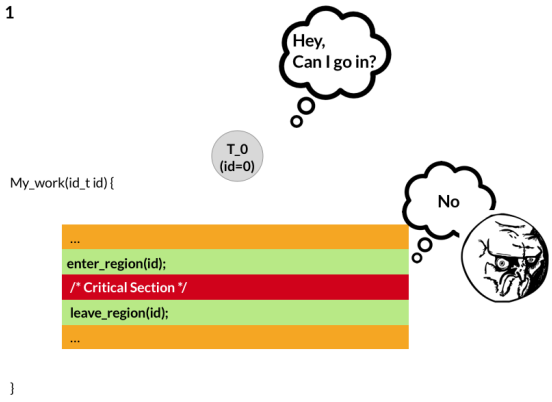
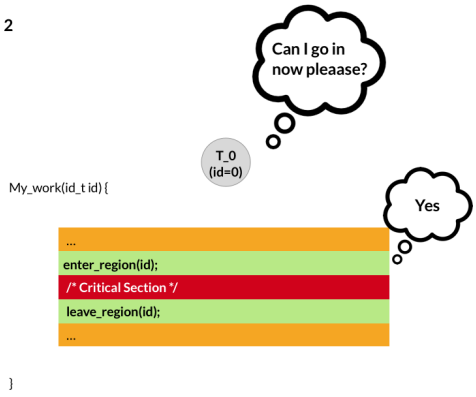
Vocabularies

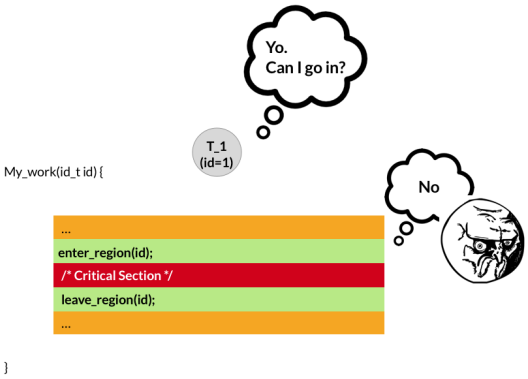
- **Peterson's Algorithm**
  - is a concurrent programming algorithm for mutual exclusion that allows two or more processes to share a single-use resource without conflict, using only shared memory for communication



