

Fundamental Data structure ICE final 2008

All the analysis can be informal, ie. you can just explain in English why it works and why the running time is such and such.

1 Suppose that both arrays A and B are sorted and contain N elements. Write a pseudo code to find the median of (A union B) that runs in $O(\log N)$. You must also write down your running time analysis of your pseudo code (algorithm).

2 An array contains N numbers, and you want to determine whether two of the numbers sum to a given number K. For instance, if the input is 8,4,1,6 and K is 10, the answer is yes (4 and 6). A number may be used twice. Do the following

2.1 Give an $O(N^2)$ algorithm to solve this problem.

2.2 Give an $O(N \log N)$ algorithm to solve this problem. (Hint: sort the items first. After doing so, you can solve the problem in linear time.)

Write down your pseudo code and its running time analysis.

3 Two trees, T1 and T2 are isomorphic if T1 can be transformed into T2 by swapping left and right children of (some of the) nodes in T1. For example, the two trees in Figure are isomorphic because they are the same if the children of A, B, and G, but not the other nodes, are swapped. Write a pseudo code to decide if two trees are isomorphic that runs in a polynomial time. You must write down the running time analysis of your algorithm.

