Istanbul Technical University **November 3, 2006**
Electrical and Electronics Faculty
Dept. of Computer Engineering Department
Advanced Data Structures - BLG341E
Midterm Examination
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Duration: 120 minutes. Books and notes are closed. Good Luck!

Questions

Q1) [30 points] Solve the given recurrences and determine good asymptotic bounds. You may use any of the methods we covered in the class.

$$T(n) = 4T(n/4) + n$$

$$T(n) = T(n-1) + \frac{1}{n}$$

Q2) [20 points] Consider the problem of sorting the following (key, satellite data) pairs: C={(3,Ankara), (345,Istanbul), (32,Antalya), (345,İzmir), (890,Tokat), (32,Sivas), (232,Trabzon)} according to increasing key values.

a) [10 points] Illustrate sorting of C using radix sort.

b) [10 points] Illustrate sorting of C using bucket sort?

Q3) [20 points] Chaining is a method for collision resolution in hash tables. Assume that the chaining algorithm is modified so that the lists are kept in sorted order with respect to the key values. Noting that chaining algorithm in the conventional sense crates the chain by simply inserting the new key to the end of the relevant chain, how does such a change affects the running time for successful and unsuccessful search, as well as for deletion and insertion operations?

Q4) [10 points] 1. Discuss whether the operation of deletion is commutative in the sense that deleting x and then y from a binary search tree leaves the same tree as deleting y and then x?

Q5) [20 points] Counting sort assumes that each of the n input elements is an integer in the range 0 to k, for some integer k . When k=O(n) the sort runs in Θ(n) time. If we relax the assumptions as follows:

a) the range of intergers is only limited by the number of bits to represent a signed integer, and

b) the minimum and the maximum values of the given set of n inputs is unknown

is it possible to modify counting sort algorithm so that it still runs in Θ(n) time? Discuss your answer.