DEPARTMENT OF COMPUTER SCIENCE, HANYANG UNIVERSITY

(DOCUMENT VERSION 1.0)

Improve the Bw-tree

Concurrent Programming

Programming Project #3

Final due date: Nov. 20, 2022 (HARD DEADLINE)

1 TASK OVERVIEW

As a computer scientist, analyze the Bw-tree and find an opening for enhancement. Define the problem clearly and resolve the issue using the technique and knowledge you learned throughout the course.

2 TASK DETAILS

The advance of hardware technology has led researchers to reconsider the architectures of conventional data structures such as the B+tree. Prior systems had to undergo radical changes to fully exploit the benefits of modern hardware. One example of such effort is the

Bw-tree: a B-tree for new hardware platforms. While admiring the common architectures of prior systems, the Bw-tree adopted new design decisions considering the characteristics of modern multi-core chips such as cache friendliness and high concurrency. The goal of this project is to understand the design principles of the Bw-tree and dive into its implementation to find an opening for enhancement through scientific analysis. We do not restrict the scope to any particular workload, but the scope of the operations to optimize is restricted to single read/write operations (i.e., Insert/Delete/GetValue). Once you find a decent problem, solve the issue and evaluate your design through your own benchmarks. We require you to show us your creativity and skills not only upon problem solving, but also problem finding.

3 Project Milestones

1. **The First Milestone**. Find a problem and propose a design to solve the issue.
    - Write a document on your Wiki and notice the instructors on Piazza.
    - If you cannot find a problem of your own, proceed with the skewed workload problem as described in the lab session. You still need to analyze and document the issue and design.
    - **Due Date**: ASAP
2. **The Second Milestone**. Integrate your design into the Bw-tree. Observe its behavior and make a report.
    - **IMPORTANT**: Never proceed to this milestone unless your design gets confirmed by the TAs or the professor.
    - **Due Date**: Nov. 20

4 General Requirements

- For minimal checks on correctness, use the basic tests (i.e., ***bwtree_test.cc***) given in the project to test your design.
- Provide your own tests to further ensure correctness. Remember that correctness comes first. Write a report of the tests that you made on your Wiki.
- Apart from a Wiki report, you must submit a slide (i.e., PPT) including your proposed design with clear explanation. You must be prepared to present your work before the entire class. Please include the motivation, design, and evaluation as a basic requirement.
- Remember to keep the programming ethics. Plagiarism issues will not be forgiven. Be-**EXTRA**-careful on sharing your thoughts and ideas on Piazza publicly. Regardless of your intention, such actions might open up a room for plagiarism.

Your report should include:

1. Overall design of the new version.
2. Details on design rationale and non-trivial issues for preserving correctness if any.
3. Custom test cases.
4. Performance analysis of the new version.

5 Test Protocol

We provide a basic performance measurement tool for measuring the average write throughput and read latency. Use it as a reference to create your own benchmarks. The test protocols are up to you, which is directly related to evaluation. Show us your design's downfalls/overheads (if any) and strengths throughout various benchmarks.

6 TEST ENVIRONMENT

Submissions will be tested in a server with the following environment:

Processor	2 x Intel Xeon CPU E5-2630 v4 @ 2.20GHz
Configuration	20 Cores / no hyperthreading
Main Memory	256 GiB / no swap space

7 EVALUATION

Evaluation items	**Points**
Problem Definition	20
Overall Design	30
POC Evaluation	40
Documents	10
Total	100

8 SUBMISSION

You should upload your project into the **project3** directory of your "hconnect" repository. The executable file **bwtree_test** should be placed at **repo/project3/build/bin/bwtree_test**.

Enjoy the project and have fun !!!