

Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich



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Principles of Distributed Computing Exercise 7

1 Concurrent Ivy

Consider the tree for the Ivy shared variable protocol in Figure 1. There are three concurrent requests placed by the nodes v_1, v_2 and v_3 . The token is initially held by the circled node labeled r. We assume synchronous execution.

- a) Give the order of serviced requests.
- **b)** Draw the tree after the last request has been served.
- \mathbf{c}^*) Show that in an asynchronous setting, Ivy incurs at most an $O(\log n)$ overhead in amortized message complexity.

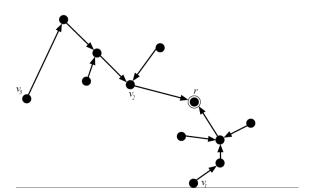


Figure 1: Tree for Question 1.

2 Tight Ivy

In Theorem 7.12 it was shown that, on average, acquiring a lock requires at most $\log n$ steps, where n is the number of processors.

Show that this bound on the number of steps is tight by constructing a tree consisting of n nodes in which each request requires $\log n$ steps if all requests are performed sequentially by suitable nodes in the tree.¹

 $^{^{1}}$ Hints: Assume that n is a power of 2. Construct a tree whose topology remains the same with respect to the token holder after each request.