

Name of student:

Scholar No.:

National Institute of Technology Hamirpur
Department of Computer Science & Engineering
End-Semester Exam December-2020

Branch: B.Tech (ECE) 3rd Sem

Subject: Data Structures

Code: CS-201

Max Marks: 50

Max Time: 02 hrs

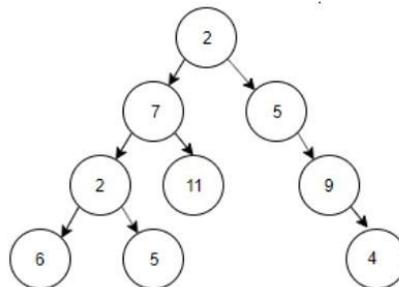
Note: 1. All questions are compulsory.

2. Draw neat diagrams wherever necessary

Q1. A hash table contains 10 buckets and uses linear probing to resolve collisions. The key values are integers and the hash function used is $\text{key} \% 10$. If the values 48, 15, 42, 31, 72, 61, 33, 17 are inserted in the table, in what location would the key value 146 be inserted? Also, apply quadratic probing for the same and compare both the methods.

[5 Marks]

Q2. (a) Give the preorder, postorder, and inorder traversal of the following tree. [3 Marks]



(b) Create unique binary tree from following traversal techniques [2 Marks]

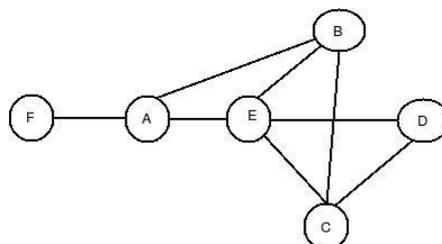
(i) Preorder: ABDHECFG

Inorder: DHBEAFCG

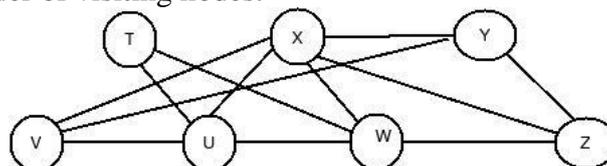
(ii) Postorder: IDBGCHFEA

Inorder: BIDACGEHF

Q3. (a) In the given graph, if Breadth First Search is applied then what is the possible order of visiting nodes: [2.5 Marks]

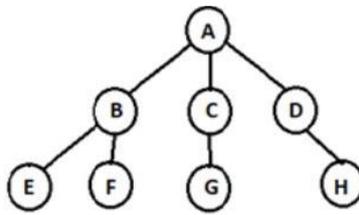


(b) Consider the following undirected graph in which DFS is to be applied on vertex T. What is the possible order of visiting nodes: [2.5 Marks]



Q4. (a) In worst case, quick sort takes 50 seconds to sort an array of size 10. In the worst case if it takes 10 minutes to sort an array of size 'n' then what will be the approximate value of 'n'. [1.5 Marks]

(b) In the following tree representation, what is the level, height and depth of node F? [1.5 Marks]



(c) Consider the following C function. What fun(5) will return: [2 Marks]

```

int fun(int n){
    int x=1,k;
    if (n==1) return x;
    for (k=1; k<n; ++k)
        x = x + fun(k) * fun(n-k);
    return x;
}
  
```

Q5. (a) Consider an array of size 'z' elements. The first 'x' elements of the array are kept in ascending order and remaining 'z-x' elements are kept in descending order. All elements of the array are distinct. What is the number of comparisons needed to search an element in the array in worst case. [2 Marks]

(b) If selection sort is modified in such a way that, in the first iteration, smallest element of the input array is kept in its appropriate place, in the second iteration, largest element of the remaining array is kept in its appropriate place and so on. If the elements in the input array are 9, 7, 1, 10, 5, 3 then what will be the sequence of the elements after fourth iteration. [3 Marks]

Q6. (a) Translate, by algorithm and hand, given infix expression into its equivalent postfix and prefix expression. $((A+B)/D) \uparrow ((E-F)*G)$ [3 Marks]

(b) Suppose a queue is maintained by a circular array QUEUE with N=12 memory cells. Find the number of elements in QUEUE if [2 Marks]

(i) FRONT=4, REAR=8;

(ii) FRONT=10, REAR=3; and

(iii) FRONT=5, REAR= 6 and then two elements are deleted.

Q7. (a) Insert the following keys in the order shown below into an initially empty m-way search tree of order (i) 5 (ii) 4 (iii) 3 [3 Marks]

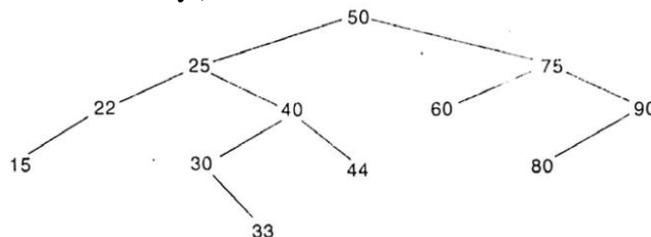
GSFLQXZVRAIJW

Also, compare it with B+ tree.

(b) Are B-trees of order 2 full binary trees? If so, how? [2 Marks]

Q8. (a) Suppose the following eight numbers are inserted in order into an empty binary search tree: 50, 33, 44, 22, 77, 35, 60, 40. Draw the tree. [1 Marks]

(b) Consider the following binary search tree T. Draw the tree T if each of the following operations is applied to the original tree T. (That is, the operations are applied independently, not successively.) [3 Marks]



(i) Node 20 is added to T.

(ii) Node 15 is added to T.

(iii) Node 88 is added to T.

(iv) Node 22 is deleted from T.

(v) Node 25 is deleted from T.

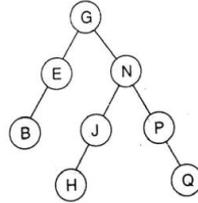
(vi) Node 75 is deleted from T.

(c) Give advantage and disadvantage of binary search tree. [1 Marks]

Q9. (a) Create an AVL tree for the following sequence. [1.5 Marks]

1, 26, 5, 24, 8, 10

(b) Delete element B from the given AVL search tree. [1.5 Marks]



(c) What do you mean by spanning tree? How you find the minimum spanning tree. [1 Marks]

Q10. (a) Apply heapsort to sort the following sequence. Also, write the algorithm. [3 Marks]

7, 1, 2, 9, 5, 4, 8, 3, 6

(b) Give the polynomial representation of linked list. How addition operation performed on it. Write algorithm. [2 Marks]