- Examples

Examples for using locks in the scope of concurrency in C++.

WE'LL COVER THE FOLLOWING ^ Example 1 Explanation Example 2

Example 1

Explanation

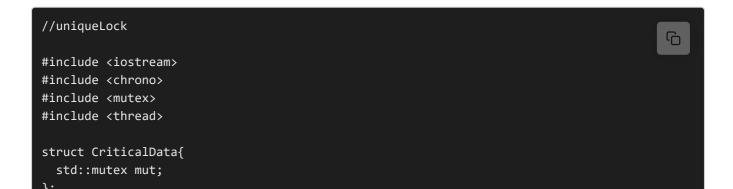
```
//lockGuard.cpp
#include <chrono>
#include <iostream>
#include <mutex>
#include <string>
#include <thread>
std::mutex coutMutex;
class Worker{
public:
  explicit Worker(const std::string& n):name(n){};
    void operator() (){
      for (int i= 1; i <= 3; ++i){
            // begin work
            std::this_thread::sleep_for(std::chrono::milliseconds(200));
           // end work
            std::lock_guard<std::mutex> myLock(coutMutex);
            std::cout << name << ": " << "Work " << i << " done !!!" << std::endl;
private:
  std::string name;
};
int main(){
```

```
std::cout << std::endl;</pre>
std::cout << "Boss: Let's start working." << "\n\n";</pre>
std::thread herb= std::thread(Worker("Herb"));
std::thread andrei= std::thread(Worker(" Andrei"));
                                             Scott"));
std::thread scott= std::thread(Worker("
std::thread bjarne= std::thread(Worker("
                                                 Bjarne"));
std::thread andrew= std::thread(Worker("
                                                  Andrew"));
std::thread david= std::thread(Worker("
                                                    David"));
herb.join();
andrei.join();
scott.join();
bjarne.join();
andrew.join();
david.join();
std::cout << "\n" << "Boss: Let's go home." << std::endl;</pre>
std::cout << std::endl;</pre>
```

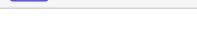


- The program has six worker-threads (lines 36 41). Each worker-thread executes the function object Worker.
- Worker has three work packages. Before each work package, the worker sleeps 1/5 second (line 18) before he starts his work.
- When the Worker is done with the i -th work packages he notifies his boss (line 21).
- All threads exclusively notify their boss (line 21).

Example 2



```
void deadLock(CriticalData& a, CriticalData& b){
      std::unique_lock<std::mutex>guard1(a.mut, std::defer_lock);
       std::cout << "Thread: " << std::this_thread::get_id() << " defer the locking of the first means the state of 
       std::this_thread::sleep_for(std::chrono::milliseconds(1));
       std::unique_lock<std::mutex>guard2(b.mut, std::defer_lock);
       std::cout << "Thread: " << std::this_thread::get_id() << " defer the locking of the second</pre>
       std::cout << "Thread: " << std::this_thread::get_id() << " locking them both atomically" <</pre>
      std::lock(guard1, guard2);
       // do something with a and b
int main(){
      std::cout << std::endl;</pre>
      CriticalData c1;
      CriticalData c2;
       std::thread t1([&]{deadLock(c1, c2);});
       std::thread t2([&]{deadLock(c2, c1);});
      t1.join();
      t2.join();
       std::cout << std::endl;</pre>
```



Explanation

• In case, you call the constructor of std::unique_lock with the argument std::defer_lock, the lock will not be locked automatically in line 14 and 19.

A

- The lock operation is performed atomically in line 23 by using the variadic template std::lock. A variadic template is a template that can accept an arbitrary number of arguments. Here, the arguments are locks.
- std::lock tries to get all the locks in an atomic step. So, either it fails or gets all of them.
- In this example, std::unique_lock handles the lifetime of the resources, and std::lock locks the associated mutex. This can also be done in reverse. In the first step, you lock the mutexes, and in the second step,

std::unique_lock handles the lifetime of resources.

• When you remove std::defer_lock in line 14 and 19 and the std::lock call in line 23, you will likely get a deadlock.

Level up your understanding of this topic with a few exercises in the next lesson.