**CS323-22: Project 9.2 (CPP)**

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Algorithm Steps:

step 0:

- numNode <-- get from input file

- dynamically allocate adjacencyMatrix // initiallize to 0

- initiallized all members

- load adjacencyMatrix from the input pairs

- newColor <-- 0

- currentNode <-- 0

step 1: - currentNode ++ // the next uncolored node

- print adjacencyMatrix

step 2: usedColor <-- findUsedColor (currentNode)

if useColor > 0

- adjacentMatrix[currentNode][currentNode] <-- usedColor

else

- newColor ++

- adjacentMatrix[currentNode][currentNode] <-- newColor

- pushUsedColor (newColor)

Step 3: repeat steps 1 to 2 until all nodes are colored.

Step 4: print newcolor // with indication, i.e., number of colors used is ...

print adjacencyMatrix

Step 5: close all files

**Source Code**

#include <iostream>

#include <fstream>

#include <string>

using namespace std;

class node{

int colorId;

node \*next;

public:

node(int color){

colorId = color;

next = NULL;

}

};

class graphColoring{

public:

int \*\*adjMatrix;

node \*usedColorTop;

int newColor;

int numNode;

graphColoring(int size){

numNode = size;

newColor = 0;

usedColorTop = new node(0);

adjMatrix = new int\*[numNode + 1];

for(int i = 0; i < size + 1; i++){

adjMatrix[i] = new int[numNode + 1];

for(int j = 0; j < size +1; j++){

adjMatrix[i][j] = 0;

}

}

}

~graphColoring(){

node \*walker = usedColorTop;

while(walker != NULL){

walker = walker->next;

delete usedColorTop;

usedColorTop = walker;

}

for(int i = 0; i < numNode + 1; i++){

delete[] adjMatrix[i];

}

delete[] adjMatrix;

}

void loadMatrix(int n1, int n2){

adjMatrix[n1][n2] = 1;

adjMatrix[n2][n1] = 1;

}

void printMatrix(){

for(int i = 1; i < numNode + 1; i++){

for(int j = 1; j < numNode +1; j++){

cout<<adjMatrix[i][j]<<" ";

}

cout<<endl;

}

}

void pushUsedColor(int color){

node \*curr = usedColorTop;

node \*newcolor = new node(color);

while(curr->next != NULL){

curr = curr->next;

}

newcolor->next = curr->next;

curr->next = newcolor;

}

int findUsedColor(int currNode){

node \*curr = usedColorTop;

int color = 0;

int used = 0;

while(curr->next != NULL){

curr = curr->next;

color = curr->colorId;

for(int i = 1;i < numNode + 1; i++){

//color is used by abjacent node

if(adjMatrix[currNode][i] == 1 && adjMatrix[i][i] == color){

used++;

}

}

//color is not used

if(used == 0){

return color;

}

used = 0;

}

//all colors in stack are used

return 0;

}

};

int main(int argc, char \*argv[]) {

//file checking ----------------------------------------------------

if(argv[1]==NULL || argv[2]==NULL) {

cout<<"no parameter, require 1 input file, 1 output file"<<endl;

return 0;

}

ifstream infile;

infile.open(argv[1]);

if(!infile.is\_open()){

cout<<"cant find file"<<endl;

return 0;

}

infile.close();

//end file checking--------------------------------------------------

streambuf \*console = cout.rdbuf();

ofstream out1;

out1.open(argv[2]);

//set output to output file 1

cout.rdbuf(out1.rdbuf());

int n1 = 0;

int n2 = 0;

int currNode = 0;

int currColor = 0;

graphColoring \*gc = NULL;

infile.open(argv[1]);

// Step 0

infile >> n1;

gc = new graphColoring(n1);

while(infile >> n1){

infile >> n2;

gc->loadMatrix(n1,n2);

cout << n1 << " " << n2 << endl;

}

infile.close();

//step 3

while(currNode < gc->numNode){

//step 1

currNode++;

cout<<"current node:"<< currNode << endl;

//step 2

currColor = gc->findUsedColor(currNode);

if(currColor > 0){

gc->adjMatrix[currNode][currNode] = currColor;

}

else{

gc->newColor++;

gc->adjMatrix[currNode][currNode] = gc->newColor;

gc->pushUsedColor(gc->newColor);

}

gc->printMatrix();

