COMP 317: Semantics of Programming Languages

Problem Sheet 9

UNIVERSITY OF LIVERPOOL

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1. Specify, implement, and prove the correctness of a program that swaps the array values `a['x]` and `a['y]`.
   In the precondition, you can either specify the initial values of `a['x]` and `a['y]`:

   ```
   var S : Store .
   vars X Y : Int .
   eq  pre(S,X,Y)  =  (S[[ a['x] ]]) is X and (S[[ a['y] ]]) is Y .
   ```

   or you can specify the inital value of the array variable `a`:

   ```
   var S : Store .
   var A : Array .
   eq  pre(S,A,X,Y)  =  (S[[ a ]]) == A  and  (S[['x]]) is X  and ...
   ```

   (in which case, the postcondition should state that, in the store `S` that results from running the program, `S[[ a['x] ]] is A[Y]`, etc.).

2. Specify, implement, and prove the correctness of a program that for all `i` (with `0 <= i < 99`) sets `a[i]` to `i`.

3. Define a Maude operation `arraySum` that takes an Array and an Int and returns an Int such that for all arrays `A` and Ints `L`

   ```
   arraySum(A,L)  =  A[0] + A[1] + ... + A[L - 1] .
   ```

   Use this to specify a program that sets `'s` to the sum of the values `a[0] + a[1] + ... + a[99]`. Implement and prove the correctness of your program.

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