

Design and Analysis of Algorithms

Quiz 2

Oct 4, 2004

1. State whether the following are true or false. You *must* justify your answers to receive credit.
 - (a) [10] Sorting 6 elements with a comparison-based sorting algorithm requires at least 10 comparisons in the worst case.
 - (b) [10] The sum of the smallest \sqrt{n} elements in an unsorted array of n distinct elements can be found in $O(n)$ time.
 - (c) [10] Insertion in a binary tree is “commutative”. That is, inserting x and then y into a binary search tree leaves the same tree as inserting y and then x .
 - (d) [10] A red-black tree on 128 keys must have at least one red node.
 - (e) [10] n integers each of value less than n^{100} can be sorted in linear time.
2. [25] Give the contents of the hash table that results when you insert items with the keys E, A, S, Y, Q, U, T, I, O, N in that order into an initially empty table of $M = 5$ lists using chaining. Use the hash function $h(k) = 11k \bmod M$ to transform the k th letter of the alphabet into a table index. For example, the hash function $h(B) = 2 * 11 \bmod 5 = 4$ because B is the second letter of the alphabet.
3. [25] Illustrate the operation BUILD-MAX-HEAP on the array [51 57 37 85 73 31 43 7 39 97]. Show each step.