

Tugas Praktikum Analisis Algoritma

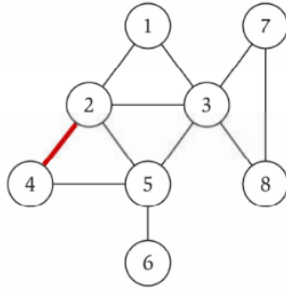


Disusun oleh:
Rahma Batari
140810180051

Program Studi S1 Teknik Informatika
Fakultas Matematika & Ilmu Pengetahuan Alam
Universitas Padjadjaran

Tugas Anda

1. Dengan menggunakan *undirected graph* dan *adjacency matrix* berikut, buatlah koding programnya menggunakan bahasa C++.



	1	2	3	4	5	6	7	8
1	0	1	1	0	0	0	0	0
2	1	0	1	1	1	0	0	0
3	1	1	0	0	1	0	1	1
4	0	1	0	1	1	0	0	0
5	0	1	1	1	0	1	0	0
6	0	0	0	0	1	0	0	0
7	0	0	1	0	0	0	0	1
8	0	0	1	0	0	0	1	0

/*

Nama : Rahma Batari

NPM : 140810180051

Kelas: A

*/

/*

* C++ Program to Implement Adjacency Matrix

*/

#include <iostream>

#include <cstdlib>

using namespace std;

#define MAX 20

/*

* Class untuk Adjacency Matrix

*/

class AdjacencyMatrix

{

private:

int n;

int **adj;

bool *visited;

public:

AdjacencyMatrix(int n)

{

this->n = n;

visited = new bool [n];

adj = new int* [n];

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

{

adj[i] = new int [n];

for(int j = 0; j < n; j++)

```
        {
            adj[i][j] = 0;
        }
    }
}
/*
 * Menambahkan edge ke graf
 */
void add_edge(int origin, int destin)
{
    if( origin > n || destin > n || origin < 0 || destin < 0)
    {
        cout<<"Invalid edge!\n";
    }
    else
    {
        adj[origin - 1][destin - 1] = 1;
    }
}
/*
 * Mencetak graf
 */
void display()
{
    int i,j;
    for(i = 0;i < n;i++)
    {
        for(j = 0; j < n; j++)
            cout<<adj[i][j]<<" ";
        cout<<endl;
    }
}
};
/*
 * Main
 */
int main()
{
    int nodes, max_edges, origin, destin;
    cout<<"Enter number of nodes: ";
    cin>>nodes;
    AdjacencyMatrix am(nodes);
    max_edges = nodes * (nodes - 1);
```

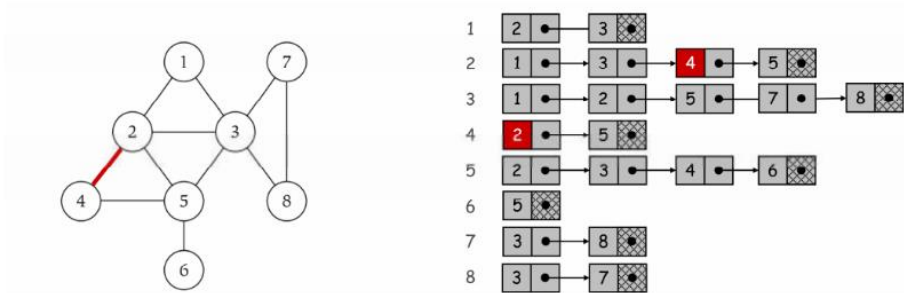
```
for (int i = 0; i < max_edges; i++)
{
    cout<<"Enter edge (-1 -1 to exit): ";
    cin>>origin>>destin;
    if((origin == -1) && (destin == -1))
        break;
    am.add_edge(origin, destin);
}
am.display();
return 0;
}
```

