Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 12097

M.E./M.Tech. DEGREE EXAMINATIONS, JANUARY 2022.

First Semester

Big Data Analytics

CP 4151 — ADVANCED DATA STRUCTURES AND ALGORITHMS

(Common to Biometrics and Cyber Security/Computer Science and Engineering/Computer Science and Engineering (With Specialization in Artificial Intelligence and Machine Learning/Computer Science and Engineering (With Specialization in Cyber Security)/Computer Science and Engineering (With Specialization in Networks)/Mobile and Pervasive Computing/Multimedia Technology/Software Engineering/Information Technology

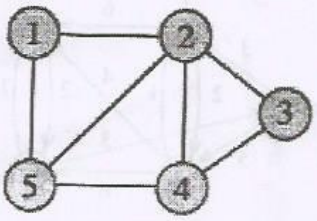
(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define time complexity of an algorithm.
2. What is recursion?
3. For the set of keys 1, 4, 5, 10, 16, 17, 21, draw a binary search tree of height 3.
4. List the properties of red-black trees.
5. Represent the following undirected graph using adjacency matrix.



6. Write the triangular inequality property of weighted graphs.

7. Write the sequence of steps followed in developing a dynamic programming algorithm.

8. What is a greedy algorithm?

9. What are NP-Complete problems? Give example.

10. Define Hamiltonian cycle. Give example.

PART B — (5 × 13 = 65 marks)

11. (a) Describe about the asymptotic notations used for algorithm analysis. Give example. (13)

Or

(b) Explain about the substitution method for solving recurrences with an example. (13)

12. (a) (i) Give recursive algorithms that perform preorder, inorder and postorder tree walks on a tree of n nodes. (8)

(ii) Write the Tree-Search algorithm for querying a binary search tree. (5)

Or

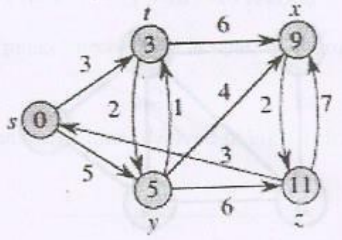
(b) (i) Outline the steps to construct a B-tree with an example. (6)

(ii) Outline the steps to construct a fibonacci heap with an example. (7)

13. (a) Outline the steps in breadth first search and depth first search traversal of a graph. (13)

Or

(b) Illustrate the steps in the Dijkstra's algorithm on the directed graph shown below using vertex 's' as the source. (13)



14. (a) (i) Give an $O(n^2)$-time algorithm to find the longest monotonically increasing subsequence of a sequence of n numbers. (8)

(ii) Determine an longest common subsequence of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$. (5)

Or

(b) (i) Describe the elements of greedy strategy. (5)

(ii) Prove that the fractional knapsack problem has the greedy-choice property. (8)

15. (a) Prove that if any NP-complete problem is polynomial-time solvable, then P = NP. Equivalently, if any problem in NP is not polynomial-time solvable, then no NP-complete problem is polynomial-time solvable. (13)

Or

(b) State the clique problem and show that solving a clique problem is NP-complete. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Suppose that we have a set of activities to schedule among a large number of lecture halls, where any activity can take place in any lecture hall. We wish to schedule all the activities using as few lecture halls as possible. Give an efficient greedy algorithm to determine which activity should use which lecture hall. (15)

Or

(b) Outline the steps in the Kruskal's algorithm to construct a minimum spanning tree with an example. (15)