Deadlock Simulation Lab Solutions

Experiment 1 output file:

```
time = 0 available = 1 2 blocked = 0
time = 1 available = 1 2 blocked = 0
time = 2 available = 1 2 blocked = 0
time = 3 available = 1 2 blocked = 0
time = 4 available = 1 2 blocked = 0
time = 5 available = 1 2 blocked = 0
time = 6 available = 1 2 blocked = 0
time = 7 available = 1 2 blocked = 0
time = 8 available = 1 2 blocked = 0
time = 9 available = 1 2 blocked = 0
time = 10 available = 0 1 blocked = 1
time = 11 available = 0 1 blocked = 1
time = 12 available = 0 1 blocked = 1
time = 13 available = 0 1 blocked = 1
time = 14 available = 0 1 blocked = 1
time = 15 available = 0 1 blocked = 1
time = 16 available = 0 1 blocked = 1
time = 17 available = 0 1 blocked = 1
time = 18 available = 0 1 blocked = 1
time = 19 available = 0 1 blocked = 1
time = 20 available = 0 0 blocked = 2
time = 21 available = 0 0 blocked = 2
time = 22 available = 0 0 blocked = 2
time = 23 available = 0 0 blocked = 2
time = 24 available = 0 0 blocked = 2
time = 25 available = 0 0 blocked = 2
time = 26 available = 0 0 blocked = 2
time = 27 available = 0 0 blocked = 2
time = 28 available = 0 0 blocked = 2
time = 29 available = 0 0 blocked = 2
time = 30 available = 0 1 blocked = 1
time = 31 available = 0 1 blocked = 1
time = 32 available = 0 1 blocked = 1
time = 33 available = 0 1 blocked = 1
time = 34 available = 0 1 blocked = 1
time = 35 available = 0 1 blocked = 1
time = 36 available = 0 1 blocked = 1
time = 37 available = 0 1 blocked = 1
time = 38 available = 0 1 blocked = 1
time = 39 available = 0 1 blocked = 1
time = 40 available = 0 2 blocked = 0
time = 41 available = 0 2 blocked = 0
time = 42 available = 0 2 blocked = 0
time = 43 available = 0 2 blocked = 0
time = 44 available = 0 2 blocked = 0
time = 45 available = 0 2 blocked = 0
time = 46 available = 0 2 blocked = 0
time = 47 available = 0 2 blocked = 0
time = 48 available = 0 2 blocked = 0
time = 49 available = 0 2 blocked = 0
time = 50 available = 0 1 blocked = 0
time = 51 available = 0 1 blocked = 0
time = 52 available = 0 1 blocked = 0
time = 53 available = 0 1 blocked = 0
time = 54 available = 0 1 blocked = 0
time = 55 available = 0 1 blocked = 0
time = 56 available = 0 1 blocked = 0
time = 57 available = 0 1 blocked = 0
time = 58 available = 0 1 blocked = 0
time = 59 available = 0 1 blocked = 0
time = 60 available = 1 2 blocked = 0
```

1. A deadlock does not occur. All processes are able to finish after 60 milliseconds.
2. Yes, process 2 needs to wait until time 40 to begin, since there are not enough resources to support its requests.

Experiment 2 Output File:

```
time = 0 available = 2 1 blocked = 0
time = 1 available = 2 1 blocked = 0
time = 2 available = 2 1 blocked = 0
time = 3 available = 2 1 blocked = 0
time = 4 available = 2 1 blocked = 0
time = 5 available = 2 1 blocked = 0
time = 6 available = 2 1 blocked = 0
time = 7 available = 2 1 blocked = 0
time = 8 available = 2 1 blocked = 0
time = 9 available = 2 1 blocked = 0
time = 10 available = 0 0 blocked = 0
time = 11 available = 0 0 blocked = 0
time = 12 available = 0 0 blocked = 0
time = 13 available = 0 0 blocked = 0
time = 14 available = 0 0 blocked = 0
time = 15 available = 0 0 blocked = 0
time = 16 available = 0 0 blocked = 0
time = 17 available = 0 0 blocked = 0
time = 18 available = 0 0 blocked = 0
time = 19 available = 0 0 blocked = 0
time = 20 available = 0 0 blocked = 3
```

1. A deadlock occurs at time 20.
2. A deadlock occurs, because there are only 2 instances of resource 0 and 1 instance of resource 1 to begin with. At time = 10, processes 0 and 2 each request an instance of resource 0, thus leaving no instances. Process 1 requests an instance of resource 1, leaving no instances. At time = 20, processes 0 and 2 each request an instance of resource 1, but there are no instances available, since process 1 has not released the instance. Process 1 requests an instance of resource 0, but both instances are held by processes 0 and 2. Since each process is waiting on another process to release an instance, all 3 processes are blocked and a deadlock occurs. This could be eliminated by allocating more instances of resources.