

Roll No.

MCA–12/MSCIT–12

Design and Analysis of Algorithms

Third Semester, Examination, 2018

Time : 3 Hours

Max. Marks : 80

Note : This paper is of **eighty (80)** marks containing **three (03)** Sections A, B and C. Learner are required to attempt the questions contained in these Sections according to the detailed instructions given therein.

Section–A

(Long Answer Type Questions)

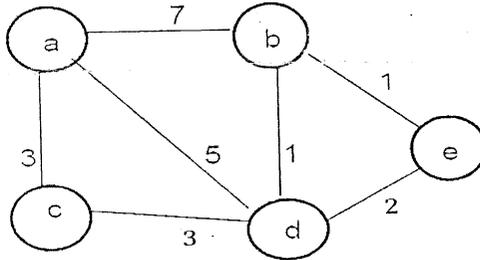
Note : Section ‘A’ contains four (04) long answer type questions of nineteen (19) marks each. Learners are required to answer *two* (02) questions only.

1. Answer the following :

- (a) What is an algorithm ? Explain. 3
- (b) What do you mean by analysis of an algorithm ? 4
- (c) Define complexity. How many classes does complexity have in context with algorithm ? Define each of them. 4
- (d) What are asymptotic notations ? Explain Big O, Big Theta and Big Omega notations. 8

(B-47) P. T. O.

2. What is minimum spanning tree ? Find the minimum spanning tree for the following graph using Prim's and Kruskal's algorithm :



3. Explain merge sort algorithm and find the complexity of the algorithm.
4. Answer the following :
- Write algorithm for single source shortest path.
 - Solve 4-queen's problem using backtracking method.

Section-B

(Short Answer Type Questions)

Note : Section 'B' contains eight (08) short answer type questions of eight (08) marks each. Learners are required to answer *four* (04) questions only.

1. Answer the following :
- Prove that :

$$3n^3 + 2n^2 + 4n + 3 = \Omega(n^3)$$

- Prove that :

$$3n^5 - 7n + 4 = \theta(n^5)$$

2. Sort the following elements using heap sort algorithm :
- 17, 19, 13, 16, 12, 9, 14, 18, 6, 15, 22, 27, 8

3. Answer the following :
 - (a) Explain the methodology of divide and conquer algorithm.
 - (b) Apply divide and conquer algorithm for binary search using an example.
4. Answer the following :
 - (a) What is optimal substructure for 0 – 1 Knapsack and fractional Knapsack problem ?
 - (b) State Cook's theorem.
5. Explain 8-queen's problem.
6. Write short notes on the following :
 - (a) Deterministic algorithm
 - (b) Non-deterministic algorithm
7. Define Greedy algorithms. Explain any *two* characteristics of Greedy algorithms.
8. Answer the following :
 - (a) What is AVL tree ? Explain.
 - (b) What are the characteristics of dynamic programming ?

Section-C

(Objective Type Questions)

Note : Section 'C' contains ten (10) objective type questions of one (1) mark each. All the questions of this Section are compulsory.

1. The worst-case time complexity of Merge Sort is
 - (a) $O(n^2)$

- (b) $O(\log n)$
 - (c) $O(n)$
 - (d) $O(n \log n)$
2. Two main measures for the efficiency of an algorithm are :
- (a) Processor and memory
 - (b) Complexity and capacity
 - (c) Time and space
 - (d) Data and space
3. The space factor when determining the efficiency of algorithm is measured by :
- (a) Counting the maximum memory needed by the algorithm
 - (b) Counting the minimum memory needed by the algorithm
 - (c) Counting the average memory needed by the algorithm
 - (d) Counting the maximum disk space needed by the algorithm
4. Which of the following case does not exist in complexity theory ?
- (a) Best case
 - (b) Worst case
 - (c) Average case
 - (d) Null case

5. The concept of order Big O is important because :
- (a) It can be used to decide the best algorithm that solves a given problem
 - (b) It determines the maximum size of a problem that can be solved in a given amount of time
 - (c) It is the lower bound of the growth rate of algorithm
 - (d) Both (a) and (b)
6. Which of the following sorting methods would be most suitable for sorting a list which is almost sorted ?
- (a) Bubble sort
 - (b) Insertion sort
 - (c) Selection sort
 - (d) Quick sort
7. The Knapsack problem where the objective function is to minimize the profit is
- (a) Greedy
 - (b) Dynamic 0/1
 - (c) Backtracking
 - (d) Branch and Bound 0/1
8. What is the type of the algorithm used in solving the 8 Queen's problem ?
- (a) Greedy
 - (b) Dynamic
 - (c) Branch and Bound
 - (d) Backtracking

9. An algorithm that calls itself directly *or* indirectly is known as :
- (a) Subalgorithm
 - (b) Recursion
 - (c) Polish notation
 - (d) Traversal algorithm
10. An all-pairs shortest-paths problem is efficiently solved using :
- (a) Dijkstra's algorithm
 - (b) Bellman-Ford' algorithm
 - (c) Kruskal's algorithm
 - (d) Floyd-Warshall's algorithm