TUGAS 6 PRAKTIKUM
DASAR ANALISIS ALGORITMA GRAF
STUDI KASUS: BREADTH FIRST SEARCH DAN DEPTH FIRST SEARCH

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PROGRAM STUDI S-1 TEKNIK INFORMATIKA
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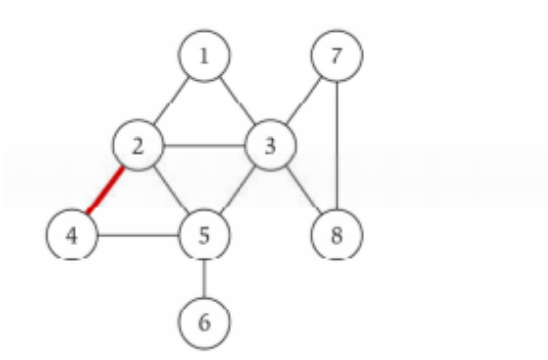
2019

Nomor 1: Adjacency Matriks

Dengan menggunakan *undirected graph* dan *adjacency matrix* berikut, buatlah koding programmnya 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

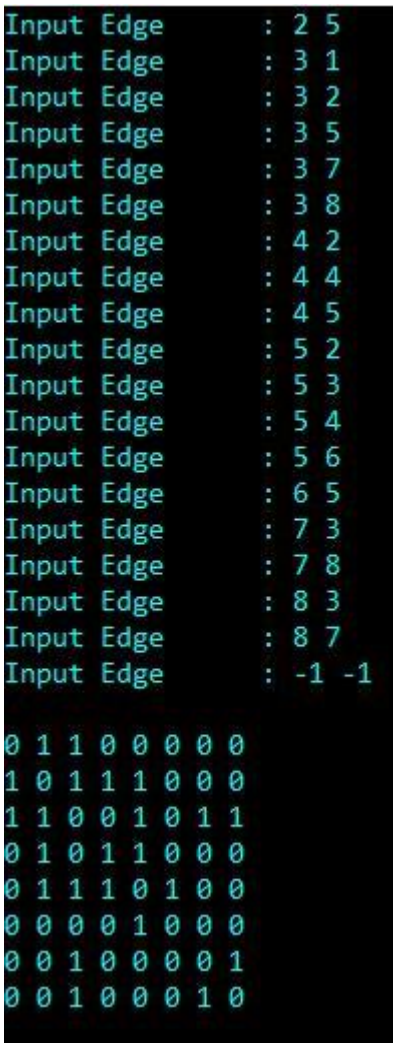
Jawab :

- Source code

```
#include <iostream>
#include <cstdlib>
using namespace std;
#define MAX 20
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;
 }
 }
 }

 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;
 }
```

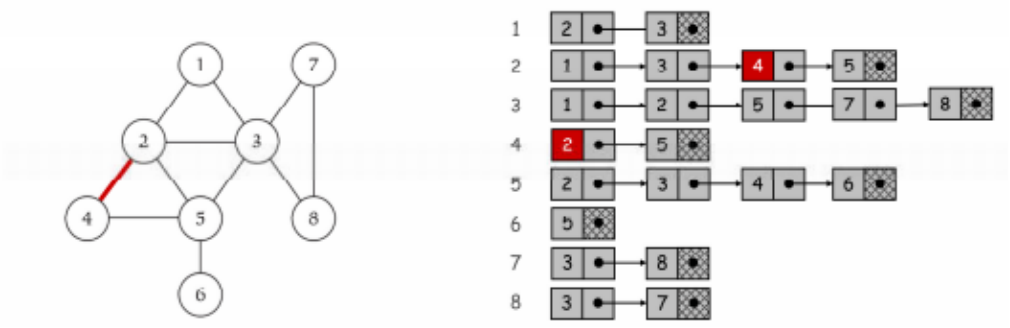
```
 }
 void display(){
 int i;
 int j;
 for(i=0; i<n; i++){
 for(j=0; j<n; j++){
 cout << adj[i][j]<<" ";
 }
 cout << endl;
 }
 }
};
int main(){
 int nodes;
 int max_edges;
 int origin;
 int destin;
 cout << "\nInput banyak Nodes\t: "; cin >> nodes;

 AdjacencyMatrix am(nodes);
 max_edges = nodes * (nodes - 1);
 cout<<"\nMasukkan Edge (misalnya: 2 4)\n(input : -1 -
1 untuk keluar program)\n";
 for (int i=0; i<max_edges; i++){
 cout<<"Input Edge\t: "; cin >> origin >>
 destin; if((origin==-1) && (destin==-1)){
 break;
 }
 am.add_edge(origin, destin);
 }
 cout << endl;
 am.display();
 return 0;
}
```

