TUGAS MODUL PRAKTIKUM 6

Untuk Memenuhi Tugas

Mata Kuliah Praktikum Analisis Algoritma

Disusun oleh :

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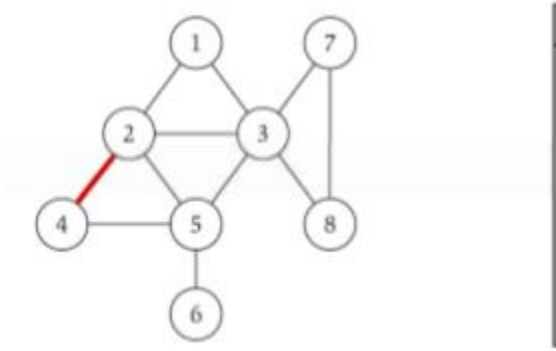
TEKNIK INFORMATIKA

FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

UNIVERSITAS PADJADJARAN

2019

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

Jawab :

Program :

```
/*
 * 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;
```

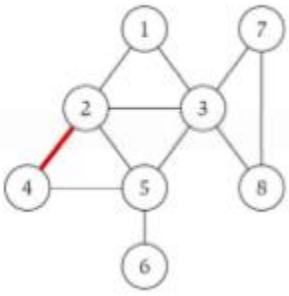
```
    visited = new bool [n];
    adj = new int* [n];
    for (int i = 0; i < n; i++)
    {
        adj[i] = new int [n];
        for(int j = 0; j < n; j++)
        {
            adj[i][j] = 0;
        }
    }
}
/*
 * Menambahkan edge ke graf
 */
void add_edge(int origin, int destin)
{
    if( origin > 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++)
```

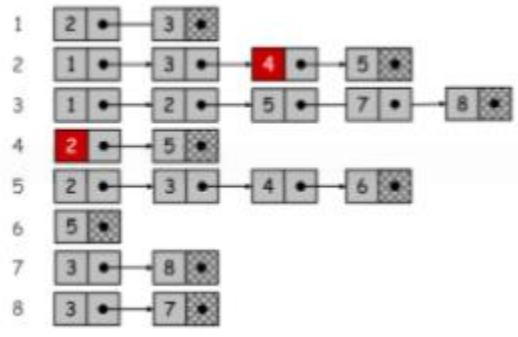
```
            {
                for(j = 0; j < n; j++)
                    cout<<adj[i][j]<<"  ";
                cout<<endl;
            }
        }
};
/*
 * Main
 */
int main()
{
    int nodes, max_edges, origin, destin;
    cout<<"Enter number of nodes: ";
    cin>>nodes;
    AdjacencyMatrix am(nodes);
    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;
}
```

Screenshot :

```
Enter number of nodes: 8
Enter edge (-1 -1 to exit): 4 4
Enter edge (-1 -1 to exit): 1 3
Enter edge (-1 -1 to exit): 3 1
Enter edge (-1 -1 to exit): 1 2
Enter edge (-1 -1 to exit): 2 1
Enter edge (-1 -1 to exit): 2 4
Enter edge (-1 -1 to exit): 4 2
Enter edge (-1 -1 to exit): 2 5
Enter edge (-1 -1 to exit): 5 2
Enter edge (-1 -1 to exit): 2 3
Enter edge (-1 -1 to exit): 3 2
Enter edge (-1 -1 to exit): 4 5
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): 5 3
Enter edge (-1 -1 to exit): 3 5
Enter edge (-1 -1 to exit): 3 7
Enter edge (-1 -1 to exit): 7 3
Enter edge (-1 -1 to exit): 3 8
Enter edge (-1 -1 to exit): 8 3
Enter edge (-1 -1 to exit): 7 8
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
```

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





Jawab :

Program :

