

**Problem 2** (4 points) A *ticket lock* is a lock implemented using two shared counters, `next_ticket` and `now_serving`, both initialised to 0. A thread wanting to acquire the lock uses an atomic operation to fetch the current value of `next_ticket` as its unique sequence number and increments it by 1 to generate the next sequence number. The thread then waits until `now_serving` is equal to its sequence number. Releasing the lock consists on incrementing `now_serving` in order to pass the lock to the next waiting thread.

Given the following data structure and incomplete implementation of the primitives that support the `ticket lock` mechanism:

```
typedef struct {
    int next_ticket;
    int now_serving;
} tTicket_lock;

void ticket_lock_init (tTicket_lock *lock) {
    lock->now_serving = 0; lock->next_ticket = 0;
}

void ticket_lock_acquire (tTicket_lock *lock) {
    // obtain my unique sequence number from next_ticket
    // generate the next_ticket sequence number
    // wait until my sequence number is equal to now_serving
}

void ticket_lock_release (tTicket_lock *lock) {
    lock->now_serving++;
}
```

**We ask:**

1. Complete the code for the `ticket_lock_acquire` primitive to be executed on two different platforms that provide the following different atomic operations:

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(a) `fetch_and_inc` atomic operation:

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int fetch_and_inc(int *addr);
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Recall that `fetch_and_inc` operation reads the value stored in `addr`, increments it by 1, stores it in `addr` and returns the old value (before doing the increment).

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AN ATOMIC WAY? WHY?

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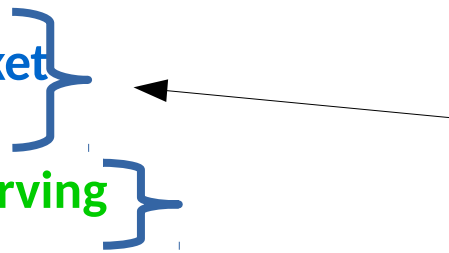
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DO WE NEED TO DO IT IN  
AN ATOMIC WAY? **Yes!**  
WHY?

You have to get the current  
`next_ticket` value and update  
it for next thread, and it  
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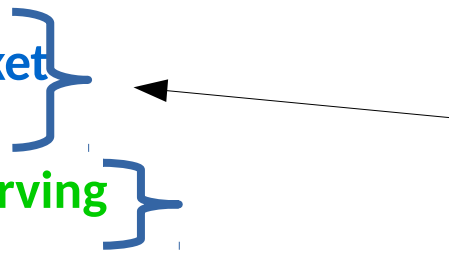
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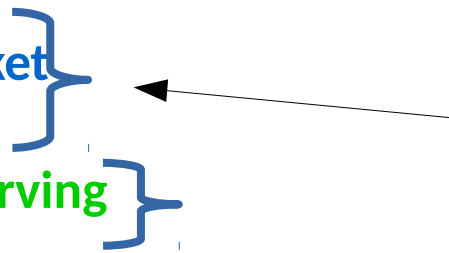
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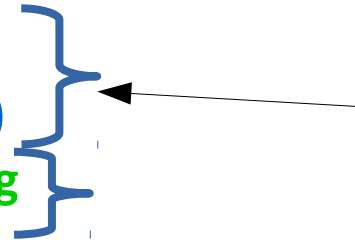
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```
void ticket_lock_acquire (tTicket_lock * lock) {  
    int local_next_ticket;  
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DO WE NEED TO DO IT IN AN ATOMIC WAY? **Yes!**  
WHY?

You have to **FETCH** the current `next_ticket` value and **INC** it for next thread, and it **SHOULD BE UNIQUE!!!!**

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}
```



DO WE NEED TO DO IT IN AN ATOMIC WAY? **No!**  
WHY?  
We only need to read and wait to have the `now_serving` equal to my **UNIQUE** ticket



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    lock->now_serving++;  
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```

```
void ticket_lock_acquire (tTicket_lock * lock) {  
    int local_next_ticket;  
    local_next_ticket = fetch_and_inc(&lock->next_ticket)  
    while (lock->now_serving != local_next_ticket);  
}
```



DO WE NEED TO DO IT IN AN ATOMIC WAY? **No!**  
WHY?  
We only need to read and wait to have the `now_serving` equal to my **UNIQUE** ticket

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How can we do that with:  
`load_linked` and  
`store_conditional` ?

1. Complete the code for the `ticket_lock_acquire` primitive to be executed on two different platforms that provide the following different atomic operations:

(b) `load_linked` and `store_conditional` operations:

```
int load_linked (int *addr);
```

```
int store_conditional (int *addr, int value);
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Recall that `store_conditional` returns 0 in case it fails or 1 otherwise.

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void ticket_lock_release (tTicket_lock *lock) {  
    lock->now_serving++;  
}
```

Load value of my possible  
**UNIQUE** ticket

```
void ticket_lock_acquire (tTicket_lock * lock) {  
    int local_next_ticket; int res=0;  
    do {  
        local_next_ticket = load_linked(&lock->next_ticket);  
    } while (store_conditional(&lock->next_ticket, local_next_ticket +1)==0);  
    while (lock->now_serving!=local_next_ticket);  
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Try to increment value next ticket ... but if fail (returns 0)... we should try again to get next ticket!!!  
OTHERWISE IT WOULD  
**NOT BE UNIQUE!**

If not fail (returns 1) we stop waiting, we have our  
**UNIQUE** Ticket

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typedef struct {
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Once we have obtain the ticket and increment next... we only need to wait

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IN ATOMIC WAY?  
No, there is only one doing  
that, **THE ONE THAT IS IN  
THE EXCLUSIVE AREA!**

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