2008 Paper 1 Question 5

Foundations of Computer Science

(*a*) Describe how lazy lists, which have possibly infinite length, can be implemented in ML. Illustrate your answer by presenting a function that accepts one (or more) lazy lists and produces another lazy list. [6 marks]

(*b*) A *lazy binary tree* either is empty or is a branch containing a label and two lazy binary trees, possibly to infinite depth. Present an ML datatype to represent lazy binary trees. [2 marks]

(*c*) Present an ML function that produces a lazy binary tree whose labels include all the integers, including the negative integers. [3 marks]

(*d*) Present an ML function that accepts a lazy binary tree and produces a lazy list that contains all of the tree's labels. [9 marks]

All ML code must be explained clearly.