Thread - Semaphore project

Introduction

Student ID	Full name	Course
21120566	Nguyen Huu Thuan	Introduction to OS

Statement

- This project is about using **Semaphore** to control access to a file.
- There are 2 **Threads**: one for writing to file and one for reading from file.
- The **Semaphore** is used to make sure that only one **Thread** can access the file at a time.
- The file is opened in write mode, so the reading **Thread** will have to wait until the writing **Thread** finishes writing to the file.
- The file is opened in read mode, so the writing **Thread** will have to wait until the reading **Thread** finishes reading from the file.
- The **Semaphore** is initialized with value `1`, so the first **Thread** that accesses the file will be able to do so immediately.
- After finishing accessing the file, the **Thread** will post to the **Semaphore** to signal the other **Thread** that it can now access the file.

Implementation

Mutex

Attributes

- `mutex`: The **mutex** object implemented by the `pthread` library.

Methods

- `Mutex()`: The constructor of the class, initialize **mutex** with default attributes.
- `~Mutex()`: The destructor of the class, destroy **mutex** when going out of scope.
- `get()`: Return the pointer to **mutex**.
- `lock()`: Lock **mutex**, use `pthread_mutex_lock` implemented by the `pthread` library.
- `unlock()`: Unlock **mutex**, use `pthread_mutex_unlock` implemented by the `pthread` library.

Condition

Attributes

- `condition`: The **condition** object implemented by the `pthread` library.

Methods

- `Condition()`: The constructor of the class, initialize **condition** with default attributes.
- `~Condition()`: The destructor of the class, destroy **condition** when going out of scope.
- `get()`: Return the pointer to **condition**.
- `wait(mutex)`: Wait for the **condition**, use `pthread_cond_wait` implemented by the `pthread` library.
- `post()`: Signal **condition**, use `pthread_cond_signal` implemented by the `pthread` library.

Thread

Attributes

- `tid`: The **thread** id object implemented by the `pthread` library.

Methods

- `Thread(start_routine, arg)`: The constructor of the class, create a new thread with the given `start_routine` and `arg`.
- `join()`: Wait for the **thread** to finish, use `pthread_join` implemented by the `pthread` library.

Semaphore

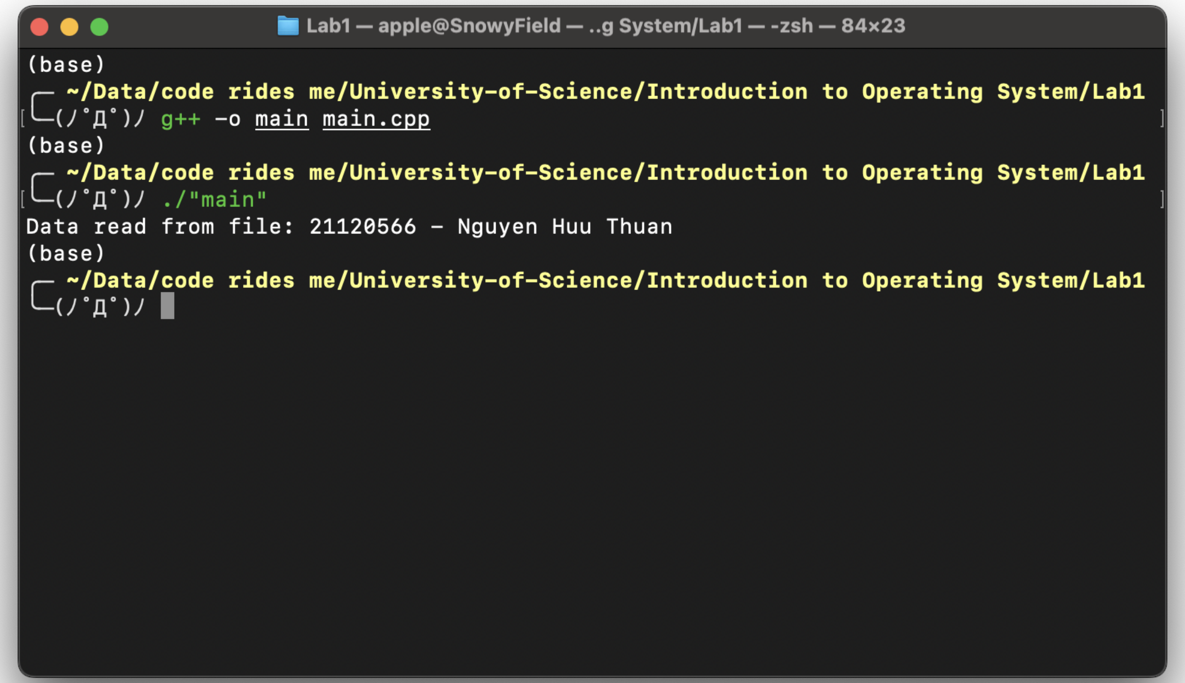
Attributes

- `count`: The **count** of the **semaphore**.
- `mutex`: The **mutex** object used to protect the **count**.
- `condition`: The **condition** object used to wait for the **semaphore** to be available.

Methods

- `Semaphore(initial_count)`: The constructor of the class, initialize **count** with the given `initial_count`.
- `*get_mutex()`: Return the pointer to **mutex**.
- `get_condition()`: Return the pointer to **condition**.
- `wait()`: Wait for the **semaphore** to be available, use `Mutex::lock` and `Condition::wait`.
- `post()`: Signal the **semaphore**, use `Mutex::unlock` and `Condition::signal`.

Result



```
Lab1 — apple@SnowyField — ..g System/Lab1 — -zsh — 84×23
(base)
┌─ ~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab1
└─(/ﾟДﾟ)/ g++ -o main main.cpp
(base)
┌─ ~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab1
└─(/ﾟДﾟ)/ ./"main"
Data read from file: 21120566 - Nguyen Huu Thuan
(base)
┌─ ~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab1
└─(/ﾟДﾟ)/ 
```

Specifications

No.	Specifications	Total Percentage	Estimated
1	The program can be compiled.	10%	10%
2	Read and write threads run correctly.	30%	30%
3	Synchronization between threads works correctly.	30%	30%
4	Return the desired result with no errors.	30%	30%