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Principles of Distributed Computing
Exercise 10

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.

c*) Show that in an asynchronous setting, Ivy incurs at most a $O(\log n)$ overhead in amortized message complexity.

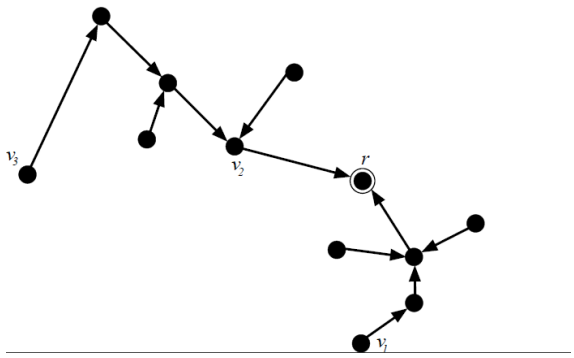

Figure 1: Tree for Question 1.

2 Tight Ivy

In Theorem 10.5 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.