CSCI 4510/6510: Distributed Systems and Algorithms - Homework 3 Problem Set

Due Wednesday, November 15, 2024 at 11:59pm in Gradescope

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

Problem 1 Describe your recovery algorithm.

Problem 2 Give the requirements for your recovery algorithm to guarantee that a recovered site learns as many log entries as the most up-to-date active site. Justify your answer.

Problem 3 In your implementation, are there any circumstances under which two sites will execute operations that update the key-value store in different orders? If there answer is yes, give an example execution in which this occurs. If the answer is no, explain why not.

Required for CSCI 6510 only

Problem 4 In the paper "The Part-Time Parliament", Lamport explains the Paxos algorithm through a description of the Paxos legislative system. Answer the following questions about the Paxon's parliament.

1. In the Paxos algorithm, we assume that processes may crash and recover, and that they have stable storage. Explain how these properties play out the Paxos legislature. Who are the processes? And how can they "fail", "recover", and have "stable storage"?

2. In the Paxos algorithm, we assume that messaging is asynchronous and unreliable, and that messages can be duplicated but not corrupted. Explain how this messaging is implemented in the Paxon parliament and why it satisfies these properties.