Alexandria University
Faculty of Engineering

Lab Assignment 3
Operating Systems
Assigned: November 27, 2017
Due: December 09, 2017

Lab Assignment 3: Synchronization and Mutual Exclusion

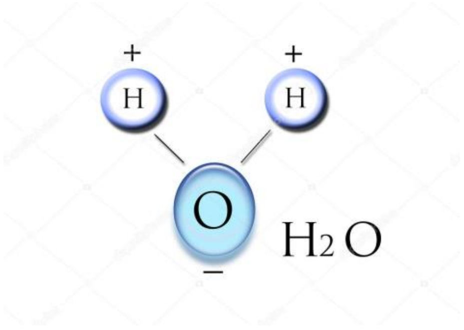
You need to work on this assignment in teams of two.
This assignment must be implemented in C.

Objectives

_ To get familiar with concurrent programming.
_ To better understand handling races, synchronization, mutex, and condition variables.
_ Learn about debugging concurrent programs.

Overview

You are required to simulate the chemical reaction performed to form water.
It turned out that it is not a straightforward one due to synchronization problems.
The trick is to get two H atoms and one O atom together at the same time.



Each atom is represented by a thread.

1-Each H atom invokes the function
void reaction h (struct reaction *r)
When it is ready to react.

2-Each O atom invokes the function
void reaction o (struct reaction *r)
You must write the code for these two functions.

The functions must delay until there are at least two H atoms and one O atom present, and then exactly one of the functions must call the procedure make water (which you needn't write; you do not need to worry about how this works).
After each make water call two instances of reaction h and one instance of reaction o should return.

Requirements

_ Write the declaration for struct reaction in the file reaction.h.

_ Write the function
reaction init(struct reaction *r) which will be invoked to initialize the reaction object.
_ Write the two required functions (described above):
reaction h and reaction o.

_ You must write your solution in C using Pthreads and its Mutex and condition variables.

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_ You should not use semaphores or other synchronization primitives.
_ You may not use more than a single lock in each struct reaction.
_ Your code must not result in busy-waiting.

Notes

_ This assignment is based on this assignment given at Stanford University:
http://web.stanford.edu/˜ouster/cgi-bin/cs140-winter13/problemSet0.php.

_ Download reactionn.h and reaction.c, and complete the missing code.

_ Download and use reaction-runner.c to test your code.

_ Make sure to call make water() when the reaction is ready to create one molecule of water and before two instances of reaction h and one instance of reaction o return.

_ You can use the included Makefile to compile your code and run the test cases.

– You will need to type the command make to build your code.

– You will need to type the command make run to run the test cases.

_ You may use ./reaction x to test your program for the percentage of hydrogen set to x%.

_ Make your code clean, simple, and obvious. This will help you get the solution right.

Thanks …, ☺

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