Algorithms – CS-27200/37000 Homework – February 13, 2004

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ADVICE. Take advantage of the TA's office hours Monday, Tuesday and Thursday 5–6pm in the Theory lounge (Ry–162).

DATES TO REMEMBER. Mon Feb 23: Quiz 2; Mon Mar 8: Midterm 2.

14.1 (U,G) (8 points) Modify the AVL-tree data structure to support the RANGESUM(α, β) request (in addition to the requests it already supports: FIND(key), INSERT(key), DELETE(node)).

On input (α, β) (reals), RANGESUM(α, β) must output the sum of all those currently stored keys x satisfying $\alpha \leq x < \beta$. Each request, including RANGESUM, should be served in $O(\log n)$ steps, where n is the number of currently stored keys. (One step is an arithemtic operation, comparison, or pointer operation.)

Concentrate on the *additional information* you need to store and maintain at each node. Give an accurate description of this information and its location, and state how it is maintained under INSERT and DELETE. Finally, describe and *prove* that this additional information allows RANGESUM requests to be served in $O(\log n)$ steps.