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27 May 2008

Proseminar Algorithmen und Datenstrukturen

Exercise Sheet 9

Exercise 1 (AVL)

a) Give AVL trees of height h ($h = 0, \ldots, 4$) with minimal number of nodes.

b) Give a construction that for any height h yields an AVL tree T_h with minimal number of nodes. Argue that your construction indeed yields a tree where the number of nodes is minimal.

c) Give a closed form for the number N_h of nodes in T_h. Hint: from your construction, derive a recursive definition of N_h. Then expree N_h in terms of the Fibonnacci sequence F_i.

Exercise 2 (Bucket sort)

a) Give the pseudo code for the bucket sort algorithm data structure and useful operations. You will consider numbers having k digits or less, digit values $\in 0, \ldots, b-1$.

b) Give the pseudo code for a recursive bucket sort algorithm. You will start to sort the most significant digit first.

c) How many buckets does your algorithm store simultaneously at a given time? Is it possible to do better? Explain how.

Exercise 3 (Insertion and Selection algorithms)

a) Implement in C the insertion and selection sorting algorithms. Develop a user interface in order to select the size and randomly generate values for an array, print the array, check if the array is ordered and order the array using one of the algorithms.

b) Stable algorithms does not change relative position of elements with equal values. Are the selection and insertion algorithms stable ?