NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

II YEAR B.TECH , SEMESTER EXAMINATION

CSPE43 ADVANCED DATA STRUCTURES AND ALGORITHMS

DATE: 12-05-2023 **Duration: 3 Hrs** **Max Marks: 50**

CO Mapping

CO1	Apply the appropriate heap data structure for solving real-world problems	1
CO2	Use special tree data structures for a given real-world problem	2
CO3	Decide on appropriate string matching algorithms for solving practical problems	4
CO4	Appreciate the backtracking and branch and bound technique to solving NP problems	3, 5

1. **(a)** Construct the Fibonacci heap with the following elements in the same order. From the resultant tree, remove the first four smallest elements. **1, 4, 7, 10, 17, 21, 31, 25, 42, 20, 43 and 48** **(4)**

   (b) Assume that in a Deap, the left subtree is a max heap and the right subtree is a min heap. With an appropriate correspondence property, construct the deap for the following numbers:

   -1, 4, 5, 7, 9, 11, 13, 8, 50, 70, 100, 20 and 4. **(5)**

2. **(a)** Construct the B+tree of order 3 with the elements given in Q.No 1 (a). From the resultant tree, remove the first four elements in the same order. **(4)**

   (b) Construct the Quad tree with the data points **A: (2, 2), B: (4, 2), C: (5, 6), D: (7, 4), E: (9, 7), F: (8, 1), G: (10, 2), H: (11, 6), I: (13, 4) and J: (14, 8).** **(4)**

   (c) How do you find the nearest neighbours using KD tree? Illustrate the steps with the suitable example. **(3)**

3. **(a)** Ajay is getting ready for the exam in four subjects (A, B, C, and D). The values along the edges of the graph shown in Fig. 1, which contains these subjects as its vertices, indicate how much time he has to spend. He needs to devote more time for the preparation in order to receive good grades. He wants to start the preparation with the subject A. What should be the order of subjects that he has to follow to score good marks. **(5)**

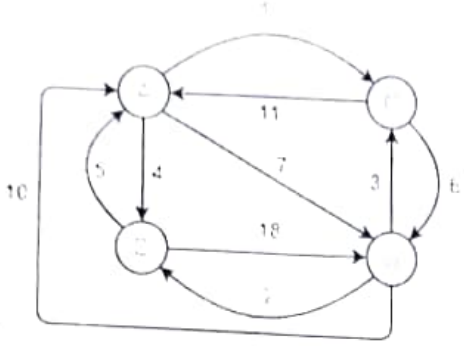

Fig. 1

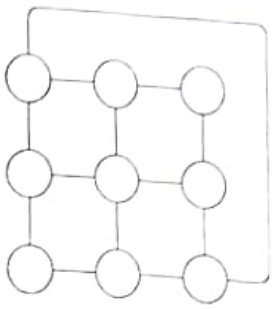

Fig. 2

(b) Find the chromatic number for the graph shown in Fig 2 using backtracking algorithm. (4)

4. (a) Construct the LPS table for the pattern **aabaabaaabaaab.** (3)

(b) Apply the Rabin karp algorithm to find the pattern **bat** in the given string **batmanandrobinarebat**. Use your own rolling hash function and also ensure that your hash function minimizes the spurious hits during the matching process. (4)

(c) Apply the Boyer moore algorithm to find the pattern **AABA** in the given string **AABAACAADAABAABA.** (3)

5. (a) Is it possible to prove NP- completeness of 0/1 knapsack problem using satisfiability problem? Justify your answer with the suitable example. (4)

(b) With an example, prove the NP completeness of clique problem using vertex cover problem. (4)

(c) Consider the data points given in the following plot. The convex hull for these data points must be predicted using Graham scan algorithm. During this entire process, how many times the stack is popped out? What are the data points are in the stack at the end of the process? (3)