

Operating System

Lab Assignment 3

Synchronization and Mutual Exclusion

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code organization :

- the code consist from three parts:

reaction.h : have the declaration for struct reaction and other function which we use in reaction.c file.

reaction-runner.c : to test the reaction.c .

reaction.c : which have three main fuctions

> reaction_init (struct reaction *reaction) : to initialize number of h atoms (make it equal to 0 in the begin of program) and initialize one mutex and two variable condition.

> reaction_h(struct reaction *reaction) : call by H-threads and using to increase the number of atom and send a signal to o-threads then wait to receive a signal then unlock the mutex.

> reaction_o(struct reaction *reaction): call by O-threads and wait until receive two h atoms (two signal) and then call make_water() function to create H₂O then send two signal to two thread that sleeps to weak up each of them and the unlock the mutex.

2 – the various mutex and condition variables used:

used one mutex two times in the code

first time to lock and unlock in the reaction_h function, the last time in reaction_o to lock and unlock.

Used two condition variables one to notify we received h atom and signal the sleep thread (waited thread on condition) that we have h atom and another one to notify that it done (we waited until have 2 h and receive one o) and signal the sleep thread (waited thread on condition) and signal the two thread that the make_water is done.

how to compile and run the code :

- Open the terminal and go to the project directory .
- Write make in terminal .
- test it by using ./reaction x where x percentage of hydrogen .
- can use the test in make file by write (make run) in terminal.

Sample runs :

- how to run and using ./reaction x

```
mohamed@mohamed-Inspiron-5537: ~/Desktop/lab3_55
mohamed@mohamed-Inspiron-5537:~$ cd Desktop/
mohamed@mohamed-Inspiron-5537:~/Desktop$ cd lab3_55/
mohamed@mohamed-Inspiron-5537:~/Desktop/lab3_55$ make
cc -g -Wall -Wno-unused-value -o reaction reaction-runner.c -lpthread
mohamed@mohamed-Inspiron-5537:~/Desktop/lab3_55$ ./reaction 20
Created 42 H and 158 O atoms (21.0% H), expecting 21 H2O molecules
Looks good!
mohamed@mohamed-Inspiron-5537:~/Desktop/lab3_55$
```

- run using write (make run) in terminal.

```
mohamed@mohamed-Inspiron-5537: ~/Desktop/lab3_55
mohamed@mohamed-Inspiron-5537:~/Desktop/lab3_55$ make run
./reaction 0
Created 0 H and 200 O atoms (0.0% H), expecting 0 H2O molecules
Looks good!
./reaction 0
Created 0 H and 200 O atoms (0.0% H), expecting 0 H2O molecules
Looks good!
./reaction 20
Created 51 H and 149 O atoms (25.5% H), expecting 25 H2O molecules
Looks good!
./reaction 20
Created 44 H and 156 O atoms (22.0% H), expecting 22 H2O molecules
Looks good!
./reaction 40
Created 73 H and 127 O atoms (36.5% H), expecting 36 H2O molecules
Looks good!
./reaction 40
Created 83 H and 117 O atoms (41.5% H), expecting 41 H2O molecules
Looks good!
./reaction 60
Created 116 H and 84 O atoms (58.0% H), expecting 58 H2O molecules
Looks good!
./reaction 60
Created 119 H and 81 O atoms (59.5% H), expecting 59 H2O molecules
Looks good!
./reaction 80
Created 157 H and 43 O atoms (78.5% H), expecting 43 H2O molecules
Looks good!
./reaction 80
Created 156 H and 44 O atoms (78.0% H), expecting 44 H2O molecules
Looks good!
./reaction 100
Created 200 H and 0 O atoms (100.0% H), expecting 0 H2O molecules
Looks good!
./reaction 100
Created 200 H and 0 O atoms (100.0% H), expecting 0 H2O molecules
Looks good!
mohamed@mohamed-Inspiron-5537:~/Desktop/lab3_55$
```