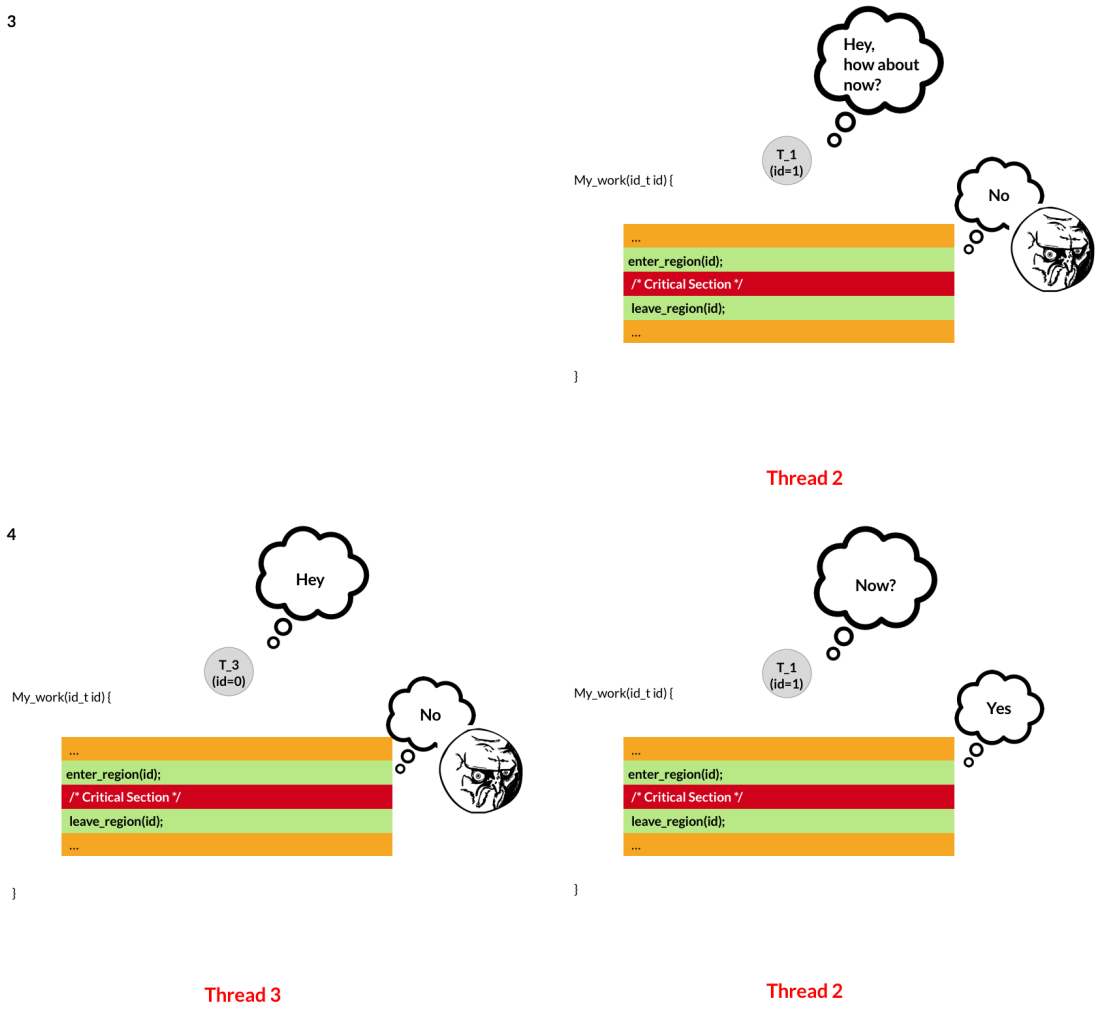
Thread 1



Thread 1



Thread 2



- **Lamport's Bakery Algorithm**
  - Is one of the simplest known solutions to the mutual exclusion/critical section problem for the general case of N process
- **Synchronization**
  - Is the concurrent execution of two or more threads that share critical resource to avoid critical resource use conflicts
- **Disable Interrupts**
  - Is a type of interrupt that postpones interrupts until a later time
- **Spin Lock**
  - Is a loop that keeps a thread from going beyond the loop till a certain condition is met

```
1     while(cantGoOn) {};
```

- **Priority Inversion**
  - Is a problem a low priority process acquiring a resource that a high priority process needs, and then being preempted by a medium priority process, so the high priority process is blocked on the resource while the medium priority one finishes

    Example

    Mars Pathfinder Rover

- **Sleep Lock**
  - Is a type of thread where locking condition is achieved by putting thread to sleep (into "blocked" state) while waiting to acquire a lock lock

```
wait_event(queue, condition)
wake_up(wait_queue_head_t *queue);
```

- **Condition variables**
  - Is an explicit queue that threads can put themselves on when some state of execution (i.e., some condition) is not as desired (by waiting on the condition); some other thread, when it changes said state, can then wake one (or more) of those waiting threads and thus allow them to continue (by signaling on the condition)
- **Semaphores**
  - Is a variable or abstract data type used to control access to a common resource by multiple processes in a concurrent system such as a multitasking operating system.


```
wait_event(queue, condition)
wake_up(wait_queue_head_t *queue);
```

- **Signal**
  - Is a function that unblock one threads currently blocked on the specified condition variable
- **Broadcast**
  - Is a function that unblock all threads currently blocked on the specified condition variable

1 Lecture Video

1.1 Synchronization Hardware

- We are not going to use peterson's algorithm or lampert's bakery algorithm to solve critical section problem
- We will be using a lot of conditional variables

1.2 Disabling Interrupts

```
boolean TAS(boolean *lock) {
  boolean old = *lock;
  *lock = True;
  return old;
}
```

```
boolean TAS(boolean *lock) {
    if(*lock == False) {
        *lock = True;
        return False;
    } else
        return True;
}
```

- Is used within the operating system
  - Is used in very short critical section
  - Disabling interrupts in OS is used sometimes
  - Disabling interrupts in OS works only on uniprocessor
- Is poor solution for user-level programs - what could go wrong here?
  - **Professor Reid:** Interrupts may never be enabled again
- Disabling interrupts not sufficient on a uniprocessor why?
  - **Professor Reid:** Because interrupts work on per process basis (so it disables interrupts on one processor and not the other)

1.3 Atomic instructions: Test and Set

```
boolean TAS(boolean *lock) {
  boolean old = *lock;
  *lock = True;
  return old;
}
```

```
boolean TAS(boolean *lock) {
    if(*lock == False) {
        *lock = True;
        return False;
    } else
        return True;
}
```

- Is hardware-based
- The code is for definition and not implementation (it may look different)
- **Professor Reid:** It modifies the value of the lock variable, and returns the value of what it was just set before

1.4 Lock Implementation

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