- Screenshoot program



Nomor 2: Adjacency List

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



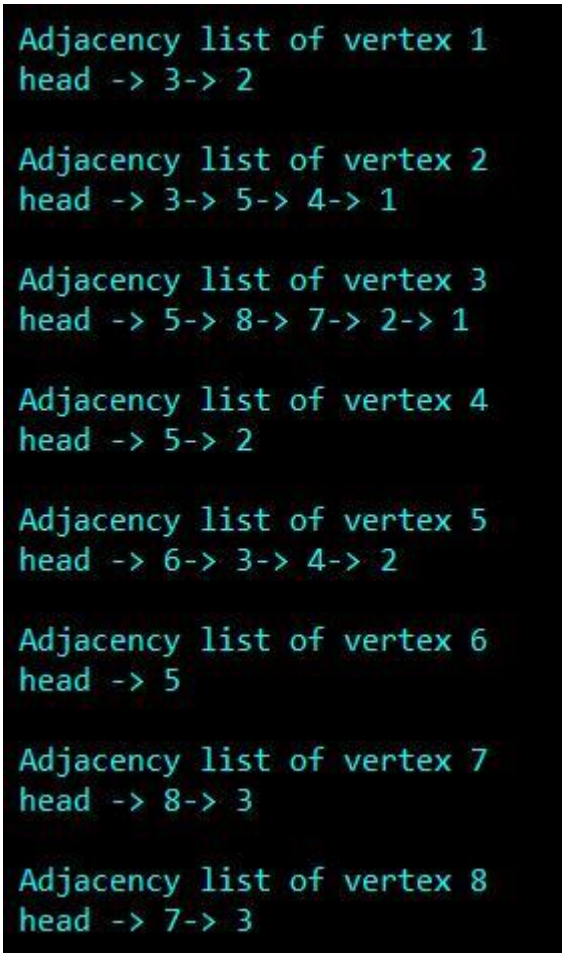
Jawab :

- Source code

```
#include <iostream>
#include <cstdlib>
using namespace std;
struct AdjListNode{
 int dest;
 struct AdjListNode* next;
};
struct AdjList{
 struct AdjListNode *head;
};
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;
 }
 AdjListNode* newAdjListNode(int dest){
 AdjListNode* newNode = new AdjListNode;
 newNode->dest = dest;
 newNode->next = NULL;
 return newNode;
 }
 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;
 }

 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;
 }
 }
};
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);
 gh.printGraph();
 return 0;
}
```

- Screenshoot program



Nomor 3: BFS

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:

- Source code

```
#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;
}
```

- Screenshoot

```
Following is Breadth First Traversal (starting from vertex 1)
1 2 3 4 5 7 8
```

- Kompleksitas waktu: O(V + E) dengan V adalah simpul dan E adalah tepian, maka Big-O = O(n) dimana n = v+e
  Big-θ = θ(n)

Nomor 4: DFS

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!

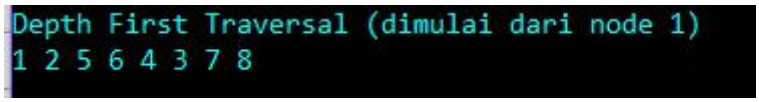
Jawab:

- Source code

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

// Graph class merepresentasikan graf berarah menggunakan representasi
ad jacency 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;
}
```

- Screenshoot



- Kompleksitas waktu : O(V+E)O(V+E), diimplementasikan dengan adjacency list