**KIIT Deemed to be University**
**Online End Semester Examination(Autumn Semester-2020)**

**Subject Name & Code:** DSA (CS 2001)Regular
**Applicable to Courses: B.Tech**

**Full Marks=50** **Time:2 Hours**

**SECTION-A(Answer All Questions. Each question carries 2 Marks)**
**Time:30 Minutes** **(7×2=14 Marks)**

| Question No | Question Type (MCQ/SAT) | Question | CO Mapping | Answer Key (For MCQ Questions only) |
|---|---|---|---|---|
| Q.No:1 | MCQ | What is the time complexity of following code:<br>int a = 0, b = 0;<br>for (i = 0; i < N; i=i*2) {<br>a = a + rand();<br>}<br>for (j = 0; j < M; j++) {<br>b = b + rand();<br>}<br><br>(A) O(N * M) time<br>(B) O(N + M) time<br>(C) O(log N+ M) time<br>(D) O(N * M) time | CO2 | (C) |
| | MCQ | What is the time complexity of following code:<br>int i, j, k = 0;<br>for (i = n/ 2; i <= n; i++) {<br>for (j = 2; j <= n; j = j * 2)<br>{<br>k = k + n / 2;<br>}<br>}<br>(A) O(n)<br>(B) O(nLogn)<br>(C) O(n^2)<br>(D) O(n^2Logn) | CO2 | (B) |
| | MCQ | What is the time complexity of following code:<br>int a = 0, i = m; | CO2 | (D) |

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| | | while (i > 0) {<br>a += i;<br>i /= 2;<br>}<br>(A) O(m)<br>(B) O(Sqrt(m))<br>(C) O(m / 2)<br>(D) O(log m) | | |
| | **MCQ** | What is the time complexity of following code:<br>int a = 0;<br>for (i = 0; i < N; i++) {<br>for (j = N; j > i; j--) {<br>a = a + i + j;<br>}<br>}<br>(A) O(N)<br>(B) O(N*log(N))<br>(C) O(N * Sqrt(N))<br>(D) O(N*N) | CO2 | (D) |
| **Q.No:2** | MCQ | A binary search tree is generated by inserting integer values in order the order: 60, 25, 65, 15, 30, 55, 80, 10, 20, 40, 75, 35. Find the number of nodes in the left subtree, right subtree of the root and the height of the tree respectively.<br>(A) (6, 5, 3)<br>(B) (7, 4, 4)<br>(C) (8, 3, 4)<br>(D) (5, 6, 3) | CO 4 | (C) |
| | MCQ | Suppose the following numbers are entered to construct a binary search tree.<br>100, 80, 200, 75, 84, 22, 63, 15, 7<br>Further, the tree is converted into a one way inorder threaded binary tree. How many threads will be present in the tree?<br>(A) 4<br>(B) 5<br>(C) 7<br>(D) 8 | CO 4 | (B) |

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| | MCQ | Suppose the following numbers are entered to construct a binary search tree.<br>80, 100, 75, 22, 63, 15, 7, 84, 200<br>Further, the tree is converted into a one way inorder threaded binary tree. How many threads will be present in the tree?<br>(A) 4<br>(B) 7<br>(C) 5<br>(D) 8 | CO 4 | (C) |
| | MCQ | Suppose the following numbers are entered to construct a binary search tree.<br>22, 15, 20, 18, 75, 60, 50, 10<br>Further, the tree is converted into a one way inorder threaded binary tree. How many threads will be present in the tree?<br>(A) 4<br>(B) 7<br>(C) 8<br>(D) 5 | CO 4 | (D) |
| **Q.No:3** | **MCQ** | Evaluate the following prefix expression.<br>+, * ,2, +, /, 14, 2, 5, 1<br>(A) 25<br>(B) 24<br>(C) 23<br>(D) Fractional Value | CO1,CO 4 | (A) |
| | **MCQ** | Evaluate the following postfix expression.<br>1, 4, 18, 6, /, 3, +, +, 5, /, +<br>(A) 2<br>(B) 3<br>(C) 4<br>(D) 5 | | (B) |
| | **MCQ** | Evaluate the following postfix expression.<br>4, 3, 6, 3, *, 12, -, *, +<br>(A) 22<br>(B) 18<br>(C) 25<br>(D) 3 | | (A) |

