COP 4520 Spring 2019

Programming Assignment 3

Note 1:

Please, submit your work via Webcourses.

Submissions by e-mail will not be accepted.

Due date: Wednesday, April 3rd by 11:59pm.

Late submissions are not accepted.

Note 2:

This assignment is individual.

You can use a programming language of your choice for this assignment.

If you do not have a preference for a programming language, I would recommend C++.

Problem 1 (100 points)

Modify the *lock-free stack* from Homework Assignment 1 so that it uses the Elimination Back-Off array detailed in Chapter 11 of *The Art of Multiprocessor Programming*.

This implementation must remain *linearizable* and *lock-free*.

In your documentation, reason about the correctness and liveness of the new stack. Be sure to include detailed analysis of the various linearization points for each stack operation.

Additionally, perform an experimental evaluation of your approach and compare it against the lock-free stack you designed in Programming Assignment 2. Include the results of both stacks in your performance graphs. Discuss the results in your documentation. If one version of the stack performs better than the other, be sure to explain why.

Additional Instructions:

- In your benchmark tests, vary the number of threads from 1 to 32 and produce graphs where you map the total execution time on the y-axis and the number of threads on the x-axis. Produce at least 3 different graphs representing different ratios of the invocation of *push*, *pop*, and *size*.
- In your benchmark tests, the total execution time should begin prior to spawning threads and end after all threads complete. All nodes and random bits should be generated before the total execution time begins (if necessary).

- For implementing your concurrent queues, you may want to make use of the <atomic> library in C++, or <stdatomic.h> in C.
- Provide a ReadMe file with instructions explaining how to compile and run your program.

Grading policy:

General program design and correctness: 60%

Efficiency: 20%

Documentation including statements and proof of correctness, efficiency, and experimental evaluation: 20%