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Question Paper Code : 61205

M.E./M.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

First Semester

Computer Science and Engineering

CS 9212/CS 912 – DATA STRUCTURES AND ALGORITHMS

(Common to M.Tech. Information Technology and M.Tech. Information and Communication Technology)

(Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare the order of growth of $f(n) = 3n$ and $g(n) = 2n$.

2. Differentiate NP-hard and NP-Complete problems.

3. Determine the null path length for each node for the heap in Fig.1 and state whether it is leftist.

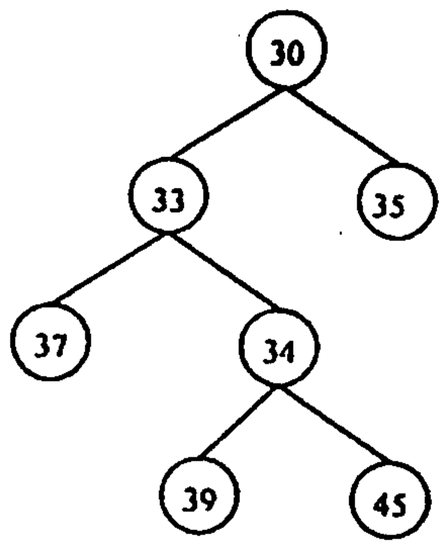

Fig. 1

4. A d-ary heap is like a binary heap, but (with one possible exception) non-leaf nodes have d children instead of 2 children. In array representation, give the position of all the children of a node at the location i.

5. Consider the BST in Fig. 2 and show the tree after splaying at node 4.

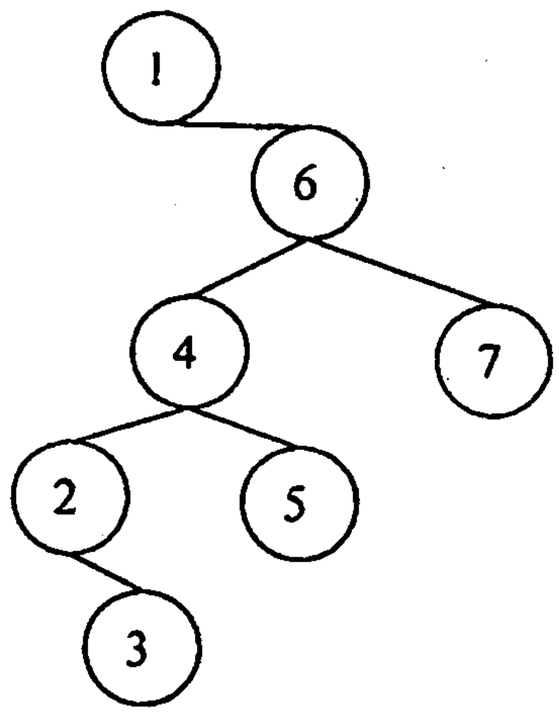

Fig. 2

6. Construct a trie structure for the following set of input words apple, automatic, autograph, bat, begin and batch.

7. How choices are made at each step by a greedy algorithm?

8. State convex hull problem.

9. What are multistage graphs? State multistage graph problem.

10. Give the outline to solve knapsack problem using backtracking.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Write the recursive algorithm to find factorial of a given integer. Identify the basic operation in it and give the recurrence relation of the algorithm. Determine the complexity of the algorithm by solving the recurrence relation.

Or

(b) Define amortized analysis. How does it differ from average case analysis? Perform suitable amortized cost analysis for the following stack and show that the cost of n stack operations, including copying the stack is $O(n)$. The operations of the stack are push, pop and copy. Any sequence of stack operation may be performed on the stack whose size never exceeds k. After k operations, a copy of the entire stack is made for backup purposes.

12. (a) Prim's algorithm is a greedy algorithm to determine the minimum spanning tree for a given graph. The algorithm always chooses an edge with minimum weight and tries to form the tree. Suggest a suitable data structure that could be used to efficiently solve this problem. Describe the operations of the ADT with their time complexity.

