Foundations of Computer Science

(a) Explain in detail how a binary search tree represents a dictionary. If reference types are not used, what is the average-case cost of an update operation?  
[8 marks]

(b) A mutable binary tree is either a leaf or a branch node containing a label and references to two other mutable binary trees. Present the ML datatype declaration for mutable binary trees.  
[2 marks]

(c) Describe how to use this datatype to implement (mutable) binary search trees. Give ML code for the lookup and update operations. The update operation must never copy existing tree nodes.  
[10 marks]