

COP 4520 Spring 2016

Programming Assignment 3

Note 1:

Please, submit your work via Webcourses.

Submissions by e-mail will not be accepted.

Due date: Monday, March 14th by 11:59 PM

Late submissions are not accepted.

Note 2:

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

If you do not have a preference for a programming language and a threading library to use for this assignment, I would recommend using C/C++ and POSIX threads.

Problem 1 (100 points)

In this assignment you will work with your project team. Refer to the document “Algorithm Assignments” to find out the specific algorithm assigned to your team. Carefully and thoroughly study the provided materials related to your algorithm.

Implement the concurrent algorithm described in the paper assigned to you. Make sure to meet the described *progress* and *correctness* conditions of the concurrent data structure.

Refer to “Report Writing Guide” and compose a report describing your algorithms, implementation, design decisions, and performance evaluation.

Additionally, in your report address the following questions:

- What is the *progress guarantee* that your data structure provides? Include an informal proof of why the data structure meets the specified progress guarantee.
- What is the *correctness condition* that your data structure provides? Include an informal proof of why the data structure meets the specified correctness condition.
- What are the key *synchronization techniques* that allow this design to meet the described correctness and progress guarantees?
- What did you have to change from the design described in the research paper in *your implementation* of the algorithm?

- What are the advantages and disadvantages of this data structure compared to its alternatives? Are there any specific use cases where this design would be more beneficial than the-state-of-the-art alternative container?
- Can you think of ways to improve the design of the data structure? If so, please attempt them and compare your design and the original re-implementation of the algorithm. (Bonus points).
- What are the biggest obstacles you encountered in your implementation?

Write a test module using 1, 2, 4 and 8 threads that share the data structure. Have each thread execute 500,000 operations on the shared data structure. Vary the distribution of the operations applied, e.g. in a Test Scenario 1 you can apply 50% push and 50% pop on a stack, and in a Test Scenario 2, you can apply 25% push and 75% pop on a stack, etc. Compare the results of this implementation with the coarse-grained locking approach you implemented in Programming Assignment 2. Plot your results on several graphs, where the x-axis would represent the number of threads used, and the y-axis would represent the total execution time in seconds needed to complete all operations. In your report provide a summary of your experimental evaluation. Make sure to specify the platform you used in your experiments and the details about your experimental setup. Additionally, include your interpretation of the observed results (very important).

Include a README file that provides thorough instructions on how to run your test program.

Grading policy:

General program design and correctness: 50%

Efficiency: 20%

Documentation including statements and proof of correctness, efficiency, and experimental evaluation: 30%

Additional Instructions:

Cheating in any form will not be tolerated. Please, submit your work via webcourses.