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CSCE 500 Midterm Exam #2

11/4/2020

(1) A binary search tree (T) is to be maintained following the in-order tree traversal order. Consider a sequence of arrival keys, {32, 27, 23, 42, 14, 25, 33, 34, 37, 28, 30, 31}, to T which is empty initially.

(a) Show the resulting T after inserting all arrival keys. (8%)

(b) Show the resulting T after its root node is then deleted. (4%)

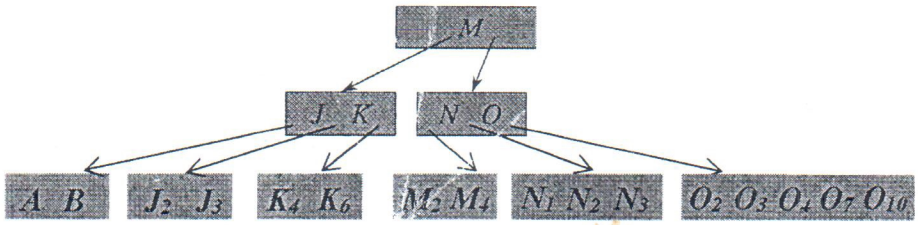
(c) Show the resulting T after deleting node with key of 27 from T obtained by (2) above. (4%)

(2) For a node in a binary search tree (T), how do you find its predecessor? its successor? (8%)

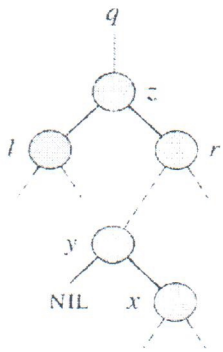
(3) For any n-key B-tree of height h and with the minimum node degree of $t \geq 2$, show that h is no larger than $\log_t \frac{n+1}{2}$. (Hint: consider the number of keys stored in each tree level.) (16%)

(4) For a given B-tree of height h and with the minimum node degree of $t \geq 2$, what is the maximum number of keys held in such a B-tree? (12%)

(5) Given the initial B-tree with the minimum node degree of $t = 3$ below, show the results (a) after deleting the key of M_2, (b) followed by inserting the key of L, (c) then by deleting the key of J_2, (d) then by inserting the key of O_5, with $O_4 < O_5 < O_7$, and (e) then by deleting K. (Show the result after each deletion and after each insertion; 20%)

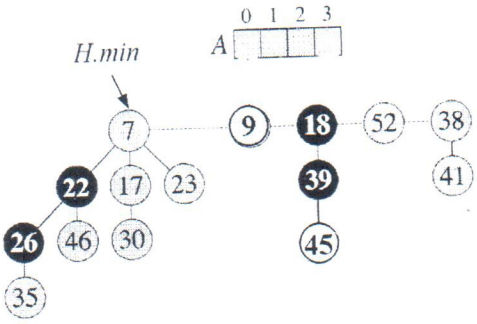


(6) When the root of a binary subtree, z, is deleted, as depicted below, show the resulting subtree. (8%)



(7) A Fibonacci min-heap relies on the procedure of CONSOLIDATE to merge trees in the root list upon the operation of extracting the minimum node. Show steps involved and the resulting heap after *H.min* is extracted form the Fibonacci min-heap given below. (16%)

After consolidation is completed, show the resulting Fibonacci min-heap with key '46' decreased to 20. (4%)



Good Luck!