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Reg. No. : .....

Name : .....

Seventh Semester B.Tech. Degree Examination, November 2013
(2008 Scheme)
08.702 : DESIGN AND ANALYSIS OF ALGORITHMS (R)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. What is the difference between Big oh (O) and Little oh (o) notations ?
2. Show that, the array representation for storing an n-element heap, the leaves are the nodes indexed by $\lfloor n/2 \rfloor + 1, \lfloor n/2 \rfloor, \ldots, n$.
3. Suppose we are comparing implementations of insertion sort and merge sort on the same machine. For inputs of size n, insertion sort runs in $8\,n^2$ steps, while merge sort runs in 64 n log n steps. For which values of n does insertion sort beat merge sort ?
4. What is meant by order of growth ?
5. What is the largest possible number of internal nodes in a red-black tree with black-height k ? What is the smallest possible number ?
6. Explain B-tree search algorithm.
7. Discuss a data structure used for implementing disjoint sets.
8. Explain branch and bound technique.
9. Define P, NP and NP complete classes.
10. Compare divide-and-conquer and dynamic programming strategies.

(10×4=40 Marks)

P.T.O.

PART – B

Answer **one full** question from **each** Module.

Module – I

11. a) The operation Heap-Delete (A, i) deletes the item in node i from heap A. Give an implementation of Heap-Delete that runs in O (log n) time for an n-element max-heap.

    b) State Master method for solving recurrences. Can master method be applied to the recurrence $T(n) = 4\,T(n/2) + n^2 \log n$?

OR

12. a) Solve the following recurrences :

    i) $T(n) = 3T(\lceil N/2 \rceil) + n$

    ii) $T(n) = 2T(\sqrt{n}) + 1$.

    b) Write the recursive version of insertion sort, which can be expressed as follows : In order to sort A [1..n], we recursively sort A [1.. n –1] and then insert A[n] into the sorted array A [1..n –1]. Write and solve the recurrence for the running time of this version of insertion sort.

Module – II

13. a) i) Explain topological sort algorithm with example.

    ii) Give a simple example of a directed graph with negative-weight edges for which Dijkstra's algorithm produces incorrect answers.

    b) Show the red-black trees that result after successively inserting the keys 41, 38, 12, 19, 8 into an initially empty red-black tree. Then delete the keys 19 and 41.

OR

14. a) Explain Kruskal's algorithms and analyse the running time.

    b) Show the results of inserting the keys F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B in order into an empty B-tree with minimum degree 2. Then delete the nodes C, T, R in order.

Module – III

15. a) Explain 8-queens problem. How back tracking technique can be used to solve the problem ?

    b) Explain Strassen's matrix multiplication algorithm. Use this algorithm to compute the matrix product $\begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix}\begin{pmatrix} 8 & 4 \\ 6 & 2 \end{pmatrix}$.

OR

16. a) Explain how dynamic programming technique can be used to solve matrix-chain multiplication problem. Find the optimal parenthesization of a matrix - chain product whose sequence of dimensions is $< 5,10, 3, 12, 5, 50 >$.

    b) i) Explain any two NP-complete problems.

    ii) Prove that if any NP-complete problem is polynomial time solvable, then P= NP.

(3×20=60 Marks)