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C++ Programme for Total Dominator Chromatic Number of Paths by Using Elementary Transformations

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ABSTRACT

A total dominator coloring of a graph G=(V,E) without isolated vertices is a proper coloring together with each vertex in G properly dominates a color class. The total dominator chromatic number of G is a minimum number of color classes with additional condition that each vertex in G properly dominates a color class and is denoted by $\chi_{td}(G)$. In this paper, we find the total dominator chromatic number of paths by using elementary transformations through C++ programme.

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Keywords: Total dominator coloring, Total dominator chromatic number.

1. INTRODUCTION

In this paper we only consider paths. Further details in graph theory can be found in[4].

Let G=(V,E) be a graph with minimum degree at least one. For two vertices v_0 and v_n of a graph G, a v_0 - v_n walk is an alternate sequence of vertices and edges

$v_0, e_1, v_1, \ldots, e_n, v_n$ such that the consecutive vertices and edges are incident. A path is a walk in which no vertex is repeated. A path with n vertices is denoted by P_n. A proper coloring of G is an assignment of colors to the vertices of G, such that adjacent vertices have different colors. The smallest number of colors for which there exists a proper coloring of G is called a chromatic number of G, and is denoted by $\chi(G)$. A total dominator coloring (td-coloring) of G is a proper coloring of G with extra property that every vertex in G properly dominates a color class. The total dominator chromatic number is denoted by $\chi_{td}(G)$ and is defined by the minimum number of colors needed in a total dominator coloring of G. This concept was introduced by A. Vijayalekshmi in[1]. This notion is also referred as a smarandachely k-dominator coloring of G, ($k \geq 1$) and was introduced by A.Vijayalekshmi in[2]. For an integer $k \geq 1$, a smarandachely k-dominator coloring of G is a proper coloring of G, such that every vertex in a graph G properly dominates a k color class. The smallest number of colors for which there exists a smarandachely k-dominator coloring of G is called the smarandachely k-dominator chromatic number of G and is denoted by $\chi_{td}^{s}(G)$.

In a proper coloring C of a graph G, a color class of C is a set consisting of all those vertices assigned the same color. Let C be a minimum td-coloring of G. We say that a color class is called a non-dominated color class (n-d color lass) if it is not dominated by any vertex of G and these color classes are also called repeated color classes.

In this paper we obtain a C++ programme to find the td-chromatic number of paths by using elementary transformations.

The total dominator chromatic number of paths was found in the following observation.

Theorem A [3]

Let G be P_n. Then

$$\chi_{td}(P_n) = \begin{cases} 2\left\lfloor \frac{n}{4} \right\rfloor + 2 & if\ n \equiv 0(mod4) \\ 2\left\lfloor \frac{n}{4} \right\rfloor + 3 & if\ n \equiv 1(mod4) \\ 2\left\lfloor \frac{n+2}{4} \right\rfloor + 2 & Otherwise \end{cases}$$

2. MAIN RESULT

We have to find the total dominator chromatic number of paths using C++ programme. The C++ programme is successfully compiled and run on C++ platform. The runtime test is included.

Program as follows

```
#include "stdafx.h"
#include <Windows.h>
#include <conio.h>
#include <iostream>
using namespace std;
        int main()
        {
        int inpt;
        cout << "Enter the Value of n" << endl;
        cin >> inpt;
     while (inpt >= 11)
        {
    // dimensions
        int N = inpt; // matrix row
        int M = inpt; // matrix column
        // dynamic allocation
        int** ary = new int*[N]; //logic matrix
        int** mat = new int*[N]; //adjacency matrix
        int** mat1 = new int*[N]; //adjacency matrix after removing 1
        for (int i = 0; i < N; ++i)
        {
        ary[i] = new int[M];
        mat[i] = new int[M];
        mat1[i] = new int[M];
        }
        // variables
        int k;
        int l;

        HANDLE p = GetStdHandle(STD_OUTPUT_HANDLE);
        SetConsoleTextAttribute(p, FOREGROUND_INTENSITY |
FOREGROUND_INTENSITY);
        // fill ary
        for (int i = 0; i < N; ++i)
        for (int j = 0; j < M; ++j)
        ary[i][j] = i;
        cout << "\n";
        cout << "The Adjacency Matrix for P" << N << "\n" << "\n";
        // fill mat
        for (int i = 0; i < N; i++)
```

