

Name: _____ Roll Number: _____

Ques.1 Choose the correct answer (Single correct only):

(20 Marks)

1. The inorder and preorder traversal of a binary tree are **d b e a f c g** and **a b d e c f g**, respectively. The postorder traversal of the binary tree is:

(a) **d e b f g c a** (c) e d b g f c a
(b) e d b f g c a (d) d e f g b c a

2. Construct an AVL Tree with the elements
21, 26, 30, 9, 4, 14, 28, 18

What will be the root node of the resultant AVL tree?

(a) 26 (b) **21** (c) 28 (d) 18

3. Construct an AVL Tree with the elements
21, 26, 30, 9, 4, 14, 28, 18

What will be the postorder predecessor of the root node in the resultant tree?

(a) 26 (b) 21 (c) **28** (d) 9

4. What will be the time complexity of printing out the values stored in all the *leaves* of a binary search tree containing 'N' elements?

(a) $O(1)$ (b) **$O(N)$** (c) $O(\log N)$ (d) $O(N^2)$

5. What will be worst-case time complexity of finding and deleting the smallest value in a binary search tree of size 'N'?

(b) $O(1)$ (b) **$O(N)$** (c) $O(\log N)$ (d) $O(N^2)$

6. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the inorder transversal sequence of the resultant tree?

(a) 7 5 1 0 3 2 4 6 8 9 (b) 0 2 4 3 1 6 5 9 8 7
(b) **0 1 2 3 4 5 6 7 8 9** (d) 9 8 6 4 2 3 0 1 5 7

7. What is the number of NULL links in a Binary Tree of 'n' nodes?

(a) n (b) **n+1** (c) n-1 (d) n/2

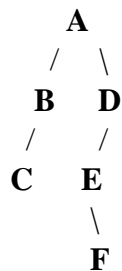
8. Consider the following code:

```
struct binary{
struct binary *left;
int data;
struct binary *right;
}

void F1(struct binary *t)
{
    if(t)
    {
        printf("%d", t->data);
        F2(t->left);
        F2(t->right);
    }
}

void F2(struct binary *t)
{
    if(t)
    {
        F1(t->left);
        printf("%d", t->data);
        F1(t->right);
    }
}
```

Now, consider the following tree



8.a If F1(t) is called on the above tree with t as root node (A), what is its output?

- (a) ABCDEF (b) ACBFED (c) ABDCFE **(d) ACBEFD**

8.b When F2(t) is called on this tree, with root as the parameter that is (F2(root)), what is its output?

- (a) BCADEF** (b) BCDEFA (c) DEFBCA (d) DEFABC

9. Consider the following C program segment

```
struct Cellnode {
    struct CellNode *leftChild;
    int element;
    struct CellNode *rightChild;
};

int DoSomething (struct CellNode *ptr)
{
    int value=0;
    if(ptr!=NULL)
    {
        if (ptr->leftChild !=NULL)
            value=1+DoSomething (ptr->leftChild);
        if (ptr->rightChild!=NULL)
            value=max(value,1+DoSomething(ptr-> right child));
        return (value);
    }
}
```

The value returned by the function DoSomething when a pointer to the root of a non-empty tree is passed as argument is

- (a) The number of leaf nodes in the tree
- (b) The number of internal nodes in the tree
- (c) The number of nodes in the tree
- (d) The height of the tree**

10. Consider the given code:

```
int fun(struct binarytreenode *root1, struct binarytreenode *root2)
{
    if(root1 == NULL && root2 == NULL)
        return 1;
    if(root1 == NULL || root2 == NULL)
        return 0;
    return (root1->data == root2->data && fun(root1->left, root2->left) && fun(root1->right, root2->right));
}
```

