Hall Ticket Number:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

**Code No. : 21913**

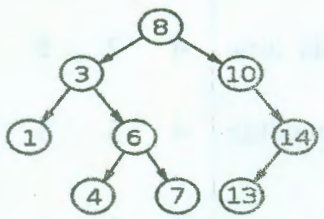
# VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

## M.Tech. (CSE: CBCS) I-Semester Main Examinations, January-2019

## Advanced Data Structures

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

| Q.No. | Stem of the question | M | L | CO | PO |
|---|---|---|---|---|---|
| | ***Part-A (10 × 2 = 20 Marks)*** | | | | |
| 1. | What are the characteristics of a good Hash Function? Give two examples. | 2 | 2 | 1 | 1 |
| 2. | Given the hash table of size 11, use Division hash function to find the indices for the keys 11, 77, 58, 46, 37, 92, 21. | 2 | 3 | 1 | 1, 2 |
| 3. | Randomizing a data structure improves the performance of operations. Justify the statement with an example. | 2 | 2 | 2 | 1 |
| 4. | Give reasons for bounding the height of a Skip list to O( logn). | 2 | 2 | 2 | 1, 2 |
| 5. | Draw the binary search tree (BST) after the insertion of the keys 50, 25 , 29, 62, 22, 56, 16, 32 into an initially empty tree. Also, draw the final BST after deletion of the keys 29, 50 from the above constructed BST. | 2 | 2 | 3 | 1, 2 |
| 6. | Perform the operation deletion(7) on the following splay tree and draw the resultant splay tree.   | 2 | 3 | 3 | 1, 2 |
| 7. | What is the longest prefix that is also the suffix of the string "cgtacgttcgtacg"? | 2 | 3 | 4 | 1,2,3 |
| 8. | Write the looking glass heuristic and character jump heuristic.Implement them on the following text and pattern.<br>T: course on ADS<br>P: ADS | 2 | 3 | 4 | 1,2,3 |
| 9. | Differentiate between 1-dimensional range tree and 2-dimensional range tree. | 2 | 2 | 5 | 1, 2 |
| 10. | What is the significance of a k-d tree? What is the worst case depth of a k-d tree defined on '**n**' points in the plane? | 2 | 2 | 5 | 1,2,3 |
| | ***Part-B (5 × 8 = 40 Marks)*** | | | | |
| 11. a) | Give reason for maintaining constant load factor for a Hash Table. Explain how Rehashing helps in improving the performance of hashing. | 4 | 2 | 1 | 1, 2 |
| b) | Rishi is excited to participate in an "online coding" game conducted during a technical fest. This game will provide the participant to randomly choose 'n' balls and place them in the baskets numbered from 0 to n-1. The number of balls 'n' cannot be more than 10. Each ball is referred with a unique ball-id number which is between 1 to 100. If the balls are uniquely placed in different baskets he will win a gift worth of 500 rupees. Given the number of balls 'n' and the ball-id numbers of 'n' balls as input, your task is to help Rishi in designing a solution to win the game. Use hashing technique to propose a solution to the problem. | 4 | 5 | 1 | 1,2,3 |

*Contd... 2*

**Code No. : 21913**

| | | | | | |
|---|---|---|---|---|---|
| 12. a) | Write an Algorithm for searching an element in a Skip list. Compare the worst case time complexity of a search function in a Skip list to a single Linked List with example. | 4 | 2 | 2 | 1, 2 |
| b) | How can we augment sorted linked lists to make the search faster? Draw a skip list resulting from performing the following sequence of operations removeElement(25), insertElement(44), removeElement(70), insertElement(75) into a Skip list Containing the keys 12, 25, 36, 50, 67, 70, 78, 96, 110. | 4 | 5 | 2 | 1,2,3 |
| 13. a) | What are the properties of a Red black tree? Explain the double red and double black problem caused while inserting and deleting a node with the help of an example. | 4 | 2 | 3 | 1, 2 |
| b) | Construct an AVL tree with the keys 45,78, 35, 10, 22, 58, 96, 112, 89, 34, 66, 12. Also specify the necessary rotations performed. | 4 | 3 | 3 | 1, 2 |
| 14. a) | Explain Huffman coding algorithm. Draw the frequency array and Huffman tree for the following string: "dogs do not spot hot pots or cats" | 4 | 2 | 4 | 1,2,3 |
| b) | Compute the failure function and show the result of implementing KMP algorithm in finding the pattern P in the text T<br>T: a a b a a c a c a c c b a b a b a b a c a a b b a c<br>P: b a b a b | 4 | 3 | 4 | 1,2,3 |
| 15. a) | Write an algorithm for 1-dimensional range search and analyze its time complexity. | 4 | 2 | 5 | 1, 2 |
| b) | Draw a Quad tree for the following set of points assuming a 16X16 bounding box {(1,2) ,(4,10) , (14,3),(6,6),(3,15),(2,2),(3,12),(9,4),(12,14)} | 4 | 3 | 5 | 1,2,3 |
| 16. a) | Illustrate extendible hashing technique with the help of an example. | 4 | 2 | 1 | 1, 2 |
| b) | What is a deterministic skip list? Explain the procedure for deletion of a key from a skip list with example. | 4 | 2 | 2 | 1, 2 |
| 17. | Answer any ***two*** of the following: | | | | |
| a) | What are the properties of B-Tree? Explain the insertion operation on a B-tree of order 5. | 4 | 2 | 3 | 1, 2 |
| b) | Draw the compact representation of suffix trie for the string "minimize minime" | 4 | 3 | 4 | 1,2,3 |
| c) | Design an algorithm to construct a priority search tree. | 4 | 2 | 5 | 1, 2 |

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

| S. No. | Criteria for questions | Percentage |
|---|---|---|
| 1 | Fundamental knowledge (Level-1 & 2) | 60 |
| 2 | Knowledge on application and analysis (Level-3 & 4) | 30 |
| 3 | *Critical thinking and ability to design (Level-5 & 6) (*wherever applicable) | 10 |