\n");
  dataready.signal(&lock);
  printf("after signal()\n");
  lock.release();
}
```

```
item = get() {
  lock.acquire();
  while (queue.isEmpty()) {
    printf("before wait()\n");
    dataready.wait(&lock);
    printf("after wait()\n");
  }
  item = dequeue();
  lock.release();
}
```

a. Use no more than three sentences to contrast Hoare and Mesa monitors
b. Assume two threads T1 and T2, as follows:

    T1                      T2

  send(item);           item = get();

What are the possible outputs if the monitor uses the Hoare implementation?
c. Repeat question (b) for a Mesa implementation of the monitor
d. . Now assume a third thread T3, i.e.,

    T1              T2             T3

  send(item);    item = get();    send(item);

What are the possible outputs if the monitor uses the Hoare implementation?
Please specify from which thread does an output come by specifying the thread id in front of the output line, e.g., [T1] before signal or [T2] after wait.