

Roll No.

Total No. of Pages : 02

Total No. of Questions : 08

M.Tech. (CSE Engg.) ( 2018 Batch) (Sem.-1)  
**ADVANCED DATA STRUCTURES**  
Subject Code : MTCS-102-18  
M.Code : 75154

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. Attempt any FIVE questions out of EIGHT questions.

2. Each question carries TWELVE marks.

1. a) Suppose you have a hash table of size 19, the keys are words, and the hash map is defined as follows : Each letter is assigned a number according to its position in the alphabet, i.e.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

and the primary hash function is “ $x$  modulo 19”, where  $x$  is the number corresponding to the first letter of the word. Why is this hash function not ideal?

- b) Suppose instead you have a hash table of size 13 and the primary hash function is “ $x$  modulo 13”, where  $x$  is the sum of the numbers corresponding to all the letters in the key word. Insert the following list of words into an initially empty hash table using linear probing:

[computer, science, in, birmingham, dates, back, to, the, sixties]

- c) What is the load factor of the resulting table, and how many collisions occurred?
- d) What is the effort (i.e. number of comparisons) involved in checking whether each of the following words are in the hash table: teaching, research, admin?
- e) Show what the resulting hash table would look like if direct chaining had been used rather than linear probing.

2.
  - a) Draw the binary search tree that results from inserting the items [19, 30, 36, 10, 40, 25, 33] in that order into an initially empty tree.
  - b) Show how the tree rotation approach can be used to balance that tree?
  - c) Draw tree that results from deleting the item 30 from your balanced tree using the delete algorithm.
3. Let  $S, T_1, T_2$  be strings of lengths  $n, m_1, m_2$  with  $m_1 + m_2 \leq n$ . Your task is to locate whether the pattern  $T_1 * T_2$  (that is,  $T_1$  followed by zero or more symbols followed by  $T_2$ ) can be found in  $S$ .
  - a) Show by means of an example that there can be  $\Theta(n^2)$  different matches of  $T_1 * T_2$  in  $S$ .
  - b) Supply an  $O(n^2)$ -time algorithm to compute all matches of  $T_1 * T_2$  in  $S$ .
  - c) Supply an  $O(n)$ -time algorithm to decide whether there is any match of the pattern  $T_1 * T_2$  in  $S$ .
4.
  - a) Describe an algorithm of search operation on skip list.
  - b) Describe an algorithm of update operation on skip list.
  - c) Explain probabilistic analysis of skip list.
5. What are the two components in KMP Algorithm? Write the algorithm for both components along with example.
6. Calculate Time and Space complexity of Priority Search Tree. Explain its application.
7. Explain in detail recent trends in Trees for efficiently solving the problems.
8. Explain different cases of insertions and deletions in Red-Black trees with example.