Problem Set 3, Part b

Due: Thursday, October 16, 2003

Reading:

Sections 15.1, 15.3, 15.4, 15.5.
Self-Stabilization, Chapter 2.

Reading for next week:

Self-Stabilization, Chapter 6.
Chapter 16.

Problems:

1. Consider the variant of the leader election problem that takes place in a line, instead of a ring. In this problem, all processes know their neighbors by local names "left" and "right", except the endpoints that know that one of their neighbors is non-existent.

   Does the lower bound from Theorem 15.12 carry over to this new setting? If so, adapt the proofs from this theorem to prove the lower bound. If not, give a counter example and point out which parts of the proof do not work in the new problem.

2. Exercise 15.30.

   You don't need to prove correctness of your algorithm, but you do need to state and prove your time bound (a convincing argument will suffice). Try to come up with the best possible time bound.

3. Exercise 15.33.

4. Prove that there is no self-stabilizing silent leader election algorithm for which the size of the communication registers is $O(1)$ (thus, the size must be a function of n).

5. Design a self-stabilizing asynchronous leader election algorithm for a tree-structured system in which the processors have no identifiers but the edges are logically (and independently) directed (the communication is in both directions but still there is a definition of head and tail for each edge). Prove its correctness.