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| | **MCQ** | Evaluate the following prefix expression.<br>*, -, +, 4, 3, 5, /, +, 2, 4, 5<br>(A) 14<br>(B) 21<br>(C) 19<br>(D) 12/5 | | (D) |
| **Q.No:4** | **MCQ** | Consider the following code: void fun(struct node * start) { if (start==NULL) return;<br>if(start->next!=NULL)<br>fun(start->next->next);<br>printf("%d",start->data);<br>For a linked list with following data input to the above code, what will be the output of the code? 11->15->25->50->87->23?<br>(A) 23 50 15<br>(B) 87 25 11<br>(C) 11 15 25 50 87 23<br>(D) 11 25 87 | CO3 | (B) |
| | **MCQ** | Consider a double circular linked list. Let P points to the start node of the linked list. Then the following code snippet will delete_____ node?<br>[prev and next represent the previous and next pointer respectively]<br>p->prev->prev->prev->next =p->prev<br>p->prev->prev=p->prev->prev->prev<br>(A) Last<br>(B) Node before the last<br>(C) First<br>(D) Second | CO3 | (B) |
| | **MCQ** | Consider the following function applied to a single linked list with odd no. of nodes :<br>struct node * fun ( )<br>{<br>struct node *p, *q;<br>p=q=start;// start points to the first node of the list | CO3 | (C) |

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| | | while(q!=NULL && q->next!=NULL)<br>{<br>q=q->next->next;<br>p=p->next;<br>}<br>retrun p;<br>}<br>The code will return _____ of the list.<br>(A) Last node<br>(B) Node before the last node<br>(C) Middle node<br>(D) None of these | | |
| | **MCQ** | Consider the following function applied to a single linked list with odd no. of nodes :<br>void fun ( struct node * start)<br>{<br>if(start!=NULL)<br>printf("%d", start->data);<br>fun(start->next);<br>printf("%d",start->data);<br>}<br>The code will print the list___.<br>(A) Two times in forward direction<br>(B) One time forward direction and one time backward direction<br>(C) Two time in backward direction<br>(D) None of these | CO3 | (B) |
| **Q.No:5** | **MCQ** | With the following set of traversal sequences together, how many binary trees can be identified?<br>Preorder : ABDEFCGHJLK<br>Postorder: DFEBGLJKHCA<br>(A) One<br>(B) Two<br>(C) Three<br>(D) Four | CO4 | (D) |

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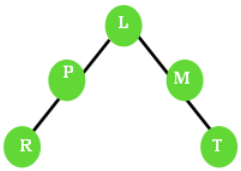
| | **MCQ** | With the following set of traversal sequences together, what is the equivalent postorder traversal sequence?<br>Preorder : abcdefghijk<br>Inorder: bacdfehgjki<br>(A) bfhkjigedca<br>(B) bfhkjigedac<br>(C) bfhkijgedca<br>(D) bhfkjigedca | CO4 | (A) |
| | **MCQ** | What is the equivalent postfix expression for the prefix expression : ++ac*d-e/+fgh?<br>(A) acd*+efg+h/+-<br>(B) acd*+efg+h/-+<br>(C) acd*+feg+h/-+<br>(D) acd+*efg+h/-+ | CO4 | (B) |
| | **MCQ** | What is the equivalent prefix expression for the postfix expression : acd*+efg+h/-+?<br>(A) ++ac*de-/+fgh<br>(B) ++ac*d-e+/fgh<br>(C) ++ac*d-e/+fgh<br>(D) ++ac*d-e/+fgh | CO4 | (C) |
| **Q.No:6** | **MCQ** | Figure below is a balanced binary tree. If a node inserted as child of the node R, how many nodes will become unbalanced?<br>  <br>(A) 2<br>(B) 1<br>(C) 3<br>(D) 0 | CO4, CO1,CO 6 | (B) |
| | **MCQ** | Maximum number of nodes present at any level of a tree is?<br>A. n<br>B. $2^n$<br>C. n+1<br>D. 2n | CO4, CO1,CO 6 | (B) |
| | **MCQ** | What is the number of | CO4, | (C) |