Or

(b) Consider the binomial heap in Fig. 3, insert the value 27 and then extract minimum value from it.

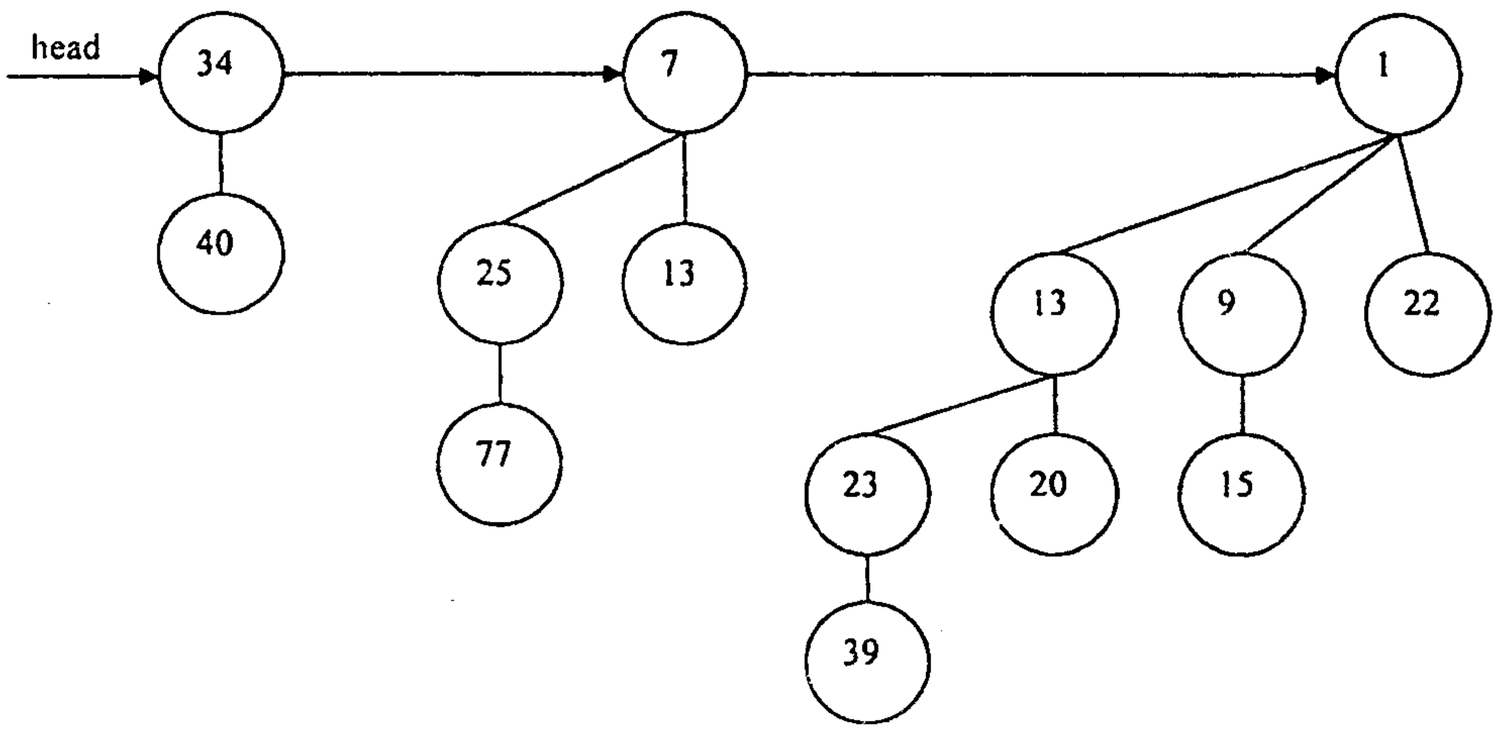

Fig. 3

13. (a) What are AVL trees? Describe the different rotations defined for AVL tree. Insert the following elements step by step in sequence into an empty AVL tree 15, 18, 20, 21, 28, 23, 30, 26.

