BCA 613 Computer Animation I

Ödev 4

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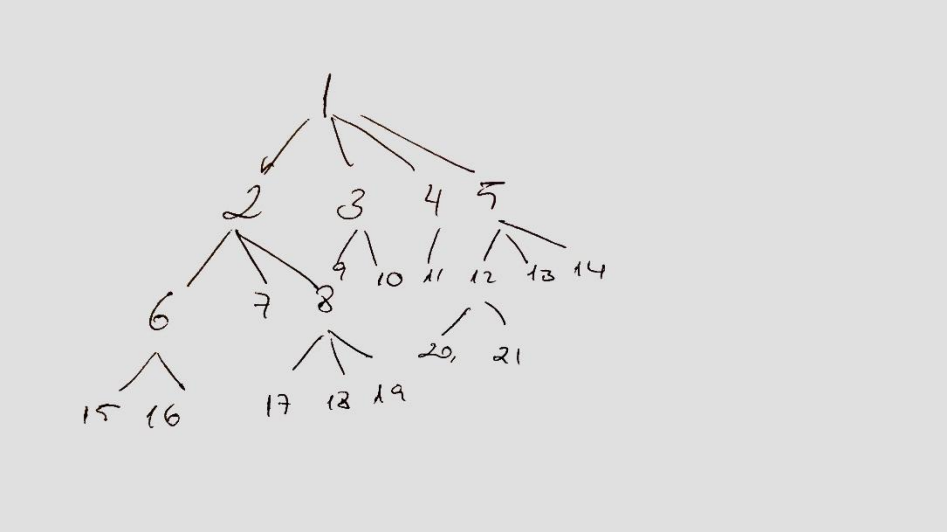
Soru: Bir n-ary ağaç yapısında Lowest Common Ancestor(LCA)' yı bulan programı yazınız.

Çözüm:

```
using System;
using System.Collections.Generic;

namespace LCA_Tree
{
    class Program
    {
        // Maximum number of nodes is 100000 and nodes are
        // numbered from 1 to 100000
        static readonly int MAXN = 100001;

        static List<int>[] tree = new List<int>[MAXN];
        static int[,] path = new int[3, MAXN]; // storing root to node path
        static bool flag;

        // storing the path from root to node
        static void dfs(int cur, int prev, int pathNumber, int ptr, int node)
        {
            for (int i = 0; i < tree[cur].Count; i++)
            {
                if (tree[cur][i] != prev && !flag)
                {
                    // pushing current node into the path
                    path[pathNumber, ptr] = tree[cur][i];
                    if (tree[cur][i] == node)
                    {
                        // node found
                        flag = true;

                        // terminating the path
                        path[pathNumber, ptr + 1] = -1;
                        return;
                    }
                    dfs(tree[cur][i], cur, pathNumber, ptr + 1, node);
                }
            }
        }

        // This Function compares the path from root to 'a' & root
        // to 'b' and returns LCA of a and b. Time Complexity : O(n)
```

```
static int LCA(int a, int b)
{
    // trivial case
    if (a == b)
        return a;

    // setting root to be first element in path
    path[1, 0] = path[2, 0] = 1;

    // calculating path from root to a
    flag = false;
    dfs(1, 0, 1, 1, a);

    // calculating path from root to b
    flag = false;
    dfs(1, 0, 2, 1, b);

    // runs till path 1 & path 2 mathches
    int i = 0;
    while (i < MAXN && path[1, i] == path[2, i])
        i++;

    // returns the last matching node in the paths
    return path[1, i - 1];
}

static void addEdge(int a, int b)
{
    tree[a].Add(b);
    tree[b].Add(a);
}

// Driver code
public static void Main(String[] args)
{
    for (int i = 0; i < MAXN; i++)
        tree[i] = new List<int>();

    // Number of nodes
    addEdge(1, 2);
    addEdge(1, 3);
    addEdge(1, 4);
    addEdge(1, 5);
    addEdge(2, 6);
    addEdge(2, 7);
    addEdge(2, 8);
    addEdge(3, 9);
    addEdge(3, 10);
    addEdge(4, 11);
    addEdge(5, 12);
    addEdge(5, 13);
    addEdge(5, 14);
    addEdge(6, 15);
    addEdge(6, 16);
    addEdge(8, 17);
    addEdge(8, 18);
    addEdge(8, 19);
    addEdge(12, 20);
```

```
            addEdge(12, 21);

            Console.Write("LCA(7, 16) = " + LCA(7, 16) + "\n");
            Console.Write("LCA(14, 20) = " + LCA(14, 20) + "\n");
        }
    }
}
```



Yukarıdaki gibi bir ağaç yapısında 7 ve 16, 14 ve 20 yapraklarının en küçük ortak atalarını bulmaya çalıştığımızda alınan sonuç: