

Problem Set 7, Part b

Due: Tuesday, December 13, 2005

Reading:

Chapter 22.
Dijkstra's paper on self-stabilization.
Dolev's book on self-stabilization, Chapter 2.

Reading for next week:

Rambo papers, by Lynch and Shvartsman, and Gilbert, Lynch, and Shvartsman.
Geoquorums paper, by Dolev, Gilbert, et al.

Problems:

1. Exercise 22.13.
2. Consider the problem of establishing and maintaining a shortest-paths tree in a network with a distinguished root node i_0 , with costs associated with the edges. The problem is similar to the one studied in Section 15.4 of the Lynch book, except that now, we model the channels as registers, as Dolev does for his basic BFS spanning tree algorithm (see his Section 2.5). Now we consider self-stabilizing algorithms to solve the shortest-paths problem.
 - (a) Assume that the costs on the edges are fixed, and known by the processes at the endpoints, and that these costs do not get corrupted. Write code, either in TIOA style or in Dolev's style, for a self-stabilizing algorithm to maintain a shortest-paths tree. Use of the TIOA front-end is not required.
 - (b) Give a proof sketch that your algorithm works correctly, that is, that it in fact stabilizes to a shortest-paths tree.
 - (c) State and prove an upper bound on the stabilization time.
 - (d) Describe how your algorithm (or a simple variation) can be used in a setting in which the costs on the edges change from time to time. State a theorem about the behavior of your algorithm in this setting. Be sure to state your assumptions clearly.