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 the circled node labeled r. We assume a 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 ammortized message complexity.

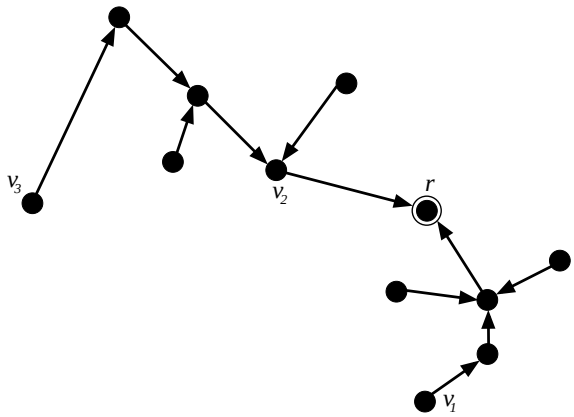

Figure 1: Tree for Question 1.

2 Tight Ivy

In Theorem 6.5 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.