Lab-7

Mruganshi Gohel

B20CS014

Synchronization Problems

How to run?

```
gcc with_deadlocks.c -o wd lpthread
./wd
gcc no_deadlocks.c -o nd lpthread
./nd
```

No Deadlocks working

Whenever a philosopher is hungry, a thread is created.

Since the threads are independent so it is possible when two philosophers are hungry together and they can eat if their forks are not common easily.

Now when a philosopher eats, their two forks are locked by sem_wait() so that if an adjacent philosopher gets hungry, they cannot pick the locked forks. this helps in avoiding deadlock

sem_post() unlocks the forks once they are free

```
Philosopher 0 thinking out loud for 6 seconds
Philosopher 1 thinking out loud for 1 seconds
Philosopher 0 is eating
Philosopher 0 is eating
Philosopher 2 thinking out loud for 6 seconds
Philosopher 1 is eating
Philosopher 0 has eaten
Philosopher 1 is eating
Philosopher 1 has eaten
Philosopher 3 thinking out loud for 0 seconds
Philosopher 2 is eating
Philosopher 2 is eating
Philosopher 4 thinking out loud for 0 seconds
Philosopher 3 is eating
Philosopher 4 is eating
Philosopher 4 is eating
Philosopher 2 has eaten
Philosopher 4 has eaten
Philosopher 3 is eating
Philosopher 3 has eaten
```

With Deadlocks Working

We maintain the array to see which philosopher has picked the left fork, in case of deadlock, it is detected and then one philosopher is randomly chosen for preemption Due to this, the remaining philosophers are able to eat and at last, the victim philosopher eats

```
Philosopher 0 thinking out loud for 1 seconds
checking deadlocks
Philosopher 1 thinking out loud for 1 seconds
checking deadlocks
Philosopher 2 thinking out loud for 1 seconds
checking deadlocks
Philosopher 3 thinking out loud for 1 seconds
checking deadlocks
Philosopher 4 thinking out loud for 1 seconds
checking deadlocks
Deadlock detected
Preempted 1
Philosopher 0 is eating
Philosopher 0 has eaten
Philosopher 4 is eating
Philosopher 4 has eaten
Philosopher 3 is eating
Philosopher 3 has eaten
Philosopher 2 is eating
Philosopher 2 has eaten
Philosopher 1 has eaten
```

2. **You have been introduced to the First Reader-Writer problem in the class where a reader the process gets higher priority when it places a request to enter the Critical Section, even if another writer process is waiting. In other words, a writer process may starve while waiting to enter the CS just because there is always another reader who keeps on coming and keeps the CS busy all the time. Give a starvation-free solution to this problem.**

   To avoid starvation, we need to make sure that the writer's request is addressed and not held for too long or forever There can be three possible solutions to this problem

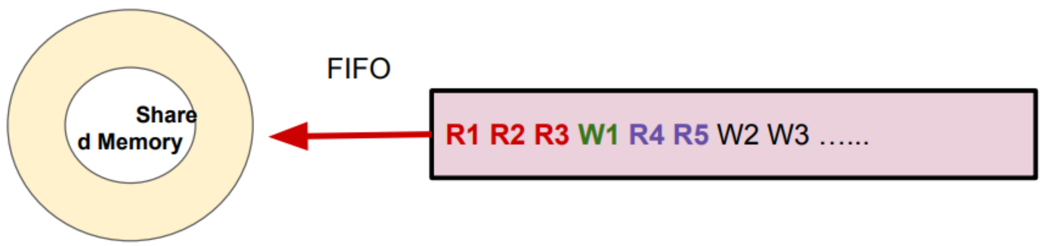
   - FIFO request address
   - Read-Process done based serve
   - Time-based serve

FIFO

Serve the writer's request as they come in the queue after the previous read/write is completed

Readers can work together as they don’t cause conflict when all readers are in a session (which

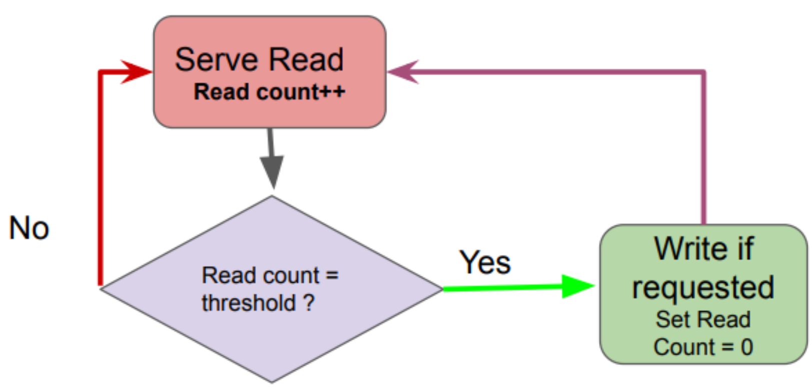
comprises continuous readers) are done, if the next is write it can enter



Answer 2

Read-Process done based serve

Keep count of the number of reads performed and after a certain threshold, the write-in queue is served , at which the counter is set to 0 again



Answer 2

Time-based serve

This is similar to the previous solution, except that instead of keeping the read count, we can keep
count of timestamps between the previous write and current read end time, if it exceeds a
threshold then write can be executed

However out of these, FIFO implementation is simpler and better if we go along the logic of execution

Answer 2