C:\Users\WINDOWS\Documents\Kuliah\Semester 4\Analisis Algoritma\Praktikum\AnalgoKu6\1. AdjacencyMatrix.exe

```
Enter edge (-1 -1 to exit): 1 2
Enter edge (-1 -1 to exit): 1 3
Enter edge (-1 -1 to exit): 2 1
Enter edge (-1 -1 to exit): 2 3
Enter edge (-1 -1 to exit): 2 4
Enter edge (-1 -1 to exit): 2 5
Enter edge (-1 -1 to exit): 3 1
Enter edge (-1 -1 to exit): 3 2
Enter edge (-1 -1 to exit): 3 5
Enter edge (-1 -1 to exit): 3 7
Enter edge (-1 -1 to exit): 3 8
Enter edge (-1 -1 to exit): 4 2
Enter edge (-1 -1 to exit): 4 4
Enter edge (-1 -1 to exit): 4 5
Enter edge (-1 -1 to exit): 5 2
Enter edge (-1 -1 to exit): 5 3
Enter edge (-1 -1 to exit): 5 4
Enter edge (-1 -1 to exit): 5 6
Enter edge (-1 -1 to exit): 6 5
Enter edge (-1 -1 to exit): 7 3
Enter edge (-1 -1 to exit): 7 8
Enter edge (-1 -1 to exit): 8 3
Enter edge (-1 -1 to exit): 8 7
Enter edge (-1 -1 to exit): -1 -1
0 1 1 0 0 0 0 0
1 0 1 1 1 0 0 0
1 1 0 0 1 0 1 1
0 1 0 1 1 0 0 0
0 1 1 1 0 1 0 0
0 0 0 0 1 0 0 0
0 0 1 0 0 0 0 1
0 0 1 0 0 0 1 0
```

```
-----
Process exited after 58.18 seconds with return value 0
Press any key to continue . . .
```

2. Dengan menggunakan *undirected graph* dan representasi *adjacency list*, buatlah koding programnya menggunakan bahasa C++.



```
/*
```

```
  Nama : Rahma Batari
```

```
  NPM : 140810180051
```

```
  Kelas: A
```

```
*/
```

```
/*
```

```
  * C++ Program to Implement Adjacency List
```

```
*/
```

```
#include <iostream>
```

```
#include <cstdlib>
```

```
using namespace std;
```

```
/*
```

```
  * Adjacency List Node
```

```
*/
```

```
struct AdjListNode
```

```
{
```

```
    int dest;
```

```
    struct AdjListNode* next;
```

```
};
```

```
/*
```

```
  * Adjacency List
```

```
*/
```

```
struct AdjList
```

```
{
```

```
    struct AdjListNode *head;
```

```
};
```

```
/*
```

```
* Class Graph
*/
class Graph
{
    private:
        int V;
        struct AdjList* array;
    public:
        Graph(int V)
        {
            this->V = V;
            array = new AdjList [V];
            for (int i = 0; i < V; ++i)
                array[i].head = NULL;
