CSCI 4510/6510: Distributed Systems and Algorithms

Due Wednesday, September 19, 2024 at 11:59pm

Submission requirements

- Homework must be typed and submitted as a pdf file in Gradescope.
- If you include figures, they may be hand-drawn or digitally created.
- Solutions must be relevant to your specific code submission to receive full credit. You should reference and/or explain key details of your implementation to illustrate your point when applicable.
- Solutions must be self-contained. The grader should not need to check your program code to grade the solutions.
- You may discuss the problems and solutions with others, but your must write up your solutions independently.

Required for CSCI 4510 and 6510

In class, we learned that primary-backup replication guarantees linearizability if there are no failures and messaging is reliable. In the following questions, you are asked to consider how your implementation of primary-backup replication behaves and what properties it satisfies in various system models.

Problem 1   Suppose, instead of requiring that the primary execute client requests in FIFO order, we allow requests to be executed concurrently. Would your system still guarantee linearizability with this modification (assuming no failures and reliable messaging)?

Problem 2   Suppose we assume that any server except the view server may fail, but there is always at least one key-value server available. Assume that messaging is reliable. Does your system implement linearizability in this setting?

Problem 3   Suppose that messaging is reliable and key-value servers may crash and restart. There are no other failures. Is it possible for multiple sites to think they are the primary at the same time?

Problem 4   Suppose that messages can be lost. How would you update your implementation to ensure linearizability (assuming no failures)?

Required for CSCI 6510 only

Problem 5   Read sections 1 and 2 of the paper "Perspectives on the CAP Theorem" by Seth Gilbert and Nancy Lynch (https://groups.csail.mit.edu/tds/papers/Gilbert/Brewer2.pdf). Which, if any, properties of CAP does your implementation guarantee? Explain your answer.