Problem Set 5, Part a

Due: Thursday, November 14, 2013

Readings:

Chapter 12; Sections 13.1, 13.2.
Next week: Sections 13.3, 13.4.

Problems:

1. Exercise 12.5.

2. Consider the agreement problem using a combination of read/write registers and multiset variables. Each value taken on by a multiset variable is a finite multiset of elements of some basic set $S$, that is, a finite set of elements of $S$ together with a positive integer multiplicity for each element. The initial value of a multiset variable is the empty multiset. A multiset variable supports two kinds of operations: (i) $\text{insert}(s)$, $s \in S$, which adds one copy the element $S$ to the multiset, that is, it increments $s$’s multiplicity by one, and (ii) $\text{number}(s)$, which does not change the multiset but returns the multiplicity of $s$.

   (a) Write the variable type definition for a multiset variable carefully, following the style used in Section 9.4.

   (b) Prove that, for sufficiently large $n$, the $n$-process agreement problem with wait-free termination cannot be solved using any finite number of shared variables, where each variable is either a read/write register or a multiset variable. How large a value of $n$ do you need?

   (c) Same question as part (b), but for 1-failure termination.


4. Exercise 13.5.

5. Work on your term project...