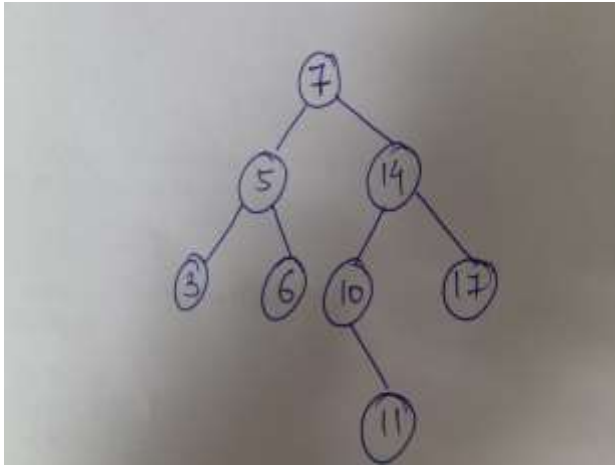
The above code describes, which of the following task?

- (a) Finding the number of nodes with only one child
- (b) Finding the total number of nodes in a tree
- (c) Finding, whether two binary trees are structurally identical or not**
- (d) Finding the number of leaf nodes in a tree

11. The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the height of the binary search tree (tree height is the maximum distance of a leaf node from the root)?

- (a) 2
- (b) 3**
- (c) 4
- (d) 6

19. Consider the given AVL-Tree



If the element with value '12' is inserted into this AVL tree, how many rotations are required to balance the tree?

- (a) 0
- (b) 1
- (c) 2
- (d) 3

Ques. 2 Do as Directed:

(8 Marks)

1. Whenever an AVL tree needs to be balanced by rotation, it is always the case that the root value gets changed.

False

2. The following elements have to be inserted on an AVL tree in the order they arrive. What will be the root value of the resultant tree?

48, 39, 80, 40, 35, 8

39

3. For an AVL tree to remain balanced it is necessary that number of nodes in left subtree should be same as number of nodes in right subtree. **False**

4. A max heap tree has elements in the following order (level order): 105, 62, 55, 44, 50, 40, 46. What will be the root value after a delete call is applied on this tree?

62

5. What is the minimum and maximum number of nodes in a **perfect** binary tree of height h (use h in your answer)?

Minimum = $2^{h+1} - 1$

Maximum = $2^{h+1} - 1$

6. Consider a tree T storing 100,000 items. What is the worst-case height of T in the following cases?

a. T is an AVL tree.

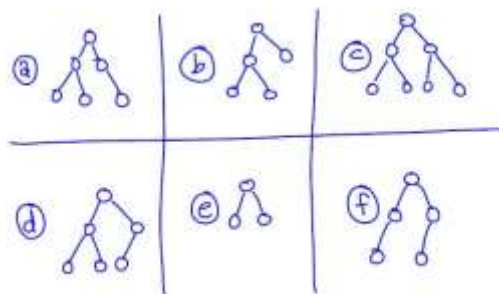
$\log n$

b. T is a binary search tree.

n

7. Given the following six trees a through f:

(3 Marks)



List the letters of all of the trees that have the following properties: (Note: It is possible that none of the trees above have the given property, it is also possible that some trees have more than one of the following properties.)

Full: **b, c, e**

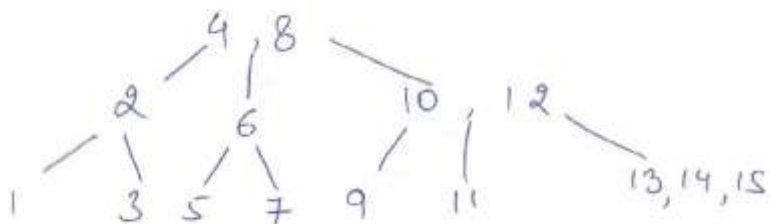
Complete: **b, c, d, e**

Perfect: **c, e**

8. Consider the set of keys $K = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 \}$.

(4 Marks)

(a) Draw a 2-3-4 tree storing K as its keys using the fewest number of nodes. Draw only the resultant tree.



(b) Draw a 2-3-4 tree storing K as its keys using the maximum number of nodes. Draw only the resultant tree.

