

Exercise 3

October 7, 2014

1 Problem 1

A *splitter* is a shared object that has only one operation, called *splitter*, that can return *stop*, *left* or *right*. Every splitter object ensures the following:

1. If a single process executes *splitter*, then the process is returned *stop*;
2. If two or more processes execute *splitter*, then not all of them get the same output value;
and
3. At most one process is returned *stop*.

Your task is to implement a wait-free, atomic splitter object using *only* atomic (multi-valued, MRMW) registers.

2 Problem 2

The snapshot algorithm presented in the lecture has step complexity that is a function of the number of processes n . That is, in the worst case, a process needs $f(n)$ steps to complete a single *update* or *scan* operation, where f is some function.

Imagine a situation where n is very large but usually only a few processes use a snapshot object. In such a scenario, it would be best to have a snapshot implementation which step complexity is not a function of n but of the number of processes that use the shared object.

Your task is to write such an algorithm. More precisely, you should devise an algorithm for a (wait-free, atomic) snapshot object such that the step complexity of its *update* and *scan* operations is $f(k)$, where k is the number of processes that ever invoked either of the operations (in the current execution) and f is some function independent of n .