1995 Paper 4 Question 5

Data Structures and Algorithms

What is a *priority queue*?   Explain the data structure known as a *heap* and document how a heap is stored in a simple linear block of memory.   [4 marks]

If a heap 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? What operations must be performed to move from one node in the tree to (*a*) its parent and (*b*) its offspring?   [5 marks]

Describe, and estimate the costs of, procedures to

(*a*) insert a new item into an existing heap;

(*b*) delete the topmost item from a non-empty heap;

(*c*) 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.
[6 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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