

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.

(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

$$A = \{13, 14, 16, 20, 8, 4, 7, 5\}. \text{ Show steps clearly.}$$

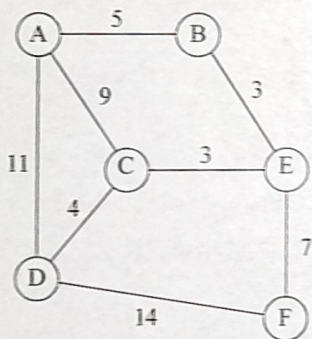
5+2+3

Please Turn Over

15. (a) Briefly state the chain matrix multiplication problem.
 (b) Apply dynamic programming approach to find the following matrix chain multiplication $A_1A_2A_3A_4$.

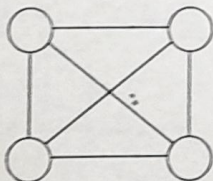
Matrix	Dimension	
A_1	5×4	
A_2	4×6	
A_3	6×2	
A_4	2×7	3+7

16. (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
17. (a) Compare between the Greedy approach and Dynamic programming approach.
 (b) Apply Floyd's algorithm to the following graph G. Show all the steps.



3+7

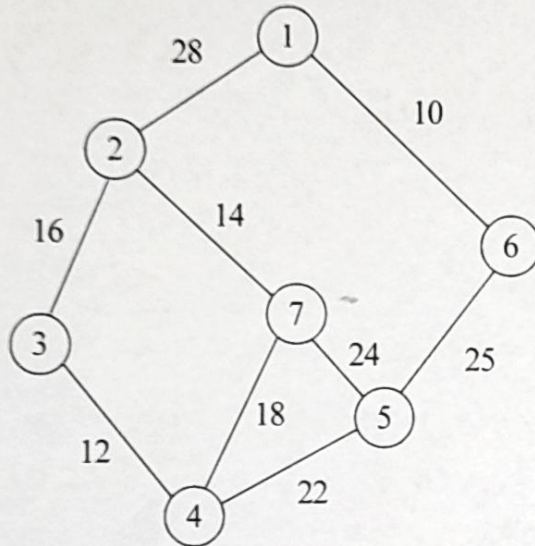
18. (a) Define a spanning tree.
 (b) Find the spanning trees of the following undirected graph.



(3)

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(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.

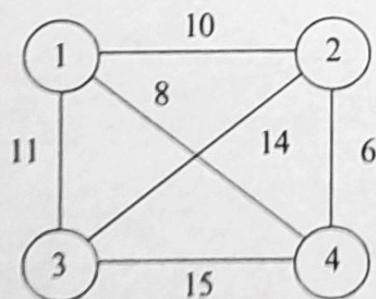
(b) Find the best case and worse case time complexities for the algorithm written above. 6+4

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