}

cout<<endl;

cout<<"Number of colors used to color:" << gc->newColor<<endl;

cout.rdbuf(console);

cout<<"input: "<<argv[1]<<endl;

cout<<"output1: "<<argv[2]<<endl;

cout<<"done"<<endl;

out1.close();

delete gc;

return 0;

}

**Input**

19

1 10

1 17

1 16

1 4

5 2

4 2

6 2

6 3

9 3

12 3

3 4

16 4

15 4

11 4

8 4

9 4

10 4

18 5

5 7

6 5

13 5

14 5

14 6

19 6

12 6

18 7

13 7

12 9

10 16

8 11

14 13

17 16

**Output 1**

1 10

1 17

1 16

1 4

5 2

4 2

6 2

6 3

9 3

12 3

3 4

16 4

15 4

11 4

8 4

9 4

10 4

18 5

5 7

6 5

13 5

14 5

14 6

19 6

12 6

18 7

13 7

12 9

10 16

8 11

14 13

17 16

current node:1

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

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current node:2

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

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0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:3

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

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current node:4

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current node:5

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

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current node:6

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current node:7

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current node:8

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current node:9

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current node:10

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0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:11

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

1 1 1 2 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0

0 1 0 0 2 1 1 0 0 0 0 0 1 1 0 0 0 1 0

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1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0

0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:12

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

1 1 1 2 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0

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1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0

0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:13

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

1 1 1 2 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0

0 1 0 0 2 1 1 0 0 0 0 0 1 1 0 0 0 1 0

0 1 1 0 1 3 0 0 0 0 0 1 0 1 0 0 0 0 1

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0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:14

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

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current node:15

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0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:16

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

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0 0 0 0 1 0 1 0 0 0 0 0 3 1 0 0 0 0 0

0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0

0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 4 1 0 0

1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0

0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:17

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

1 1 1 2 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0

0 1 0 0 2 1 1 0 0 0 0 0 1 1 0 0 0 1 0

0 1 1 0 1 3 0 0 0 0 0 1 0 1 0 0 0 0 1

0 0 0 0 1 0 1 0 0 0 0 0 1 0 0 0 0 1 0

0 0 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0

0 0 1 1 0 0 0 0 3 0 0 1 0 0 0 0 0 0 0

1 0 0 1 0 0 0 0 0 3 0 0 0 0 0 1 0 0 0

0 0 0 1 0 0 0 1 0 0 3 0 0 0 0 0 0 0 0

0 0 1 0 0 1 0 0 1 0 0 2 0 0 0 0 0 0 0

0 0 0 0 1 0 1 0 0 0 0 0 3 1 0 0 0 0 0

0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0

0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 4 1 0 0

1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 2 0 0

0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:18

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

1 1 1 2 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0

0 1 0 0 2 1 1 0 0 0 0 0 1 1 0 0 0 1 0

0 1 1 0 1 3 0 0 0 0 0 1 0 1 0 0 0 0 1

0 0 0 0 1 0 1 0 0 0 0 0 1 0 0 0 0 1 0

0 0 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0

0 0 1 1 0 0 0 0 3 0 0 1 0 0 0 0 0 0 0

1 0 0 1 0 0 0 0 0 3 0 0 0 0 0 1 0 0 0

0 0 0 1 0 0 0 1 0 0 3 0 0 0 0 0 0 0 0

0 0 1 0 0 1 0 0 1 0 0 2 0 0 0 0 0 0 0

0 0 0 0 1 0 1 0 0 0 0 0 3 1 0 0 0 0 0

0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0

0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 4 1 0 0

1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 2 0 0

0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 3 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

current node:19

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0

0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0

1 1 1 2 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0

0 1 0 0 2 1 1 0 0 0 0 0 1 1 0 0 0 1 0

0 1 1 0 1 3 0 0 0 0 0 1 0 1 0 0 0 0 1

0 0 0 0 1 0 1 0 0 0 0 0 1 0 0 0 0 1 0

0 0 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0

0 0 1 1 0 0 0 0 3 0 0 1 0 0 0 0 0 0 0

1 0 0 1 0 0 0 0 0 3 0 0 0 0 0 1 0 0 0

0 0 0 1 0 0 0 1 0 0 3 0 0 0 0 0 0 0 0

0 0 1 0 0 1 0 0 1 0 0 2 0 0 0 0 0 0 0

0 0 0 0 1 0 1 0 0 0 0 0 3 1 0 0 0 0 0

0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0

0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0

1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 4 1 0 0

1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 2 0 0

0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 3 0

0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1

Number of colors used to color:4