

Thread Synchronization

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Examples

Example 1

- **Make program**
 - 5 Reader + 1 Writer
 - Writer updates value 1,000,000 times
 - Each reader reads value 10,000,000 times
- **Use pthread_mutex**

Example 2

- **Implement same thing using pthread_spinlock**
 - pthread_spinlock_t s
 - pthread_spin_init(&s, PTHREAD_PROCESS_PRIVATE)
 - pthread_spin_[un]lock(&s)
 - pthread_spin_destroy(&s)

- **What is the difference?**

Readers-Writer Lock



- **Reader blocks other reader**
 - Do we need this?
- **Implementation**
 - Using two mutexes
 - Using a condition variable and a mutex

Readers-Writer Lock(1)

■ Two mutex

Begin Read

- Lock r .
- Increment b .
- If $b = 1$, lock g .
- Unlock r .

End Read

- Lock r .
- Decrement b .
- If $b = 0$, unlock g .
- Unlock r .

Begin Write

- Lock g .

End Write

- Unlock g .

Readers-Writer Lock(2)

▪ A condition variable and a mutex

- Lock for read

- Input: mutex m , condition variable c , integer r (number of readers waiting), flag w (writer waiting).
- Lock m (blocking).
- While w :
 - wait $c, m^{[a]}$
- Increment r .
- Unlock m .

- Lock for write

- Lock m (blocking).
- While w :
 - wait c, m
- Set w to true.
- While $r > 0$:
 - wait c, m
- Unlock m .

Example 3-4

- **Example 3**

- Implement program with readers-writer lock(Using mutex)

- **Example 4**

- Implement program with readers-writer lock(Using condition variables)

- **What is the difference?**