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 :

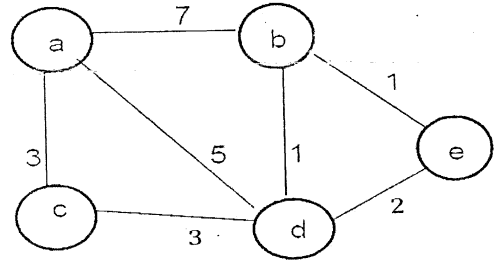
   (a) What is an algorithm ? Explain. 3

   (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

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 :
   (a) Write algorithm for single source shortest path.
   (b) 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 :
   (a) Prove that :

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

   (b) 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 effciently solved using :

   (a) Dijkstra's algorithm

   (b) Bellman-Ford' algorithm

   (c) Kruskal's algorithm

   (d) Floyd-Warshall's algorithm