        }
    /*
        * Creating New Adjacency List Node
    */
    AdjListNode* newAdjListNode(int dest)
    {
        AdjListNode* newNode = new AdjListNode;
        newNode->dest = dest;
        newNode->next = NULL;
        return newNode;
    }
    /*
        * Adding Edge to Graph
    */
    void addEdge(int src, int dest)
    {
        AdjListNode* newNode = newAdjListNode(dest);
        newNode->next = array[src].head;
        array[src].head = newNode;
        newNode = newAdjListNode(src);
        newNode->next = array[dest].head;
        array[dest].head = newNode;
    }
    /*
        * Print the graph
    */
    void printGraph()
    {
        int v;
```

```
        for (v = 1; v <= V; ++v)
        {
            AdjListNode* pCrawl = array[v].head;
            cout<<"\n Adjacency list of vertex "<<v<<"\n head ";
            while (pCrawl)
            {
                cout<<"-> "<<pCrawl->dest;
                pCrawl = pCrawl->next;
            }
            cout<<endl;
        }
    };

    /*
    * Main
    */
    int main()
    {
        Graph gh(8);
        gh.addEdge(1, 2);
        gh.addEdge(1, 3);
        gh.addEdge(2, 4);
        gh.addEdge(2, 5);
        gh.addEdge(2, 3);
        gh.addEdge(3, 7);
        gh.addEdge(3, 8);
        gh.addEdge(4, 5);
        gh.addEdge(5, 3);
        gh.addEdge(5, 6);
        gh.addEdge(7, 8);

        // print the adjacency list representation of the above graph
        gh.printGraph();

        return 0;
    }
```

```

C:\Users\WINDOWS\Documents\Kuliah\Semester 4\Analisis Algoritma\Praktikum\AnalgoKu6\2. AdjacencyList.exe

Adjacency list of vertex 1
head -> 3-> 2

Adjacency list of vertex 2
head -> 3-> 5-> 4-> 1

Adjacency list of vertex 3
head -> 5-> 8-> 7-> 2-> 1

Adjacency list of vertex 4
head -> 5-> 2

Adjacency list of vertex 5
head -> 6-> 3-> 4-> 2

Adjacency list of vertex 6
head -> 5

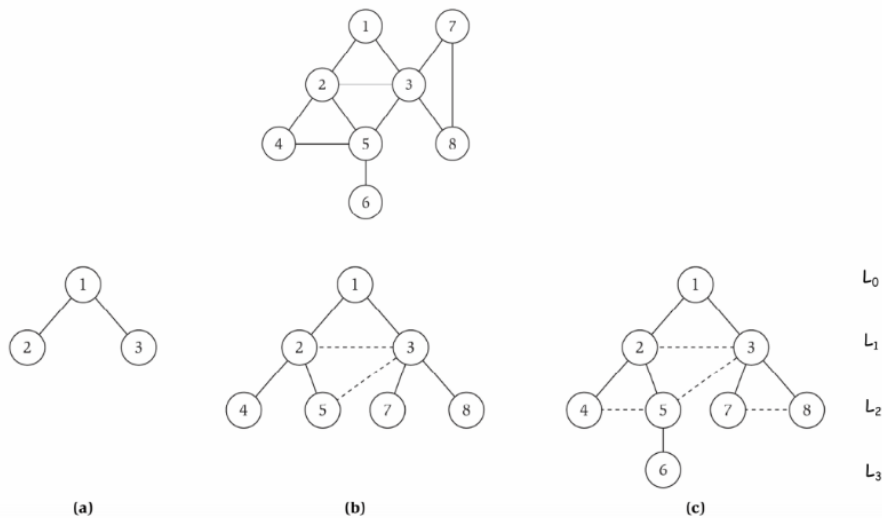
Adjacency list of vertex 7
head -> 8-> 3

Adjacency list of vertex 8
head -> 7-> 3

-----
Process exited after 5.456 seconds with return value 255
Press any key to continue . . .

