Natatoria

Introduction

Your mayor recently received funding from an agency to develop the city. He decided to build a new swimming pool for the welfare of the people. The swimming pool has at least few resources like a reception counter, a changing room, and a pool but with limited capacity.

You have been mandated by the leading committee of the swimming pool to simulate the whole system to validate its design choices and guaranty a proper synchronization of the resources.

The architecture and the description of swimming pool is given bellow.

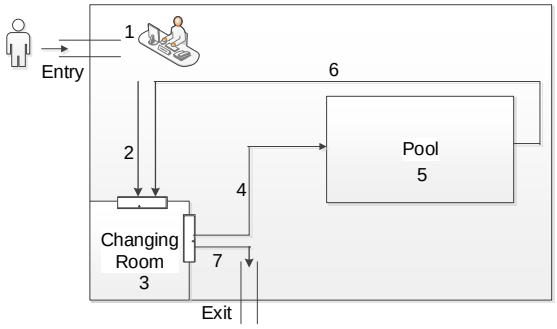

Figure 1: Architecture of the swimming pool

Swimming Pool : It is the global view of the system. It has a reception counter, a changing room, and a pool.

Reception Counter : A client enters the swimming pool only through the reception counter. The reception counter is responsible for selling tickets to the clients. It can sell only one ticket at a time. However, clients selling order is anarchic. It is assumed that clients have enough money, and they always give the exact amount of money.

Changing Room : In order to maintain hygiene, clients need to wear a swimsuit inside the pool. After getting a ticket, every client always comes to this room to switch their clothes to a swimsuit. The capacity of this room is limited. When a client wants to leave the pool, he/she will come to this room again to change his/her clothes back. For convenience, a client takes a constant amount of time to change his/her clothes. The entering order into the Changing room is also anarchic.

Pool : When leaving the changing room, the client will finally access the pool. Again, the pool has a limited capacity. However, there is no time bound here, but each client has to leave the pool at some point. There is no ordering process to jump into the pool.

Client : All clients come to the reception counter and buy a new ticket. Once a client bought a ticket, he/she wears swimming suits to access the pool. Thereafter, finishing the swimming activity, the client again goes back to the changing room and changes the clothes before living the swimming pool.

Report

In addition to your source code, you have to write a report (max 8 pages) describing your design choices. You can include a class diagram. You must describe which elements are threads, monitors. If you absolutely need to use semaphores, you must justify their utilization and their initial value. More precisely, you need to explain every synchronization issues you had and link them with the synchronization issues that you have studied in this lecture.

We are asking you to give a special care in the design of your system (as this will count in your final mark). You have to think your system before jumping on the keyboard to code. **And don't forget to heavily comment your code.**

In order to allow us to validate your work, you must display on the standard output the movement of clients and sessions. These displays will be the execution traces that you must include aside your report.

Expectations

You must return an archive named: NAME1_NAME2.zip; whose the unzipping will create a folder that also respects the same convention. This folder will include your report in PDF, your source code saved by sections (so 3 sub-folders) and the trace files.

You must return your work before 30th of November, 2017 at 23h59 CET, penalties are applied by missing hour.

Please note the penalty of 0.5 points by violated rules.

Part 1 : Jump into deep water

To start, you will model the behavior of the system as described in the introduction. Pay attention to the capacity of the changing room and the pool.

Part 2 : Head first

On normal days, one reception counter is enough to sell tickets. But during the weekend, more clients want to access to the pool. One way to scale up the ticketing process is to add one more reception counter in the system. But the queue line remains unique.

Part 3 : Swimming like a fish

Your swimming pool is a success. To continue pleasing your clients, you decide to allow clients to borrow swimfins. As such, you add a swimfin free rental desk inside the complex that clients may or may not visit.

However the number of swimfins is limited and each client requires to borrow 2 swimfins. You will have to ensure that when a client decides to borrow swimfins he/she will be able to get 2 of them, or will wait until 2 are available.

Swimfin : The store keeps a limited number of swimfins and a client request is satisfied only with 2 swimfins. The rule of the store is that clients have to return the borrowed items after using them.

Client: Now, each client is given a choice to borrow a pair of swimfins before going to the pool. If a client wishes to wear it, he/she will go to borrow them. Otherwise, the client will go

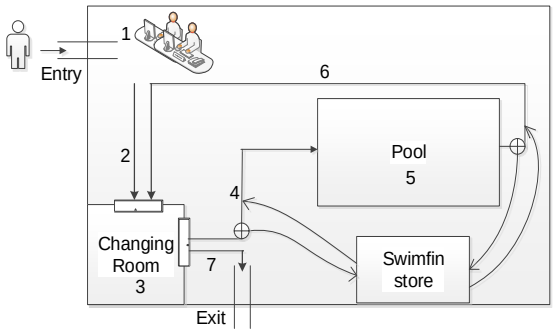

Figure 2: New architecture of the swimming pool

to the pool. After leaving the pool, the client will return any borrowed items to the store before going to the changing room.

Bonus : Jean-Luc

Because of the huge success, a lot of people come to your swimming pool. The major drawback is that the pool gets dirty very quickly. The committee decides to hire Jean-Luc who is responsible for cleaning the swimming pool at random time interval and thus while there is still client in the building. However to complete his work, the pool must be empty and clients can not jump into the pool as long as Jean-Luc is cleaning the pool.