Department of Computer Science and Engineering
University of California at San Diego

CSE 230
Winter 1998

Problem Set 4

DUE TUESDAY FEBRUARY 3 IN CLASS.

1. Recall that for the third problem set, you defined two functions to flatten binary trees, one obvious and one with linear time complexity. The first function can be viewed as a formal specification of which the second function is an efficient implementation.

   Use structural induction to prove that your two functions are equivalent, i.e. that given the same binary tree as input, each function yields the same list as output.

2. An expression of the form $[E|V \in L]$ is called a list comprehension and evaluates to the list of values of E as the value of V ranges over items of the list L. An example is $[2 * x|x \in 1\ upto\ 20]$. With more than one variable, the syntax is

   $$[E|V_1 \in L_1; V_2 \in L_2; \cdots]$$

   and the value of L_k may depend on the value of V_1 up to V_{k-1}. For example, the value of

   $$[x * y|x \in 1\ upto\ 10; y \in 1\ upto\ x]$$

   is a list of 55 integers.

   Specify an abstract syntax for list comprehension expressions, and then define ML datatypes to represent this. (The arithmetic expressions allowed inside comprehensions may be limited to very simple integer expressions.) Using this datatype, implement an ML "interpreter" function that evaluates list comprehensions.

   Alternatively, you may choose to represent the abstract syntax using Java classes, and then implement the interpreter using Java.