```

3. Buatlah program Breadth First Search dari algoritma BFS yang telah diberikan. Kemudian uji coba program Anda dengan menginputkan *undirected graph* sehingga menghasilkan tree BFS. Hitung dan berikan secara asimptotik berapa kompleksitas waktunya dalam Big- Θ !



/*

Nama : Rahma Batari

NPM : 140810180051

Kelas: A

***/**

```
// Program to print BFS traversal from a given  
// source vertex. BFS(int s) traverses vertices  
// reachable from s.  
#include<iostream>  
#include <list>
```

```
using namespace std;
```

```
// This class represents a directed graph using  
// adjacency list representation
```

```
class Graph  
{  
int V; // No. of vertices
```

```
// Pointer to an array containing adjacency  
// lists  
list<int> *adj;
```

```
public:  
Graph(int V); // Constructor
```

```
// function to add an edge to graph  
void addEdge(int v, int w);
```

```
// prints BFS traversal from a given source s  
void BFS(int s);  
};
```

```
Graph::Graph(int V)  
{  
this->V = V;  
adj = new list<int>[V];  
}
```

```
void Graph::addEdge(int v, int w)  
{  
adj[v].push_back(w); // Add w to v's list.  
}
```

```
void Graph::BFS(int s)  
{
```

```
// Mark all the vertices as not visited
bool *visited = new bool[V];
for(int i = 0; i < V; i++)
visited[i] = false;

// Create a queue for BFS
list<int> queue;

// Mark the current node as visited and enqueue it
visited[s] = true;
queue.push_back(s);

// 'i' will be used to get all adjacent
// vertices of a vertex
list<int>::iterator i;

while(!queue.empty())
{
// Dequeue a vertex from queue and print it
s = queue.front();
cout << s << " ";
queue.pop_front();

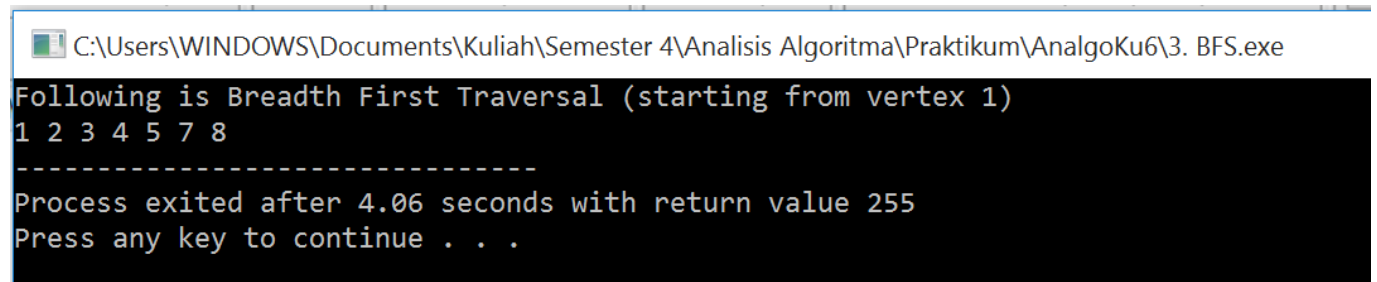
// Get all adjacent vertices of the dequeued
// vertex s. If a adjacent has not been visited,
// then mark it visited and enqueue it
for (i = adj[s].begin(); i != adj[s].end(); ++i)
{
    if (!visited[*i])
    {
        visited[*i] = true;
        queue.push_back(*i);
    }
}
}
}

// Driver program to test methods of graph class
int main()
{
// Create a graph given in the above diagram
Graph g(8);
    g.addEdge(1, 2);
}
```

```
g.addEdge(1, 3);
g.addEdge(2, 4);
    g.addEdge(2, 5);
    g.addEdge(2, 3);
    g.addEdge(3, 7);
    g.addEdge(3, 8);
    g.addEdge(4, 5);
    g.addEdge(5, 3);
    g.addEdge(5, 6);
    g.addEdge(7, 8);

cout << "Following is Breadth First Traversal "
<< "(starting from vertex 1) \n";
g.BFS(1);

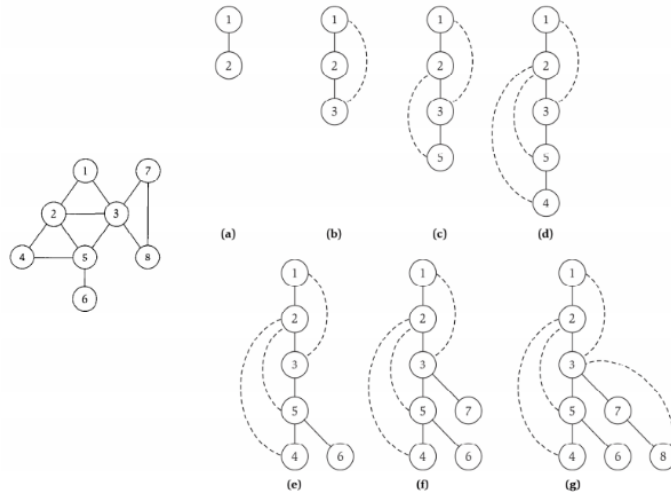
return 0;
}
```



The screenshot shows a Windows command prompt window with the title bar "C:\Users\WINDOWS\Documents\Kuliah\Semester 4\Analisis Algoritma\Praktikum\AnalgoKu6\3. BFS.exe". The command prompt displays the output of the BFS program: "Following is Breadth First Traversal (starting from vertex 1)", followed by the sequence of vertices "1 2 3 4 5 7 8" on the next line. Below this, a separator line of dashes is shown. The final output lines are "Process exited after 4.06 seconds with return value 255" and "Press any key to continue . . .".

BFS merupakan metode pencarian secara melebar sehingga mengunjungi node dari kiri ke kanan di level yang sama. Apabila semua node pada suatu level sudah dikunjungi semua, maka akan berpindah ke level selanjutnya. Dalam worst case BFS harus mempertimbangkan semua jalur (path) untuk semua node yang mungkin, maka nilai kompleksitas waktu dari BFS adalah $O(|V| + |E|)$.

4. Buatlah program Depth First Search dari algoritma DFS yang telah diberikan. Kemudian uji coba program Anda dengan menginputkan *undirected graph* sehingga menghasilkan tree DFS. Hitung dan berikan secara asimptotik berapa kompleksitas waktunya dalam Big- Θ !



