2022

COMPUTER SCIENCE — HONOURS

Paper : CC-9

(Introduction to Algorithms and Its Applications)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***question no.*** **1** and ***any four*** questions from the rest.

1. Answer ***any five*** questions : 2×5

   (a) Assume that there are two algorithms A and B for a given problem P.

   The time complexities of the functions of A and B are $2n$ and 2^n respectively. Which algorithm should be selected, keeping all other conditions same for A and B? Why?

   (b) Write the recursive algorithm to find the n^{th} term of Fibonacci series.

   (c) Define NP problem.

   (d) What do you mean by space complexity of an algorithm?

   (e) What is the difference between BFS and DFS algorithms based on the data structure used?

   (f) State the difference between Dijkstra's and Floyd's algorithms.

   (g) Define θ. Illustrate with the help of a diagram.

   (h) How would you measure the growth of a function? Explain with an example.

2. (a) You are given a Polynomial function

   $$f(x) = 19x^3 + 15x^2 + 98x + 65$$

   Express the above function in terms of Asymptotic Big-O notation.

   (b) Arrange the following functions in ascending order in terms of the growth of the functions given below :

   n^2; n; $\log(n)$; e^n;

   (c) Apply divide and conquer strategy to find the maximum elements of the following array

   A = {13, 14, 16, 20, 8, 4, 7, 5}. Show steps clearly. 5+2+3

3. (a) Briefly state the chain matrix multiplication problem.

(b) Apply dynamic programming approach to find the following matrix chain multiplication $A_1A_2A_3A_4$.

Matrix	Dimension
A_1	5×4
A_2	4×6
A_3	6×2
A_4	2×7

3+7

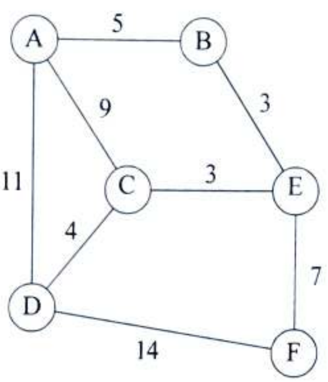
4. (a) State the salient features of a recursive algorithm.

(b) 'The limitation of a greedy algorithm approach is that it does not always lead to a global optimal solution.' Justify this statement by means of an example or illustration.

(c) Differentiate between fractional Knapsack and 0/1 Knapsack problem with an example. 3+4+3

5. (a) Compare between the Greedy approach and Dynamic progamming approach.

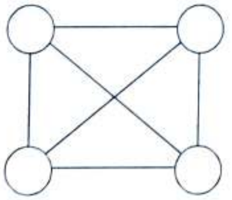
(b) Apply Floyd's algorithm to the following graph G. Show all the steps.



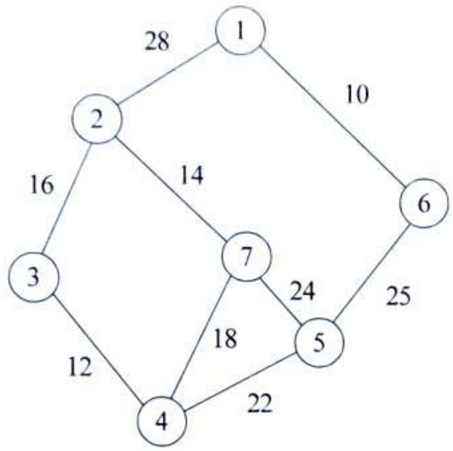
3+7

6. (a) Define a spanning tree.

(b) Find the spanning trees of the following undirected graph.



(c) Use Prim's algorithm to find the minimum spanning tree of the following graph using Greedy method. Show all the steps.



2+2+6

7. (a) Write an algorithm for Quicksort that sorts the elements of an array a[1..n] in descending order using Divide and Conquer strategy.

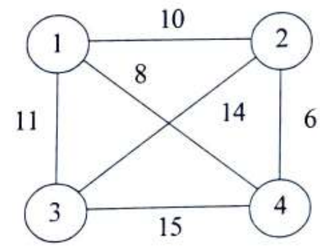
(b) Find the best case and worse case time complexities for the algorithm written above. 6+4

8. (a) Briefly state the graph colouring problem with an example.

(b) Solve the following Travelling Salesman Problem (TSP) using Dynamic approach.

There are four cities 1, 2, 3 and 4. Start from city 1 and visit all the cities.

The complete, undirected, weighted graph G is given below.



3+7