**1998 Paper 10 Question 6**

**Data Structures and Algorithms**

What is a *priority queue*? Explain the data structure known as a *heap* and describe how a heap can be implemented using a simple linear block of memory. Assuming that a heap implemented in this way stores $N$ items, describe how it can be viewed as an almost-balanced binary tree. What difference can there be between the greatest and least lengths of paths from the root of the tree to a leaf?    [5 marks]

Describe, and estimate the costs of, procedures to

(*a*)  find the parent and offspring of a given node;    [2 marks]

(*b*)  insert a new item into an existing heap;    [2 marks]

(*c*)  delete the topmost item from a non-empty heap;    [2 marks]

(*d*)  starting from an array holding $N$ items in arbitrary order, rearrange those items so that they form a heap, taking time less than that which would be needed if the items were just inserted into the heap one after the other.
    [4 marks]

A *stable* sorting method is one where items whose keys compare as equal will appear in the output in the same order that they appeared in the input list. Would a heap sort based on the algorithms you have documented be stable? Justify your answer.
    [5 marks]

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