B.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Third Semester

COMPUTER SCIENCE AND ENGINEERING

U07CS301: Design and Analysis of Algorithms

Time: Three hours   **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. If t(I) is the time for processing of the problem instance I of size n, the worst case complexity for problems of size n is

    A) min of t(I)   B) max of t(I)   C) always 1   D) always 0

2. Ω notation is used to denote the ------------- bound that is asymptotically --------------

    A) lower, tight   B) lower, not tight   C) upper, tight   D) upper, not tight

3. The Worst case running time of merge sort is

    A) $\theta(n \log n)$ B) $\theta(n^2)$ C) $\theta(\log n)$ D) $\theta(n)$

4. If $f(n)=10n^2+4n+2$. What is $O(f(n))$?

    A) 1   B) n   C) n^2 D) n^3

5. Which of the following describes the Quicksort method?

    (i) does not always decompose the array into 2 equal subranges

    (ii) slicing the array into 2 equal halves and sort the halves separately

    (iii) running time is O(n log n)

    A) (i), (ii) & (iii)   B) (iii)   C) (ii) &(iii)   D) (i) & (iii)

6. In ------------ method solution is found without expanding all its competing branches

    A) DFS   B) BFS   C) Best FS   D) Gradient search

7. "In an optimal sequence of decisions, each sub-sequences are also optimal" This Statement best describes

    A) Dynamic programming   B) Greedy method

    C) Branch and Bound   D) Divide and Conquer

8. Which of the following is/are not true about Prim's algorithm?

    (i) It is based on Divide and Conquer method

    (ii) Minimum spanning tree grows starting from the arbitrary root

    (iii) Worst case running time = $O(n^2)$

    A) (i)   B) (i) & (ii)   C) (ii) & (iii)   D) (iii)

9. Which of the following is(are) correct about bounding functions?

    (i) They are used to help avoid the generation of subtrees that do not contain answer nodes

    (ii) They are used to kill live nodes without generating all their children

    A) (ii) is true (i) is false   B) (i) is true (ii) is false   C) Both are true   D) Both

10. A live node in a state space tree is

    (i) a node whose children are not yet generated

    (ii) all of whose children nodes are generated

    (iii) exactly the leaf node

    A) only (ii) is true   B) only (i) is true   C) both(ii) & (iii) are true   D) all an

PART B (10 x 2 = 20 Marks)

11. Define O and θ notation

12. Write the recurrence relation for binary search algorithm.

13. Write down the algorithm for Fibonacci series.

14. How will you decide the quality of an algorithm?

15. Describe merge sort using divide and conquer method.

16. Give the algorithm for Breadth First Search

17. Write the balance factor of AVL Trees.

18. Define Principle of Optimality.

19. Define a) E-node b) live node of a tree.

20. Briefly describe the method of backtracking

PART C (5 x 14 = 70 Marks)

21. (a) Solve the following recurrence relation assuming N as an integer power of 2.

      $T(N) = 4T(N/2) + N$, $N >= 2$ and

      $T(N) = 1$, $N=1$

(OR)

(b) Write an algorithm to find the maximum and minimum element in a given set of elements. Analyse the time complexity.

22. (a) i) What are the possible ways to find the asymptotic efficiency of algorithms? (7)

      ii) Devise a binary search algorithm that splits the set not into 2 equal sets but one set is twice the size of the other. Find the time complexity of the algorithm. (7)

(OR)

(b) i) Write an algorithm to find the kth smallest element in a set. (7)

      ii) Write an algorithm to check whether every sequence of consecutive ones in a one dimensional boolean array is even. Determine the time complexity as well. (7)

23. (a) Write the algorithm for Quick sort and illustrate it with the following 8 elements 36, 21, 70, 16, 4,0, 34, 81. Determine the time complexity of the algorithm

(OR)

(b) Write the algorithm for D-search which differs from BFS in such a way that the next vertex to explore is the vertex most recently added to the list of unexplored vertices. This list operates as a stack rather than a queue. Also find the ordering of vertices by D-search for the graph given in Fig: 1
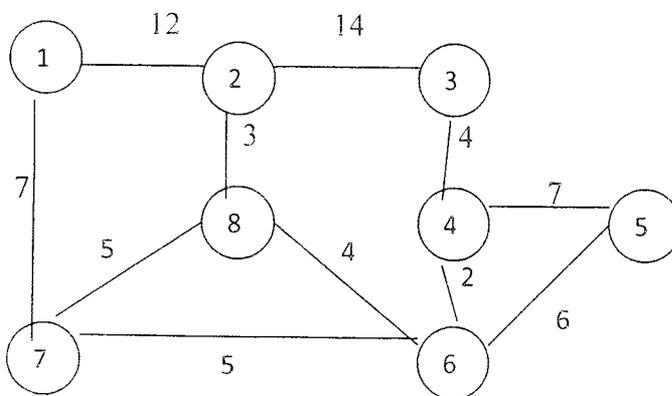

Fig: 1

24. (a) Illustrate how Greedy method can be used to find the minimum cost spanning tree.(use Fig:1 for illustration). Write the corresponding algorithm.

(OR)

(b) Construct an optimal binary search tree for the following, using dynamic programming. $N=(a1,....a4)$, $P(1:4)=(3,2,1,2)$ and $Q(0:4)=(1,2,3,1,1)$. Describe how the cost of the binary search tree is calculated.

25. (a) Consider the TSP instance defined by the cost matrix.

$$\begin{pmatrix} \infty & 7 & 3 & 12 & 8 \\ 5 & \infty & 8 & 6 & 18 \\ 6 & 14 & \infty & 8 & 9 \\ 7 & 5 & 6 & \infty & 11 \\ 5 & 6 & 3 & 14 & \infty \end{pmatrix}$$

(i) Obtain the reduced cost matrix.

(ii) Draw the state space tree generated by LCBB algorithm.

(OR)

(b) The sum of subsets problem is to find all combinations of the n given distinct numbe whose sum is M. Draw the state space tree for the problem with the numbe 7,5,12,18,20,8 and M=25. Describe how backtracking gives the solution.

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