



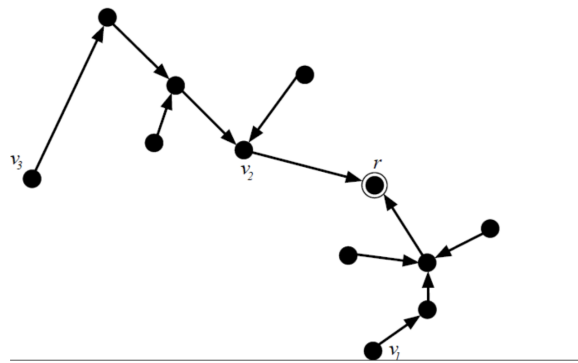
Theory of Distributed Systems

Exercise Sheet 10

Exercise 1: Concurrent Ivy

Consider the tree for the Ivy shared-variable protocol shown in Figure . 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.

1. Give the order in which the requests are serviced.
2. Draw the tree after the last request has been served.



Exercise 2: Tight Ivy

First, recall the following theorem from the lecture notes:

Theorem. *If the initial tree is a star, a find request of Ivy shared object algorithm needs at most $\log n$ steps on average, where n is the number of processors.*

In this exercise, we show that this bound is tight.

1. Construct a tree of n nodes (with n a power of two) in which each request, when performed sequentially by suitably chosen nodes, indeed requires $\log n$ steps.
2. Show that this worst case can even occur when each node requests the object exactly once.