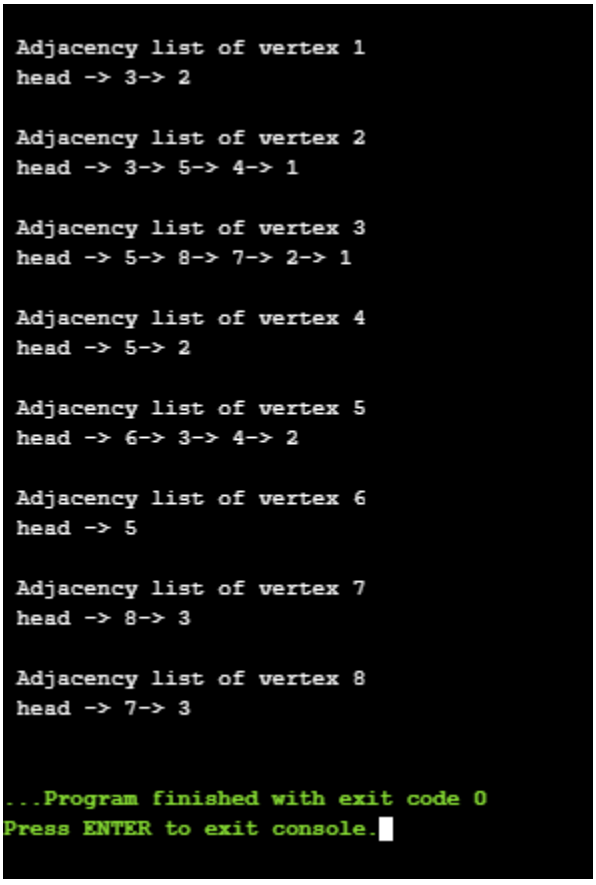
```
/*
 * C++ Program to Implement Adjacency List
 */
#include <iostream>
#include <cstdlib>
using namespace std;

/*
 * 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;
```

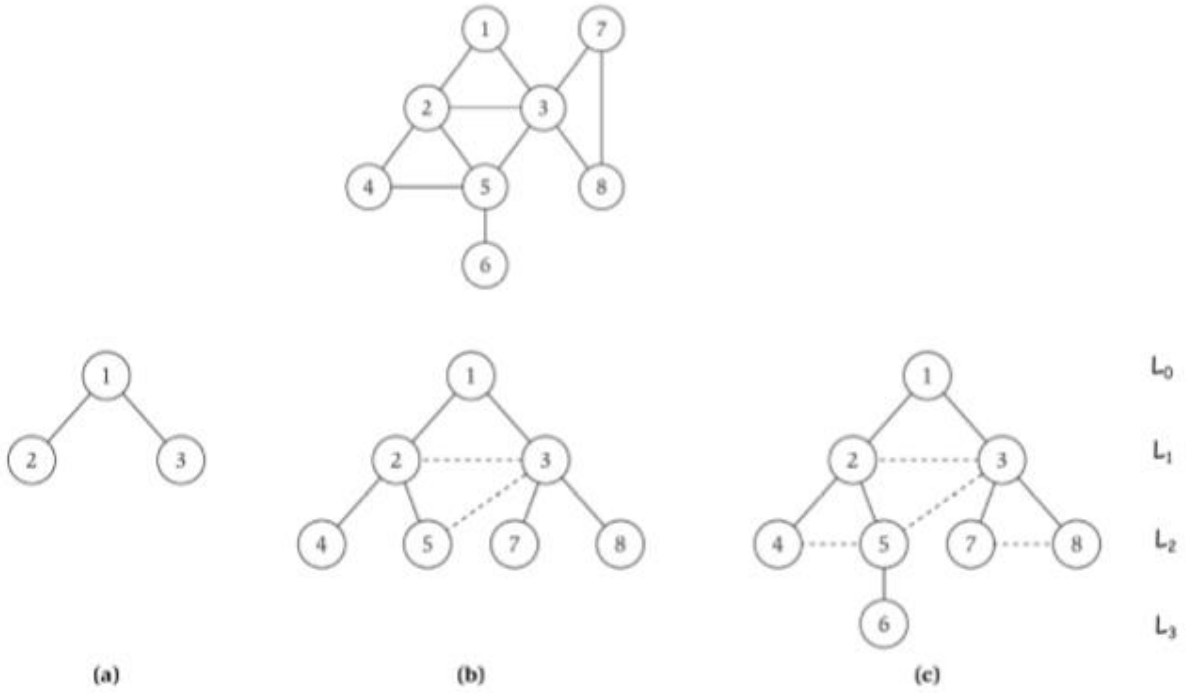
```
        }
        /*
         * Print the graph
         */
        void printGraph()
        {
            int v;
            for (v = 1; v <= V; ++v)
            {
                AdjListNode* pCrawl = array[v].head;
                cout<<"\n Adjacency list of vertex "<<v<<"\n head ";
                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;
}
```

Screenshot :



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!



