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NATIONAL INSTITUTE OF TECHNOLOGY (KOYRAJHAR)

53 (CS 503) DAAL

2021

DESIGN AND ANALYSIS OF ALGORITHMS

Paper : CS 503

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

GROUP–A

***All** questions are mandatory.* 2×10=20

1. Define time complexity and space complexity.

2. When do we observe the worst case time complexity of a quick sort algorithm ?

3. What is the significance of a recurrence relation ?

Contd.

4. Compare Divide-and-Conquer strategy *vs* Dynamic Programming approach.

5. What do you mean by principle of optimality ?

6. What is a negative weight cycle ?

7. Define a state space tree.

8. What is the chromatic number of a graph ?

9. Define a Hamiltonian cycle.

10. State the Cook's theorem on NP-completeness.

GROUP–B

Answer ***any four.***

1. *(a)* What do you mean by asymptotic analysis of an algorithm ? Discuss the three basic asymptotic notations used for measuring the running time of an algorithm. 2+6=8

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(b) Solve the following recurrence relation : 6

$$T(n) = T(n-1) + n$$
$$T(1) = 1$$

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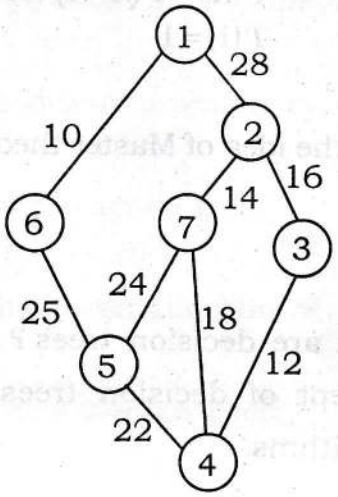
(c) Give the idea of Master theorem in brief. 6

2. (a) What are decision trees ? Explain the concept of decision trees for sorting algorithms. 2+5=7

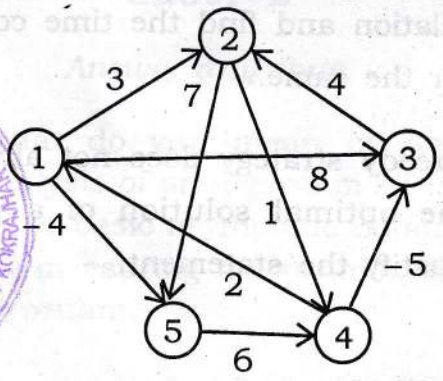
(b) Explain the working of Strassen's matrix multiplication with the help of an example. Derive its recurrence relation and find the time complexity for the same. 5+5=10

(c) Greedy strategy does not always give the optimal solution of a problem. Justify the statement. 3

3. *(a)* Give the pseudocode for Kruskal's algorithm and apply the same to find the minimum cost spanning tree for the graph shown below: 5+5=10



(b) Apply the Floyd-Warshall algorithm on the following graph to solve the "All pairs shortest path" problem using Dynamic Programming. 10



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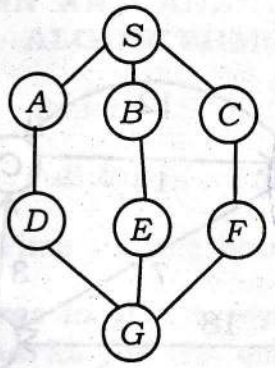
4. *(a)* State the differences between BFS and DFS. Apply BFS as well as DFS on the following graph and find out the sequence in which the vertices are traversed in both the cases: 4+6=10



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(b) Explain the concept of backtracking. Write the pseudocode for the recursive backtracking algorithm. 4+6=10

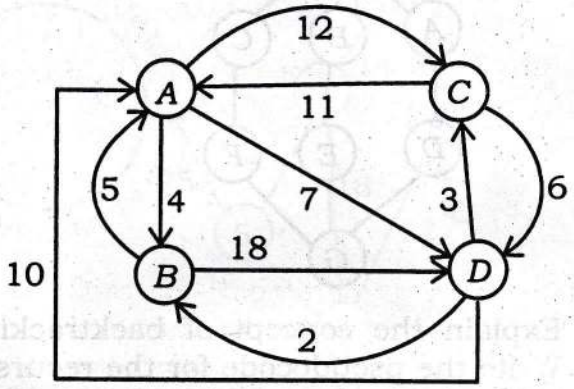
5. *(a)* Explain how backtracking can be used to solve the 4-queens problem. 6

(b) Briefly explain the concepts of P, NP, NP-Hard and NP-Complete problems. 8

(c) Write the non-deterministic algorithm for the knapsack decision problem. 6

6. *(a)* Discuss the different types of branch and bound strategies for solving a problem. 6

(b) Use LCBB to solve the following instance of the travelling salesperson problem. 14



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