

**National Institute of Technology Kurukshetra**  
**Advanced Data Structures and Algorithms(ITPC-45)**  
**End Semester**

**Duration: 2 hours**

**M.M: 50**

**Date: 27/11/2021(10am Onwards)**

**Note: All questions are compulsory.** Assume suitable missing data, if any.

**Note: All questions are compulsory and there is no step marking.**

I	What is Red Black tree? Write down the insertion algorithm of Red black tree and insert the following elements: 35, 29, 17, 44, 55, 67, 3, 2, 114, 55, 15, 28, 88, and 41. Draw the figures depicting your tree immediately after insertion and label all nodes with their color and identify the rotation type. Note: R- Red Color Node B- Black Color Node	8
II	a) Write down the decrease key procedure in Fibonacci heaps with example and explain why the BINOMIAL-HEAP-MINIMUM procedure might not work correctly if keys can have the value $\infty$ . Rewrite the pseudo code to make it work correctly in such cases.  b) Suppose we have two binomial Heaps H1 and H2. H1 comprises of three Binomial trees of degree 0, 1 and 2. Similarly, H2 comprises of three Binomial Trees of degree 0, 1 and 4, respectively. Perform the Union operation on the given Heaps to form a new Heap H.	8  4
III	Answer the following questions relating to string matching algorithms: i. Discuss various types of string matching algorithm. ii. Discuss which one the best algorithm for string is matching. iii. Explain the basic concept of Rabin Karp algorithms. Can we use Rabin- Karp algorithm for discovering plagiarism in a sentence or not? Now, in the example given a pattern of length- 5 window, find the spurious hit in the given text string by step by step procedure. Pattern: 3 1 4 1 5 Modulus: 13 Index: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Text: 2 3 5 9 0 2 3 1 4 1 5 2 6 7 3 9 9 2 1 3 9	10
IV	a)Write short note on the following:  i) 3-CNF SAT with example ii) Las Vegas  b) Explain P, NP, and NP-Hard in decision problems.	8     4

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V	Solve and explain the TSP problem with Dynamic Programming for given cost matrix.	8																									
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