Tugas Praktikum Analisis Algoritma

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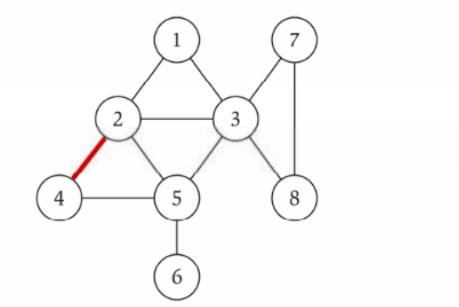
Tugas Anda

1. 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

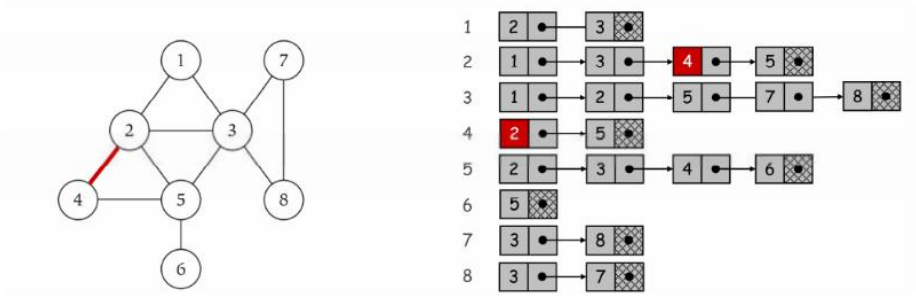
```
/*
Nama : Rahma Batari
NPM  : 140810180051
Kelas: A
*/

/*
 * 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 number of nodes: 4
Enter edge (-1 -1 to exit): 1 3
Enter edge (-1 -1 to exit): 3 1
Enter edge (-1 -1 to exit): 2 2
Enter edge (-1 -1 to exit): -1 -1
0  0  1  0
0  1  0  0
1  0  0  0
0  0  0  0

--------------------------------
Process exited after 12.19 seconds with return value 0
Press any key to continue . . .
```

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

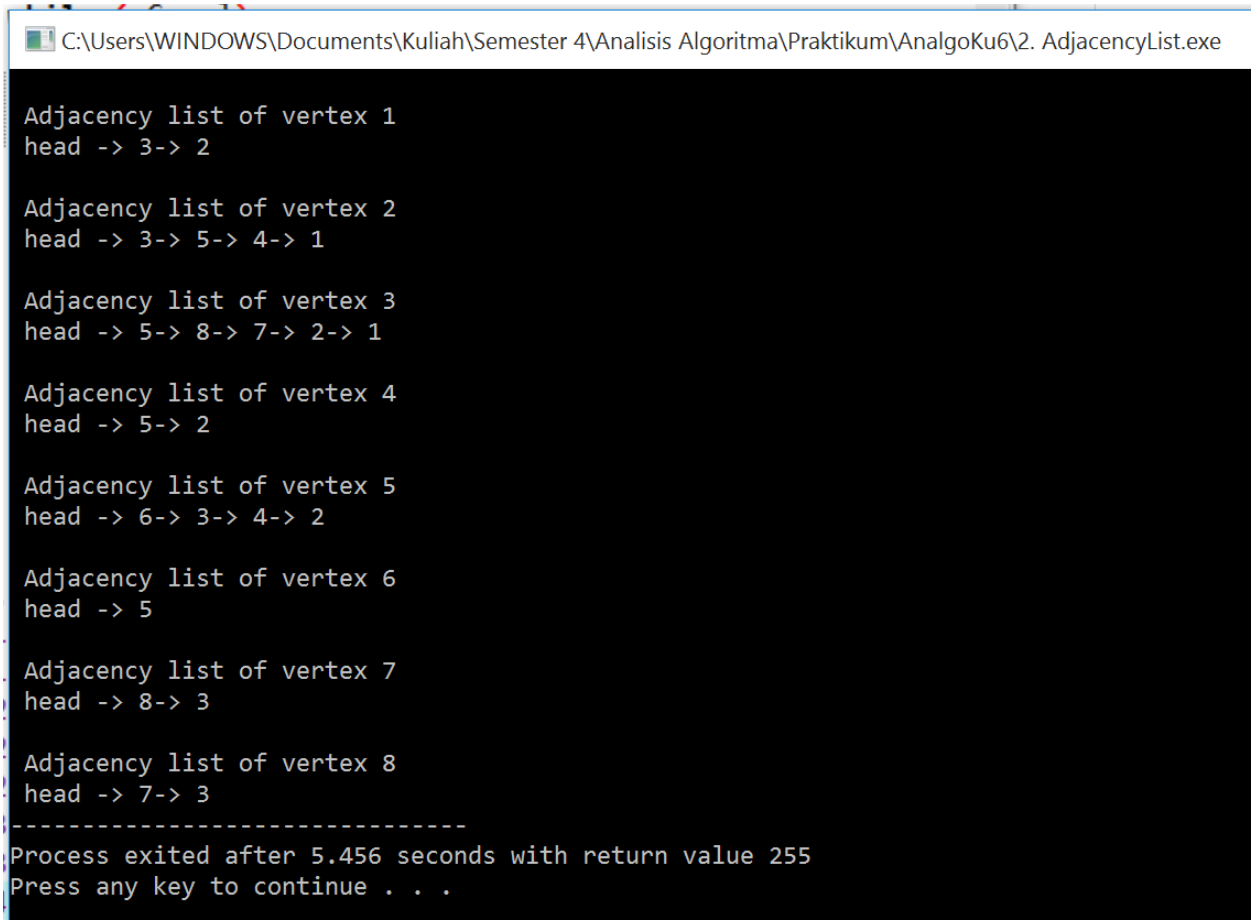



```
/*
Nama : Rahma Batari
NPM  : 140810180051
Kelas: A
*/
```

