– Lab2 –

Synchronization

1 Purpose

The purpose of this lab is to get a deeper understanding on the concept of mutual exclusion through semaphores and mutexes to avoid resource contention problems.

2 Content

- Mutexes
- Semaphores
- Shared resource contention

3 Demonstration

Demonstrate a working solution using semaphores and mutexes

4 Assignment

The producer-consumer problem is well known to cause issues when not implemented correctly in multi-threaded systems. This assignment is designed so you will understand how to identify and encounter problems which can occur when implementing any multi-threaded program.

Firstly, take a look at the code, understand the program and identify which part of the program may cause an erratic behavior.

- Start with decreasing the amount of producers to 1 and consumers to 1 and run the program. What happens?
- Increase the amount of producers to 10 and the number of consumers to 3 and run the program, what happens now?
- As you can see, this program is not working correctly… Can you tell why?
- Introduce a mutex to partially solve the problems

- Introduce a counting semaphore to the program and place it appropriately, what happens now?

5 Report

To demonstrate this lab you need to show a working solution which includes semaphores and mutexes. You can easily tell if your code shows erroneous behavior or not through the code messages. You will also have to provide a report for this lab answering the following questions:

Answer the following questions in your lab report:

1. What problems occur during execution of the program without using semaphores or mutexes? Why do these problems occur?
2. When you introduced a mutex, the problem got partially fixed, explain how the problem got fixed using a mutex, and what remains to be solved.
3. Finally, when inserting the counting semaphores, the problem is gone, explain why both a counting semaphore and a mutex is needed for fixing the problem entirely.
4. For all 3 above points, please provide a detailed explanation describing sequences which can lead to errors. The report will only be accepted if you can show that you fully understood the producer/consumer problem.