1

o

CS2951-S Homework 3
Due 4 April 2016
email pdf to `mph@cs.brown.edu`

Maurice Herlihy

March 21, 2016

0.1 Exercise 7.1

In the *k-simultaneous consensus* task a process has an input value for k independent instances of the consensus problem and is required to decide in at least one of them. A process decides a pair (c, d), where c is an integer between 1 and k, and if two processes decide pairs (c, d) and (c', d'), with $c = c'$, then $d = d'$, and d was proposed by some process to consensus instance c and c'. State formally the k-simultaneous consensus problem as a colorless task, and draw the input and output complex for $k = 2$. Show that k-set agreement and k-simultaneous consensus (both with sets of possible input values of the same size) are wait-free equivalent (there is a read/write layered protocol to solve one using objects that implement the other).

0.2 Exercise 7.1

Using the BG-simulation, show that a colorless task is solvable by an A-resilient layered snapshot protocol if and only if it is solvable by a t-resilient layered immediate snapshot protocol, where t is the size of the minimum core of A (and in particular by a $t + 1$ process wait-free layered immediate snapshot protocol).

0.3 Exercise 8.2

Prove that the complex constructed by assigning binary values to $n + 1$ processes is a combinatorial sphere. (Hint: think of equators, north and south poles, and argue by induction on n.)

0.4 Exercise 8.3

In the *strong symmetry breaking* task processes decide binary values, and not all processes decide the same value when all participate, as in weak symmetry breaking. In addition, in every execution (even when less that $n + 1$ participate) at least one process decides 0. Define the input complex, output complex and carrier map formally. Show that strong symmetry breaking is equivalent to n-set agreement: there is a wait-free read/write layered protocol that can invoke n-set agreement objects and solves strong symmetry breaking, and vice-versa.