CS241 #19 ReaderWriter & Deadlock - part 2

#1 Reader Writer (Writers priority implementation)

**int** writers; // # writer threads that want to enter the critical section (some or all of these may be blocked)  
**int** writing; // Number of threads that are actually writing inside the C.S. (can only be zero or one - can you see why?)  
**int** reading; // Number of threads that are reading inside the C.S.

**int** readers; // Number of threads that are or want to read

// if writing !=0 then reading must be zero (and vice versa)

|  |  |
| --- | --- |
| **reader**() {  **mutex\_lock**(&m)  readers ++  **while** (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)  **cond\_wait**(&reader\_cv, &m)  **Do we need to wait for**  **both 'writers' and 'writing'?**  reading++  **unlock**(&m)   // perform reading here   **lock**(&m)  reading--  readers--  **wake up who here? (and how many)**  **unlock**(&m) } | **writer**(){  **lock**(&m)   writers++   **while** (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)   **cond\_wait**(&writer\_cv, &m)    writing++   **unlock**(&m)  // perform writing here  **lock**(&m)   writing--   writers--  **wake up who here? (and how many)**  **unlock**(&m)  } |

**DEADLOCK**

#2 Deadlock Definition:

#3 Coffman Conditions

Necessary? Y/N

Sufficient? Y/N

1

2

3

4

#4 Resource Allocation Graphs

Figure 1. Deadlocks; not to be confused with Dreadlocks.

Assume processes acquire locks in the order specified and release resources only when finished. Create a *resource allocation graph* to determine if and when there is deadlock.

When a process waits for a resource it will acquire an exclusive lock on resource as soon as no other process has an exclusive lock. Assume locks are fair (earliest waiting process obtains the lock).

|  |  |
| --- | --- |
| Q1  Process 1 ("P1") requests  Resource A & Resource B  Process 2 requests C and B.  Deadlock for P1? PR2? |  |
| Q2  P1 requests A, B & C  P2 requests B & C |  |
| Q3  P1 requests A and B  P2 requests B and C  P3 requests B  P4 requests C and B  Deadlock for P1? P2? P3? P4? |  |
| Q4  P1 requests A and B  P2 requests B and C and D  P4 requests D  P3 requests B  P1 requests C  Deadlock for P1? P2? P3? P4? |  |
| Q4  P1 requests A and B  P2 requests B and C and D  P4 requests D  P3 requests B  P1 *releases* B (assume P2 acquires B)  P1 requests C  Deadlock for P1? P2? P3? P4? |  |

#5 What is the Banker's Algorithm?

#6 Deadlock Avoidance

#7 Linux/Windows strategy for deadlock avoidance?