Problem Set 3, Part b

Due: Thursday, October 17, 2013

Readings:
Chapters 16 and 18
Lamport’s “Time, Clocks,...” paper, Mattern paper

Next week:
Chapter 19.

Problems:

1. Design an algorithm for an undirected graph network in which every process determines the diameter of the network, which is the maximum distance between any pair of nodes in the graph. Assume that the processes start out not knowing anything about the graph. Try to minimize the time until every node outputs the diameter, perhaps using a synchronizer strategy.
   (a) Describe your algorithm in words.
   (b) Provide pseudocode for the part of the algorithm that uses the synchronizer. You don’t need to write code for the synchronizer itself or its implementation.
   (c) Give an upper bound for the time until every node outputs the diameter.


3. For $k$ even, consider a new problem that we call the $k$-pseudo-session problem. This is a modification of the $k$-session problem that allows a limited amount of leeway in the way events at different processes are ordered. Namely, define a pseudo-session to be any sequence of flash events containing at least 3 flash i events for every i. The $k$-pseudo-session problem requires that the algorithm should perform at least $\frac{k}{3}$ disjoint pseudo-sessions, in any fair execution.
   (a) What is the best upper bound you can give for the worst-case time of the last flash event in any execution? Describe an algorithm that demonstrates this bound.
   (b) What is the best lower bound you can give for the worst-case time of the last flash event in any execution?
   (Note: Formally, the measure we consider is $T(A)$, as defined on p. 557 of the textbook.)