Or

(b) Describe the insert and delete procedure for red-black trees and insert the value 9 into the tree shown in Fig. 4.

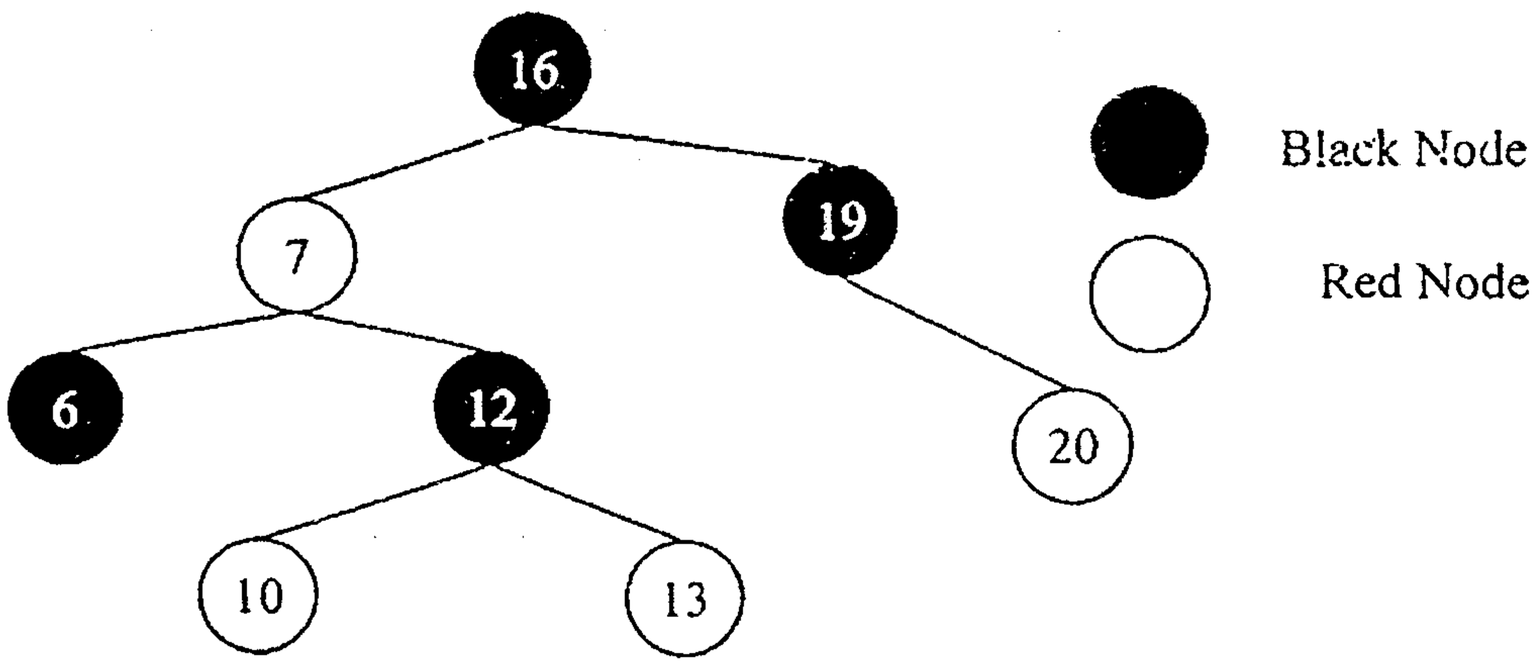

Fig. 4

14. (a) Write the quicksort algorithm (divide and conquer strategy). Discuss the efficiency of the algorithm for all the three cases (best case, worst case, and average case).

Or

(b) Write Strassen's Multiplication algorithm (divide and conquer strategy) and evaluate the asymptotic efficiency of the algorithm.

15. (a) Explain how backtracking can be used to solve 8-queens problem? Draw the state-space tree for solving it. Mark the successful and unsuccessful attempts in it.

Or

(b) Explain the algorithm using dynamic programming to solve 0/1 knapsack problem. State the complexity of the algorithm.