/*

Nama : Rahma Batari

NPM : 140810180051

Kelas: A

*/

```
#include<iostream>
```

```
#include<list>
```

```
using namespace std;
```

```
// Graph class merepresentasikan graf berarah menggunakan representasi adjacency list
```

```
class Graph
```

```
{
```

```
int V; // No. simpul
```

```
// Pointer ke array yang memiliki adjacency lists
```

```
list<int> *adj;
```

```
// Fungsi rekursif yang digunakan DFS
```

```
void DFSUtil(int v, bool visited[]);
```

```
public:
```

```
Graph(int V); // Constructor
```

```
// fungsi untuk menambah tepian ke graf
```

```
void addEdge(int v, int w);
```

// DFS traversal dari simpul yang terjangkau dari v

void DFS(int v);

};

Graph::Graph(int V)

{

this->V = V;

adj = new list<int>[V];

}

void Graph::addEdge(int v, int w)

{

adj[v].push_back(w); // Menambah w ke list v.

}

void Graph::DFSUtil(int v, bool visited[])

{

// Menandakan node bersangkutan sudah dikunjungi lalu cetak

visited[v] = true;

cout << v << " ";

// Ulang simpul berdekatan ke node ini

list<int>::iterator i;

for (i = adj[v].begin(); i != adj[v].end(); ++i)

if (!visited[*i])

DFSUtil(*i, visited);

}

// DFS traversal dari simpul terjangkau dari v.

// Menggunakan rekursif DFSUtil()

void Graph::DFS(int v)

{

// Menandakan semua simpul belum dikunjungi

bool *visited = new bool[V];

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

visited[i] = false;

// Memanggil fungsi rekursif pembantu untuk mencetak DFS traversal

DFSUtil(v, visited);

}

int main()

{

// Membuat graf di diagram

Graph g(8);

g.addEdge(1, 2);

g.addEdge(1, 3);

g.addEdge(2, 5);

g.addEdge(2, 4);

g.addEdge(5, 6);

g.addEdge(3, 7);

g.addEdge(3, 8);

g.addEdge(7, 8);

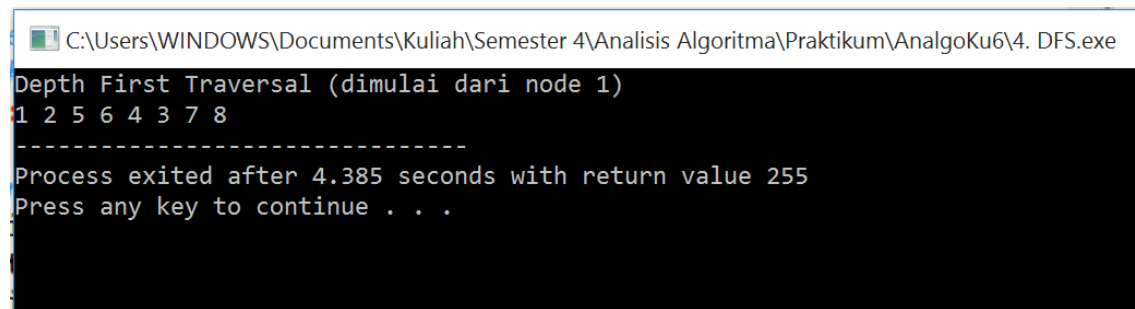
cout << "Depth First Traversal"

" (dimulai dari node 1) \n";

g.DFS(1);

return 0;

}



```
C:\Users\WINDOWS\Documents\Kuliah\Semester 4\Analisis Algoritma\Praktikum\AnalgoKu6\4. DFS.exe
Depth First Traversal (dimulai dari node 1)
1 2 5 6 4 3 7 8
-----
Process exited after 4.385 seconds with return value 255
Press any key to continue . . .
```

DFS merupakan metode pencarian mendalam, yang mengunjungi semua node dari yang terkiri lalu geser ke kanan hingga semua node dikunjungi. Kompleksitas ruang algoritma DFS adalah $O(bm)$, karena kita hanya perlu menyimpan satu buah lintasan tunggal dari akar sampai daun, ditambah dengan simpul-simpul saudara kandungnya yang belum dikembangkan.