A Practical Activity Report For
Data Structures and Algorithms (UCS406)

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Submitted To:

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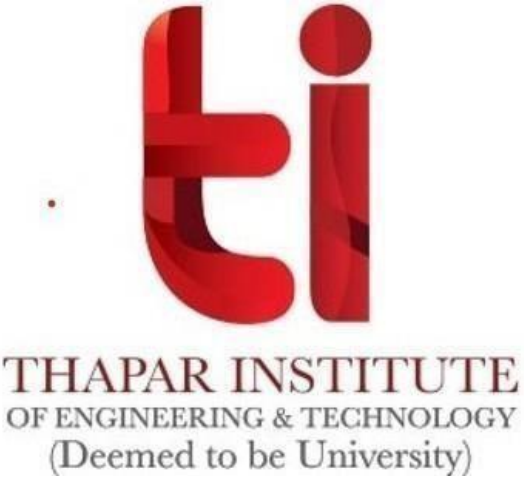

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

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ASSIGNMENT 11

QUESTION 1:

Write a program for the implementation of Breadth First Search(BFS) for a given Graph.

```
#include<iostream>
#include<list>
using namespace std;
class grph
{
 int V;
list&lt;int&gt; *adj;
public:
grph(int V);
void adEg(int v, int w);
void BFS(int s);
};

grph::grph(int V)
{
this-&gt;V = V;
adj = new list&lt;int&gt;[V];
}

void grph::adEg(int v, int w)
{
adj[v].push_back(w);
}

void grph::BFS(int s)
{
bool *vsitd = new bool[V];
for(int i = 0; i &lt; V; i++)
vsitd[i] = false;
list&lt;int&gt; queue;
vsitd[s] = true;
queue.push_back(s);
list&lt;int&gt;::iterator i;
while(!queue.empty())
{
s = queue.front();
cout &lt;&lt; s &lt;&lt; &quot; &quot;;
```

```
queue.pop_front();
for (i = adj[s].begin(); i != adj[s].end(); ++i)
{
if (!vsitd[*i])
{
vsitd[*i] = true;
queue.push_back(*i);
}
 }
}

}
int main()
{
 grph g(4);
g.adEg(0, 3);
g.adEg(0, 2);
g.adEg(1, 2);
g.adEg(2, 0);
g.adEg(3, 1);
g.adEg(3, 3);
cout &lt;&lt; &quot;Following is Breadth First Traversal &quot;
&lt;&lt; &quot;(starting from vertex 2) \n&quot;;
g.BFS(2);

return 0;
 }
```

QUESTION 2:

Write a program for the implementation of Depth First Search(DFS) for a given graph

```
#include<iostream>
#include<list>
using namespace std;
class grph
{
int V;
list&lt;int&gt; *adj;
void DFSUtil(int v, bool vstd[]);
public:
grph(int V); // Constructor
```

```
void adEg(int v, int w);
void DFS(int v);
};
grph::grph(int V)
{
this-&gt;V = V;
adj = new list&lt;int&gt;[V];
}

void grph::adEg(int v, int w)
{
adj[v].push_back(w);
}

void grph::DFSUtil(int v, bool vstd[])
{
vstd[v] = true;
cout &lt;&lt; v &lt;&lt; &quot; &quot;;
list&lt;int&gt;::iterator i;
for (i = adj[v].begin(); i != adj[v].end(); ++i)

if (!vstd[*i])
DFSUtil(*i, vstd);

}
void grph::DFS(int v)
{
bool *vstd = new bool[V];
for (int i = 0; i &lt; V; i++)
vstd[i] = false;
DFSUtil(v, vstd);
}
int main()
{
grph g(4);
g.adEg(0, 1);
g.adEg(1, 2);
g.adEg(2, 2);
g.adEg(2, 0);
g.adEg(2, 3);
g.adEg(3, 3);

cout &lt;&lt; &quot;Following is Depth First Traversal&quot;
```

```
&amp;quot; (starting from vertex 2) \n&amp;quot;;

g.DFS(2);
return 0;
 }
```

QUESTION 3: Write a program for Dijkstra's Shortest path algorithm for a given graph.

