

1995 Paper 11 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]