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| | | edges present in a complete graph having n vertices?<br>A. (n*(n+1))/2<br>B. n<br>C. (n*(n-1))/2<br>D. nC2 | CO1,CO 6 | |
| | **MCQ** | A B-tree of order 4 is built from scratch by 10 successive insertions. What is the maximum number of node splitting operations that may take place?<br>(A) 3<br>(B) 4<br>(C) 5<br>(D) 6 | CO4, CO1,CO 6 | **(C)** |
| Q.No:7 | MCQ | Given the following input (122, 634, 1976, 679, 989, 571, 6773, 2399) and the hash function x mod 10, which of the following statements are true?<br>(A) 679, 989, 2399 are having collision<br>(B) 571,1976 are having collision.<br>(C) All elements hash to the same value<br>(D) Each element hashes to a different value | CO5,CO 6 | (A) 679, 989, 2399 are having collision |
| | MCQ | Suppose we have a O(n) time algorithm that finds median of an unsorted array. Now consider a QuickSort implementation where we first find median using the above algorithm, then use median as pivot. What will be the worst case time complexity of this modified QuickSort.<br>(A) O(n^2 Logn)<br>(B) O(n^2)<br>(C) O(n Logn Logn)<br>(D) O(nLogn) | CO5,CO 6 | (D) |
| | MCQ | Which of the following sorting algorithms in its typical implementation gives best performance | CO5,CO 6 | (C) Insertion Sort |

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| | | when applied on an array which is sorted or almost sorted (maximum 1 or two elements are misplaced).<br>(A) Quick Sort<br>(B) Heap Sort<br>(C) Insertion Sort<br>(D) Merge Sort | | |
| | MCQ | For merging two sorted lists of size m and n into sorted list of size m+n, no. of comparisons required ----------?<br>a) O(m)<br>b) O(n)<br>c) O(m+n)<br>d) O(logm + logn) | CO5,CO 6 | (C) |

**SECTION-B(Answer Any Three Questions. Each Question carries 12 Marks)**

**Time: 1 Hour and 30 Minutes** **(3×12=36 Marks)**

| Question No | Question | CO Mapping (Each question should be from the same CO(s)) |
|---|---|---|
| **Q.No:8** | What is the difference between a single linked list and double linked list representation? Write a C function to rotate a double linked list anti clock wise. Given a double linked list, rotate the linked list counter-clockwise by k nodes. Where k is a given positive integer. For example, if the given linked list is A->B->C->D->E->F and k is 3, the list should be modified to D->E->F->A->B->C. Assume that k is smaller than the count of nodes in linked list. [12] | CO3 |
| | What is the difference between an array and linked list representation? Write function to reverse a single list starting with k node followed by k+1, k+2, …The function should reverse first k nodes in the list, then reverse next k+1 nodes in the list, then reverse next k+2 node in the list, and like this, it will continue till the end of the list.[12] | |
| | What is the difference between a single linked list and a circular linked list representation? Write a function detect the Loop() that checks whether a given double Linked List contains loop and if loop is | |

