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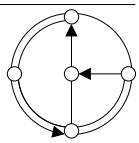

SS 2003 Prof. R. Wattenhofer / Regina Bischoff / Fabian Kuhn

Principles of Distributed Computing
Exercise 7

1 Linear Arrow

In Theorem 9.7 of the lecture notes, it is sketched that the cost of the Arrow protocol (Algorithm 9.4) for a set S of simultaneous requests is by a factor $O(\log |S|)$ larger than the cost (i.e. message complexity) of an optimal algorithm. In this exercise, we consider this problem for the simpler case where the tree is a linear list. Show that the approximation factor of Arrow is $O(1)$ if a set S of simultaneous requests is processed on a synchronous array (linear list).

2 Concurrent Arrow

In Theorem 9.9 it was shown that the Read/Write Caching Algorithm 9.8 is 3-competitive (with respect to message complexity) for sequential access to some global variable. Now we want to investigate what happens in the case of concurrent access.

a) If a read is implemented as in the lecture, what happens to the competitive ratio if we now allow multiple reads at the same time?

b) Improve the algorithm so that it is 3-competitive for concurrent readers.

c) Devise an algorithm that also allows one write concurrently with the reads.

d) Is your algorithm above linearizable? If not, devise one. What is its competitive ratio?

e) Finally, improve the algorithm so that it handles any number of concurrent operations (reads, writes) correctly and is linearizable.
Hint: Do not worry about the competitive ratio of your algorithm.