1. Given an array of integers A = [a1, a2, . . ., an], suppose that

there exists an (unknown) index k such that the subarray [a1, a2, . . ., ak]

is sorted in strictly increasing order, and the subarray [ak, . . . , an]

is sorted in strictly decreasing order. Design an optimum algo-

rithm to solve this problem, and analyze its running time.

2) Consider the following variation of the Mergesort algorithm.

Instead of partitioning the input array into two roughly bal-

anced parts, we will partition it into m parts. Let

and let the m subarrays have the same size. The sorted subar-

rays are merged using a priority queue implemented as a binary

heap (hence, insertions and deletions are performed in logarith-

mic time, with respect to the size of the queue). Prove that the

running time of this variant is O(n log n log log n). [Hint: show

that the recursion tree has O(log log n) levels.]