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

Question Paper Code : 47114

M.E./M.Tech. DEGREE EXAMINATION, JANUARY 2018
First Semester
Bio Metrics and Cyber Security
CP 5151 – ADVANCED DATA STRUCTURES AND ALGORITHMS
(Common to M.E. Computer Science and Engineering/M.E. Computer Science and Engineering (With Specialization in Networks)/M.E. Multimedia Technology/ M.E. Software Engineering/M.Tech. Information Technology)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. List the important problems that are solved by algorithms.
2. When are the recursion trees useful ?
3. Write the binary-search-tree property.
4. Why don't we allow a minimum degree of t = 1 in B-trees ?
5. Give the advantages and disadvantages of graph representation.
6. State minimum spanning tree.
7. Identify the optimal substructure of longest-common-subsequence problem to be solved using dynamic programming.
8. What is activity-selection problem ?
9. List the key properties in showing a problem to be NP-Complete.
10. Define verification algorithms.

PART – B (5×13=65 Marks)

11. a) Write the advantages of divide-and-conquer design approach. How do you design a sorting algorithm using divide-and-conquer approach. (13)

(OR)

b) i) Explain why the statement, "The running time of algorithm A is atleast $O(n^2)$" is meaningless. (5)

ii) What is a recurrence ? List the methods for solving recurrence. Describe the steps involved in substitution method to solve recurrence. (2+2+4=8)

12. a) i) Write the procedure for deleting a given node z from a binary search tree. (6)

ii) Write pseudocode for RIGHT-ROTATE operation in red-black trees. (7)

(OR)

b) Show how do you decrease the key of a node in a Fibonacci heap in O(1) amortized time and how to delete any node from an n-node Fibonacci heap in O(D(n)) amortized time. (13)

13. a) Write an algorithm to compute strongly connected components using DFS and prove that the algorithm correctly computes the strongly connected components of a directed graph G. (13)

(OR)

b) Write an algorithm to multiply matrices using shortest path approach and show that the multiplication is association. (13)

14. a) Elucidate the two key ingredients that an optimization problem must have in order for dynamic programming to be applicable. (13)

(OR)

b) i) Discuss the general properties of Greedy method. (6)

ii) Illustrate the construction of a Huffman code using an example. (7)

15. a) Write a short note on :

i) Reducibility (6)

ii) Formal-language framework. (7)

(OR)

b) Prove that the circuit-satisfiability problem belongs to the class NP and also NP-Hard. (13)

PART – C (1×15=15 Marks)

16. a) i) For the set of keys {1, 4, 5, 10, 16, 17, 21}, draw binary search trees of height 2, 3, 4 and 5. (8)

ii) Give an algorithm that determines whether or not a given undirected graph G = (V, E) contains a cycle. Your algorithm should run in O(V) time, independent of $|E|$. (7)

(OR)

b) i) The salesman wishes to make a tour, or Hamiltonian cycle, visiting each city exactly once and finishing at the city he starts from. There is an integer cost c(i, j) to travel from city i to city j, and the salesman wishes to make the tour whose total cost is minimum, where the total cost is the sum of the individual costs along the edges of the tour. Prove that the travelling salesman problem is NP-complete. (8)

ii) Show that the Hamiltonian-path problem is NP-complete. (7)