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


int findMinVertex(int* distance, bool* visited, int n){

    int minVertex = -1;
    for(int i = 0; i < n; i++){
        if(!visited[i] && (minVertex == -1 ||  distance[i] < distance[minVertex])){
            minVertex = i;
        }
    }
    return minVertex;
}

void dijkstra(int** edges, int n){
    int* distance = new int[n];
    bool* visited = new bool[n];

    for(int i = 0; i < n; i++){
        distance[i] = INT_MAX;
        visited[i] = false;
    }

    distance[0] = 0;

    for(int i = 0; i < n - 1; i++){
        int minVertex = findMinVertex(distance, visited, n);
        visited[minVertex] = true;
        for(int j = 0; j < n; j++){
            if(edges[minVertex][j] != 0 && !visited[j]){
                int dist = distance[minVertex] + edges[minVertex][j];
                if(dist < distance[j]){
                    distance[j] = dist;
                }
            }
        }
```

```
    }

    for(int i = 0; i < n; i++){
        cout << i << " " << distance[i] << endl;
    }
    delete [] visited;
    delete [] distance;

}

int main() {
    int n;
    int e;
    cin >> n >> e;
    int** edges = new int*[n];
    for (int i = 0; i < n; i++) {
        edges[i] = new int[n];
        for (int j = 0; j < n; j++) {
            edges[i][j] = 0;
        }
    }

    for (int i = 0; i < e; i++) {
        int f, s, weight;
        cin >> f >> s >> weight;
        edges[f][s] = weight;
        edges[s][f] = weight;
    }
    cout << endl;
    dijkstra(edges, n);

    for (int i = 0; i < n; i++) {
        delete [] edges[i];
    }
    delete [] edges;
}
```

QUESTION 4:

Write a program to for Prim's and Kruskal algorithms for finding the minimum spanning tree.

Prim's Algorithm :-

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

int findMinVertex(int* weights, bool* visited, int n){
```

```
    int minVertex = -1;
    for(int i = 0; i < n; i++){
        if(!visited[i] && (minVertex == - 1 || weights[i] < weights[minVertex])){
            minVertex = i;
        }
    }
    return minVertex;
}


void prims(int** edges, int n){

    int* parent = new int[n];
    int* weights = new int[n];
    bool* visited = new bool[n];

    for(int i = 0; i < n; i++){
        visited[i] = false;
        weights[i] = INT_MAX;
    }
    parent[0] = -1;
    weights[0] = 0;

    for(int i = 0; i < n - 1; i++){
        // Find Min Vertex
        int minVertex = findMinVertex(weights, visited, n);
        visited[minVertex] = true;
        // Explore un visted neighbours
        for(int j = 0; j < n; j++){
            if(edges[minVertex][j] != 0 && !visited[j]){
                if(edges[minVertex][j] < weights[j]){
                    weights[j] = edges[minVertex][j];
                    parent[j] = minVertex;
                }
            }
        }
    }

    for(int i = 1; i < n; i++){
        if(parent[i] < i){
            cout << parent[i] < " << i << " " << weights[i] << endl;
        }else{
            cout << i << " " << parent[i] << " " << weights[i] << endl;
        }
    }
}

int main() {
    int n;
```

```
    int e;
    cin >> n >> e;
    int** edges = new int*[n];
    for (int i = 0; i < n; i++) {
            edges[i] = new int[n];
            for (int j = 0; j < n; j++) {
                    edges[i][j] = 0;
            }
    }

    for (int i = 0; i < e; i++) {
            int f, s, weight;
            cin >> f >> s >> weight;
            edges[f][s] = weight;
            edges[s][f] = weight;
    }
    cout << endl;
    prims(edges, n);

    for (int i = 0; i < n; i++) {
            delete [] edges[i];
    }
    delete [] edges;
}
```

