

## SFDV3006 Concurrent Programming

Q1. Consider the following code for an unbounded buffer.

```
import java.util.*;

public class UnBoundedBuffer {

    private ArrayList buffer = new ArrayList();

    public synchronized void put(Object o) {
        buffer.add(o);
    }

    public synchronized Object take() throws InterruptedException {
        while(buffer.size() == 0) wait;
        return buffer.remove(0);
    }
}
```

Assume that there are many Producer threads and many consumer threads which are running concurrently

in an infinite loop. Producers are calling `put()` and Consumers are calling `take()`.

(i) What are synchronization problems that can happen?

(ii) How would you change the above unbounded buffer code to solve the problems? Your solution should be *fair* to both the Producers and Consumers - none of Producers or Consumers should starvation

2. Consider three threads  $t_1, t_2$  and  $t_3$  which use three semaphores  $s_1, s_2$  and  $s_3$  as shown below

i) Will  $t_1, t_2$  and  $t_3$  go into a deadlock? Why or why not? Explain your answer.

### MCQs

1) What is the minimum numbers of threads and resources that can lead to a deadlock?

- a) 1 thread and 2 resources
- b) 2 threads and 1 resource
- c) 1 thread and 1 resource
- d) 2 threads and 2 resources

2) Which of the following is true about starvation?

- a) all the threads/processes are blocked
- b) some of threads processes are blocked
- c) starvation may automatically go away after some time
- d) none of the above

3) Which of the following is true about livelock?

- a) Livelock is same as deadlock
- b) In livelock some threads are running and some are blocked
- c) In livelock all threads are blocked
- d) In livelock all threads are running but not making any progress

4. Which one of the following conditions should be prevented from happening to avoid a deadlock?

- a) Resource preemption
- b) Mutual exclusion
- c) Wait for cycle
- d) Hold and wait

5. Deadlocks can be prevented by using

- a) synchronized
- b) semaphores
- c) locks
- d) none of the above

6. Starvation can be prevented by using

- a) synchronized
- b) semaphores
- c) locks
- d) none of the above

7. Livelocks can be prevented by using

- a) synchronized
- b) semaphores
- c) locks
- d) none of the above

### Short Answer Questions

Please **write** answers to these questions in your notebooks because that is what you will need to do for the **exam**!

1. What are differences between deadlock and livelock?
2. What are the differences between deadlock and starvation?
3. Give an example of a situation where the dining philosophers go into a livelock.

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