

Problem Set 6, Part a

Due: Thursday, December 1, 2005

Reading:

Chapter 13. Herlihy paper on “Wait-Free Synchronization” (read carefully). Jayanti papers (skim). Attiya-Welch, Chapter 15 (optional).

Reading for next week:

Borowsky-Gafni-Lynch-Rajsbaum paper (read carefully). Attiya-Welch, Section 5.3.2 (optional). Chapter 21. Lamport’s “Part-Time Parliament” (skim).

Problems:

1. Exercise 13.24.
2. Exercise 13.26.
3. Read the SnapshotRegister algorithm described on p. 447-448. Prove its correctness, as expressed by Theorem 13.27.
4. Herlihy’s paper contains an algorithm, which we covered (or will cover) in class, that shows how to implement 2-process wait-free consensus using queue objects. However, the queue objects used in the algorithm are initialized by enqueueing the value 0 and then the value 1. Describe a new algorithm that uses initially-empty queues.
5. This exercise is about determining the consensus number (defined in Herlihy’s paper and to be defined shortly in class) of the “stack” variable type.
 - (a) Give a formal definition of the “stack” variable type (see Section 9.4 for the notation we use for variable types). It should have two operations, push and pop. The pop operation should return, and remove, the last item pushed onto the stack, from among those still remaining on the stack. If the stack is empty, the pop operation should return a special “empty” indicator.
 - (b) Prove that the consensus number of your stack datatype is at least two.
 - (c) Prove that the consensus number of your stack datatype is at most two.