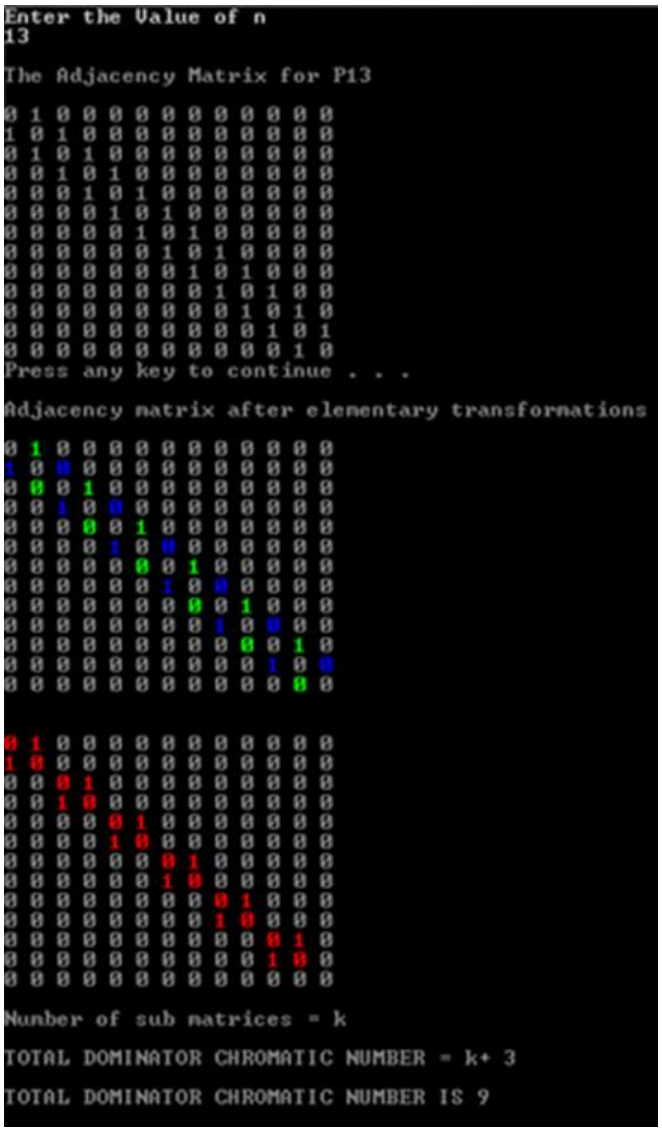
```
{
for (int j = 0; j < N; j++)
{
if (ary[j][i] == i + 1 | ary[j][i] == i - 1)
{
mat[i][j] = 1;
cout << mat[i][j] << " ";
}
else
{
mat[i][j] = 0;
cout << mat[i][j] << " ";
}
}
cout << "\n";
}
system ("pause");
cout << "\n";
// -----END LOGIC TO FORM MATRIX------
// ------ FORMING ADJACENCY MATRIX BY SUBSTRATING THE ROW AND
COLUMN VALUES
cout << "Adjacency matrix after elementary transformations" << "\n" <<"\n";
for (int i = 0; i < N; i++)
{
for (int j = 0; j < N; j++)
{
if (i >= i + 2 || mat[i][j] == 1 && mat[i][j - 2] == 1 && i % 2 != 0)
{
mat1[i][j] = mat[i][j] - mat[i][j - 2]; // R3 = R3-R1
SetConsoleTextAttribute(p, FOREGROUND_BLUE |
FOREGROUND_INTENSITY);
cout << mat1[i][j] << " ";
                    }
else if (i >= 2 && mat[i][j] == 1 && mat[i - 2][j] == 1 && i % 2 == 0)
{
mat1[i][j] = mat[i][j] - mat[i - 2][j];  // C3 = C3-C1
SetConsoleTextAttribute(p, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
cout << mat1[i][j] << " ";
}
else
```

```
        {
        if (mat[i][j] == 1 && i % 2 != 0 && i <= N - 2)
        {

        SetConsoleTextAttribute(p, FOREGROUND_BLUE |
FOREGROUND_INTENSITY);
        }
        else if (mat[i][j] == 1 && i % 2 == 0 && j <= N - 2)
        {

        SetConsoleTextAttribute(p, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
        }
        else
        {

        SetConsoleTextAttribute(p, FOREGROUND_INTENSITY |
FOREGROUND_INTENSITY);
        }
        mat1[i][j] = mat[i][j];
        cout << mat1[i][j] << " ";
        }
        }
        cout << "\n";
        }

        SetConsoleTextAttribute(p, FOREGROUND_INTENSITY |
FOREGROUND_INTENSITY);
        system("pause");
        cout << "\n";

        // --- END OF ADJACENCY MATRIX AFTER SUBSTRACTING THE ROW AND
COLUMN VALUES
        // ---- SHADING THE 2X2 MATRIX-------
        if (N % 2 != 0)
        {
        l = N - 1;
        }
        else
        {
        l = N;
        }
```

```
        for (int i = 0; i < N; i++)
        {
        for (int j = 0; j < N; j++)
        {
        if (j == i && j != l || mat1[i][j] == 1)
        {

        SetConsoleTextAttribute(p, FOREGROUND_RED |
FOREGROUND_INTENSITY);
        cout << mat1[i][j] << " ";
        }
        else
        {

        SetConsoleTextAttribute(p, FOREGROUND_INTENSITY |
FOREGROUND_INTENSITY);
        cout << mat1[i][j] << " ";
        }
        }
        cout << "\n";
        }

        SetConsoleTextAttribute(p, FOREGROUND_INTENSITY |
FOREGROUND_INTENSITY);
        // sub matrices
        {
    }
        if (N % 2 == 0)
        {
        k = N / 2;
        }
        else
        {
        k = (N-1) / 2;
        }
        // Final Formula
        if (N % 4 == 0)
        {
        cout << "\n";
    cout << "Number of sub matrices = k";
    cout << "\n";
```

```
            cout << "\n";
            cout << "TOTAL DOMINATOR CHROMATIC NUMBER = k + 2 ";
            cout << "\n";
            cout << "\n";

            cout << "TOTAL DOMINATOR CHROMATIC NUMBER is" << k + 2 << "\n";
            }
            else
            {

cout << "\n";
      cout << "Number of sub matrices = k";
      cout << "\n";
            cout << "\n";

            cout << "TOTAL DOMINATOR CHROMATIC NUMBER = k + 3 ";
cout << "\n";
            cout << "\n";
            cout << "TOTAL DOMINATOR CHROMATIC NUMBER IS " << k + 3 << "\n";
            }
            cout << "\n";
            system("Pause");
            return 0;

     // free ary and mat

            for (int i = 0; i < N; ++i)

            {

            delete[] ary[i];
            delete[] ary;
            delete[] mat1[i];
            delete[] mat1;
            delete[] mat[i];
            delete[] mat;

            }
            }
            return main();

            }
```

Runtime Test



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