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| | present then removes the loop and returns true. If the list doesn't contain loop then it returns false. [12]<br>Note: For a loop to be present either the last node's next pointer may keep the address of any other node or the first node's previous pointer may keep the address of any other node in the list or both. | |
| **Q.No:9** | A. Suppose a computer system has one processor to execute different tasks. Each task has a time of execution. Each task is assigned with a priority number depending upon the type of task: Local Printing (Lowest Priority -1), Web Applications (Priority-2), I/O interfacing (Highest Priority -3). Every time a task is generated, its execution time and priority number are entered and stored. Which data structure can efficiently maintain task waiting for the processor? Write functions for insertion and deletion operations for the tasks with the following conditions. i) A task will be processed first with minimum execution time. ii) A task will be processed first with highest priority. [8]<br><br>B. Write insertion and deletion functions to implement an input restricted double ended queue. [4] | CO1,CO4 |
| | A. Write insertion and deletion functions for implementing a priority queue using a two dimensional array. Discuss the time complexities of the functions. [4]<br><br>B. Write a program to merge two sorted stacks S1 & S2 by using only push and pop functions and without taking any additional data structures. The final merge list to be stored in S1. Both S1 and S2 must be created dynamically. [8] | |
| | A. Write insertion and deletion functions to implement a QUEUE ADT using STACK ADT.[4]<br><br>B. Write a program to rearrange two sorted stacks S1 & S2 by using only push and pop functions and without taking any additional data structures. [8]<br>Note: **Rearrange**:- Finally, both the arrays will be sorted, but the highest element in S1 should be less than the lowest element in S2. | |
| **Q.No:10** | A. What is the need of doing height balance of a Binary search tree? Illustrate the steps involved while building an AVL tree with values and also identify the rotations:<br>34, 36, 39, 28, 31, 22, 45, 76, 42, 75, 88, 92, 27, 65, | CO4,CO6 |

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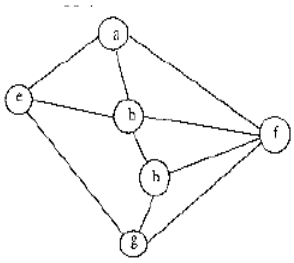
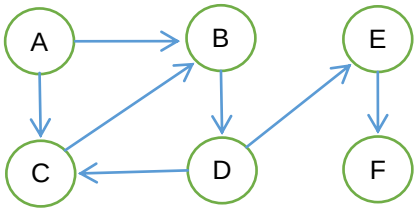
| | 37, 45, 40,7 [7 ]<br><br>B. Write a function to construct a fully complete binary tree from the given level order traversal sequence of the tree. [5] | |
| | A. What is an m-way search tree? How is it different from AVL tree? Create a B-tree of order 3 with the following elements. [8 ]<br>30,40,50,60,62,25,20,15,70,96,75, 100, 85, 62, 34, 12, 23, 90, 17, 15, 77<br><br>B. Write a function to check a given tree is a binary search tree or not.[4] | |
| | A. What is a max heap tree and min heap tree. Construct a max heap with the following data elements. [4]<br>100, 120, 60, 32, 108, 88, 48, 28, 72.<br><br>B. Write a program to convert a given postfix arithmetic expression into its equivalent prefix arithmetic expression using expression tree. [8] | |
| Q.No:11 | A. Write the pseudo code for Quick sort including partition() function. Also illustrate the step by-step process of partition() function with a given array: {30, 40, 45, 32, 67, 21}, considering first element as the pivot element. [6]<br><br>B. Write the DFS traversal algorithm. Show all the steps to find DFS traversal of the given graph. The traversal starts from vertex h. [3]<br>  <br><br><br>C. Write a function to implement chaining(collision resolution technique) in hashing. [3] | CO4, CO5,CO6 |
| | A. Write the pseudo code for Merge sort including merging ( ) function. Also illustrate the step-by-step process of merge sort with a given array: {30, 40, 45, 32, 67, 21, 89, 24, 100}. Discuss the time complexity of insertion sort, quick sort, and merge sort. [6] | |

B. Write a function to implement linear probing (collision resolution technique) in hashing. [3]

C. Write the Depth First Search (DFS) graph traversal algorithm/ pseudo code. Discuss the steps of DFS algorithm with the following graph, where A is considered as starting vertex. [3]




D.

A. What is Hashing? Explain the collision with example. A hash table of length 10 uses open addressing with hash function h(k)=k mod 10, and linear probing. After inserting 8 values into an empty hash table, the table is as shown below.

| | |
|---|---|
| 0 | |
| 1 | |
| 2 | 12 |
| 3 | 13 |
| 4 | 2 |
| 5 | 3 |
| 6 | 23 |
| 7 | 5 |
| 8 | 18 |
| 9 | 15 |

Find out the possible order in which the key values could have been inserted in the table (justify the answer with proper explanation). Write function to implement linear probing. [8 ]

B. Write the BFS traversal algorithm. Show all the steps to find BFS traversal of the given graph. The traversal starts from R. [4]