1994 Paper 1 Question 8

Sets of distinct integers can be implemented in ML as values of type `set` declared below:

```
datatype set = Leaf | N of set * int * set;
```

Describe how you would use this data type to represent sets. [4 marks]

Give simple definitions for the following functions:

(a) `insert: int*set->set`
Returns a set containing the given integer as well as all the elements of the given set; [4 marks]

(b) `mkset: int list->set`
Creates a set containing all the integers from the given list; [3 marks]

(c) `mklist: set->int list`
Makes a list of all the integers present in the given set; [3 marks]

(d) `union: set*set->set`
Forms a set from all integers in the two arguments, avoiding the introduction of repeated entries; [3 marks]

(e) `select : set->int*set`
Returns an arbitrary integer from the set, and also the set with that item removed.
`select` should raise an exception if the given set is empty. [3 marks]

Your definitions should aim for simplicity and elegance rather than efficiency.