Jawab :

Program :

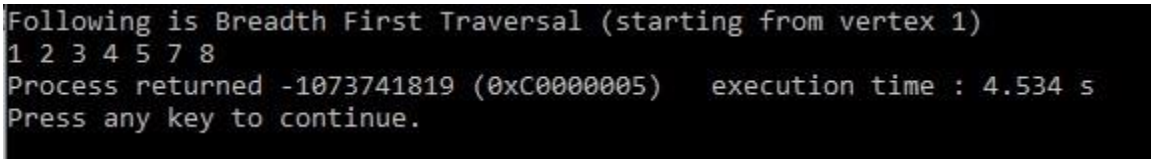
```
// Program to print BFS traversal from a given
// source vertex. BFS(int s) traverses vertices
// reachable from s.
#include<iostream>
#include <list>

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;
}
```

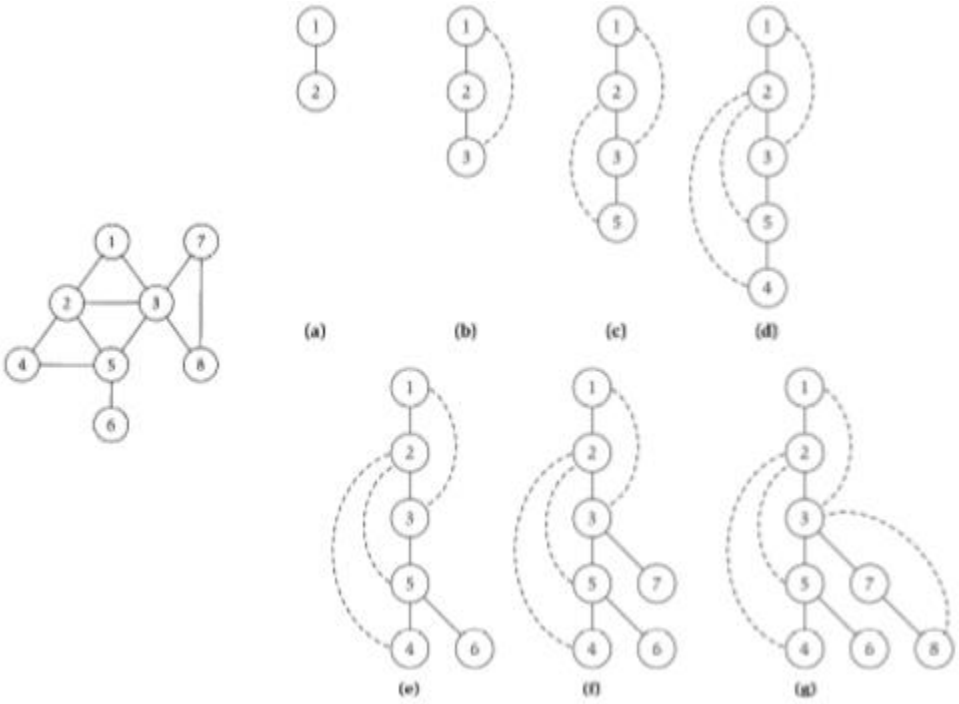
Screenshot :



Karena Big-O dari BFS adalah O(V+E) dimana V itu jumlah vector dan E itu adalah jumlah edges maka Big-O = O(n) dimana n = v+e

Maka dari itu Big-Θ nya adalah Θ(n).

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!



Jawab :

Program :

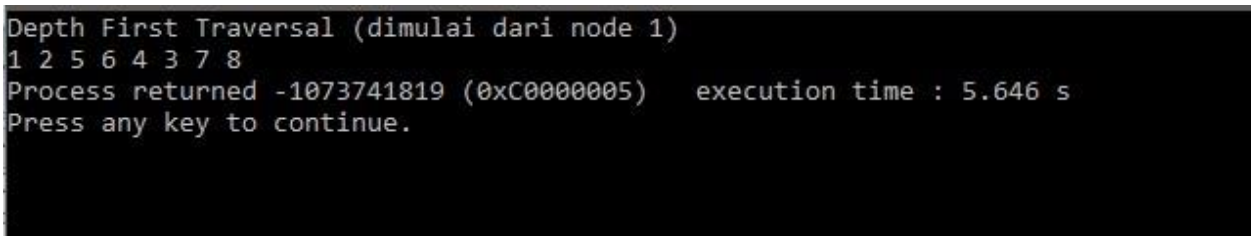
```
#include<iostream>
#include<list>
using namespace std;


// 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;
}
```

Screenshot :



Kompleksitas waktu : O(V+E)O(V+E), saat diimplementasikan menggunakan *adjacency list*.