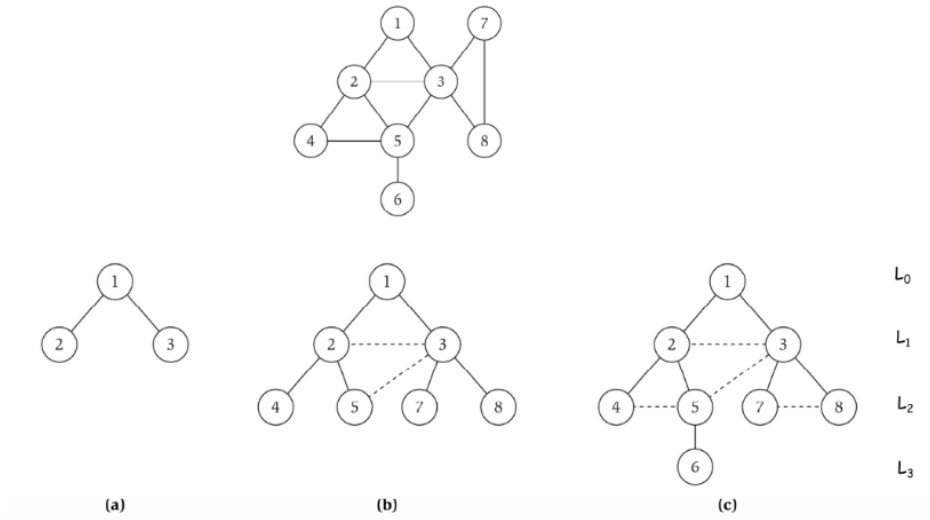
```
/*
 * C++ Program to Implement Adjacency List
 */
#include <iostream>
#include <cstdlib>
using namespace std;

/*
 * 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;
}
```



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!




```
/*
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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
```
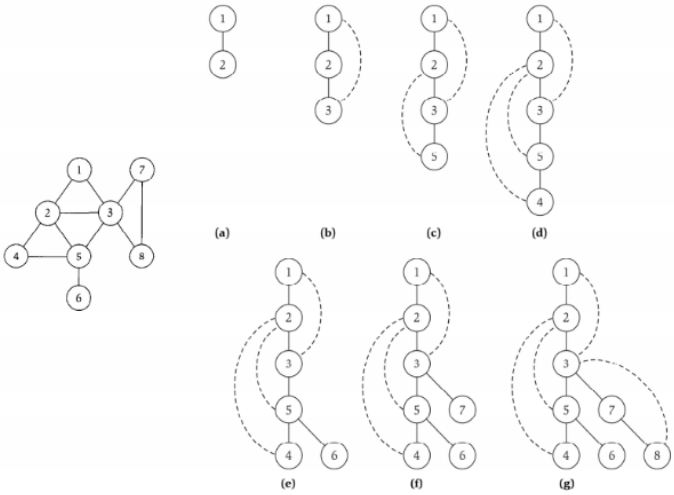

```
void addEdge(int v, int w);

// 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;
}
```

```
C:\Users\WINDOWS\Documents\Kuliah\Semester 4\Analisis Algoritma\Praktikum\AnalgoKu6\3. BFS.exe
Following is Breadth First Traversal (starting from vertex 1)
1 2 3 4 5 7 8
--------------------------------
Process exited after 4.06 seconds with return value 255
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!

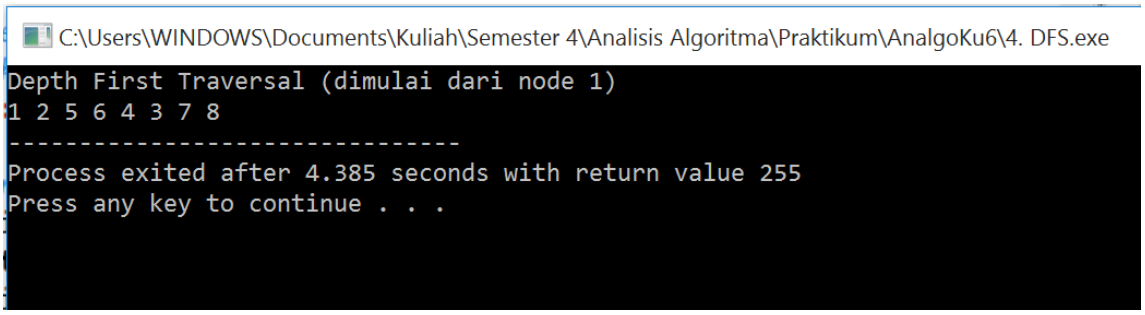


/*
Nama : Rahma Batari
NPM : 140810180051
Kelas: A
***/**

```
#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;
}
```



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 hanya perlu menyimpan satu buah lintasan tunggal dari akar sampai daun, ditambah dengan simpul-simpul saudara kandungnya yang belum dikembangkan.