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e Institute of Information Technology
T1 Examination, 2014
B.Tech IV Semester

Course Title: Fundamentals of Algorithms
Course Code: 10B11CI411

Maximum Time: 1 Hr
Maximum Marks: 20 marks

Q1 [4 Marks] AVL tree is a balanced binary search tree and grows almost equally in all paths. Let us define three types of nodes in an AVL Tree: a) Full node- A node with two children; b) Half Node- A node with one child, either left child or right child; c) Leaf Node- A node with no child. Develop an **efficient non-recursive algorithm** to compute the counts of Full Node, Half Node and Leaf Node in a given AVL Tree.

Note: zero marks will be awarded if you propose the recursive algorithm.

Q2 [4 Marks] Analyse the worst case time complexity for the given program.

Algorithm: A (array X, low, high, Y)

$T(n) = aT\left(\frac{n}{b}\right) + f(n)$

$1.T\left(\frac{n}{4}\right) + O(1)$

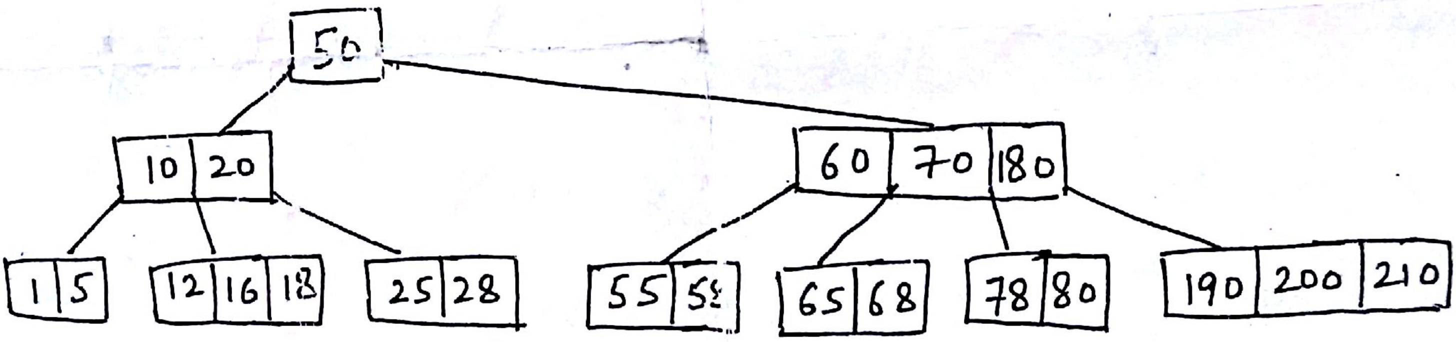
```
{
   M2 = (low + high) / 2; M1= (low + high) / 4; M3 = 3 * (low + high) / 4;
   if ( X[M2]= =Y ) { return 1;}
   else if ( X[M1]= =Y) { return 1; }
   else if ( X[M3]= =Y) { return 1; }
   else if ( low == high) { return 0; }
   else if( X[M2] < Y )
          if ( X[M1] < Y )
             A( X, low, M1 - 1, Y );
          else
             A( X, M1 + 1, M2 - 1, Y );
   else if ( X[M3] > Y )
             A( X, M3 + 1, high, Y );
   else
             A( X, M2 + 1, M3 - 1, Y );
}
```

Q3 [4 Marks] An inversion in an array A[1..n] is a pair of indices (i, j) such that **i < j and A[i] > A[j]**. Propose an efficient algorithm to count the number of inversions in an n element array.

Q4 [4 Marks] Insert the following elements into an empty Red-Black tree.

20,10,5,30,40,57,3,2,4,35,25,18,22,21

Q5 [4 Marks] Delete 210, 5, 25, and 55 from the given B Tree of Order 5.



B Tree of Order-5