Kruksal's Algorithm

```
#include <iostream>
#include <vector>
#include <utility>
#include <algorithm>

using namespace std;
const int MAX = 1e4 + 5;
int id[MAX], nodes, edges;
pair <long long, pair<int, int> > p[MAX];

void initialize()
{
        for(int i = 0;i < MAX;++i)
        id[i] = i;
}

int root(int x)
{
        while(id[x] != x)
        {
        id[x] = id[id[x]];
        x = id[x];
```

```
        }
        return x;
}

void union1(int x, int y)
{
        int p = root(x);
        int q = root(y);
        id[p] = id[q];
}

long long kruskal(pair<long long, pair<int, int> > p[])
{
        int x, y;
        long long cost, minimumCost = 0;
        for(int i = 0;i < edges;++i)
        {
        // Selecting edges one by one in increasing order from the beginning
        x = p[i].second.first;
        y = p[i].second.second;
        cost = p[i].first;
        // Check if the selected edge is creating a cycle or not
        if(root(x) != root(y))
        {
        minimumCost += cost;
        union1(x, y);
        }
        }
        return minimumCost;
}

int main()
{
        int x, y;
        long long weight, cost, minimumCost;
        initialize();
        cin >> nodes >> edges;
        for(int i = 0;i < edges;++i)
        {
        cin >> x >> y >> weight;
        p[i] = make_pair(weight, make_pair(x, y));
        }
        // Sort the edges in the ascending order
        sort(p, p + edges);
        minimumCost = kruskal(p);
        cout << minimumCost << endl;
        return 0;
}
```

QUESTION 5: Write a program using Greedy approach for fractional knapsack problem.

```
#include <iostream>
#include <bits/stdc++.h>
using namespace std;
typedef struct {
  int v;
  int w;
  float d;
} Item;
void input(Item items[],int sizeOfItems) {
  cout << "Enter total "<< sizeOfItems <<" item's values and weight" <<
  endl;
  for(int I = 0; I < sizeOfItems; i++) {
        cout << "Enter "<< i+1 << " V ";
        cin >> items[i].v;
        cout << "Enter "<< i+1 << " W";
        cin >> items[i].w;
  }
}
void display(Item items[], int sizeOfItems) {
  int i;
  cout << "values: ";
  for(i = 0; i < sizeOfItems; i++) {
        cout << items[i].v << "\t";
  }
  cout << endl << "weight: ";
  for (I = 0; I < sizeOfItems; i++) {
        cout << items[i].w << "\t";
  }
  cout << endl;
}
bool compare(Item i1, Item i2) {
  return (i1.d > i2.d);
}
float knapsack(Item items[], int sizeOfItems, int W) {
  int i, j, pos;
  Item mx, temp;
  float totalValue = 0, totalWeight = 0;
  for (i = 0; i < sizeOfItems; i++) {
        items[i].d = items[i].v / items[i].w;
  }
  sort(items, items+sizeOfItems, compare);
  for(i=0; i<sizeOfItems; i++) {
        if(totalWeight + items[i].w<= W) {
        totalValue += items[i].v ;
```

```
            totalWeight += items[i].w;
            } else {
            int wt = W-totalWeight;
            totalValue += (wt * items[i].d);
            totalWeight += wt;
            break;
            }
    }
    cout << "total weight in bag " << totalWeight<<endl;
    return totalValue;
}
int main() {
    int W;
    Item items[4];
    input(items, 4);
    cout << "Entered data \n";
    display(items,4);
    cout<< "Enter Knapsack weight \n";
    cin >> W;
    float mxVal = knapsack(items, 4, W);
    cout << "Max value for "<< W <<" weight is "<< mxVal;
}
```

QUESTION 6: Write a program using dynamic programming strategy for finding the Fibonacci value of 5 th term.

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

int fibo_dp(int n) {
    int *ans = new int[n+1];

    ans[0] = 0;
    ans[1] = 1;

    for(int i = 2; i <= n; i++) {
            ans[i] = ans[i-1] + ans[i-2];
    }

    return ans[n];
}

int main() {
    cout << fibo_dp(5) << endl;
}
```