// Kruskal's algorithm in C++

// The time complexity Of Kruskal's Algorithm is: O(E log E).

#include <algorithm>

#include <iostream>

#include <vector>

using namespace std;

#define edge pair<int, int>

class Graph {

private:

vector<pair<int, edge> > G; // graph

vector<pair<int, edge> > T; // mst

int \*parent;

int V; // number of vertices/nodes in graph

public:

Graph(int V);

void AddWeightedEdge(int u, int v, int w);

int find\_set(int i);

void union\_set(int u, int v);

void kruskal();

void print();

};

Graph::Graph(int V) {

parent = new int[V];

//i 0 1 2 3 4 5

//parent[i] 0 1 2 3 4 5

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

parent[i] = i;

G.clear();

T.clear();

}

void Graph::AddWeightedEdge(int u, int v, int w) {

G.push\_back(make\_pair(w, edge(u, v)));

}

int Graph::find\_set(int i) {

// If i is the parent of itself

if (i == parent[i])

return i;

else

// Else if i is not the parent of itself

// Then i is not the representative of his set,

// so we recursively call Find on its parent

return find\_set(parent[i]);

}

void Graph::union\_set(int u, int v) {

parent[u] = parent[v];

}

void Graph::kruskal() {

int i, uRep, vRep;

sort(G.begin(), G.end()); // increasing weight

for (i = 0; i < G.size(); i++) {

uRep = find\_set(G[i].second.first);

vRep = find\_set(G[i].second.second);

if (uRep != vRep) {

T.push\_back(G[i]); // add to tree

union\_set(uRep, vRep);

}

}

}

void Graph::print() {

cout << "Edge :"

<< " Weight" << endl;

for (int i = 0; i < T.size(); i++) {

cout << T[i].second.first << " - " << T[i].second.second << " : "

<< T[i].first;

cout << endl;

}

}

int main() {

int ver,e,u,v,w;

cout<<"Enter number of vertices : ";

cin>>ver;

Graph g(ver);

// Graph g(6);

cout<<"Enter number of edges : ";

cin>>e;

for(int i=0;i<e;i++){

cout<<"Enter Edge (Start,End,Weight) : ";

cin>>u>>v>>w;

g.AddWeightedEdge(u,v,w);

}

// g.AddWeightedEdge(0, 1, 4);

// g.AddWeightedEdge(0, 2, 4);

// g.AddWeightedEdge(1, 2, 2);

// g.AddWeightedEdge(1, 0, 4);

// g.AddWeightedEdge(2, 0, 4);

// g.AddWeightedEdge(2, 1, 2);

// g.AddWeightedEdge(2, 3, 3);

// g.AddWeightedEdge(2, 5, 2);

// g.AddWeightedEdge(2, 4, 4);

// g.AddWeightedEdge(3, 2, 3);

// g.AddWeightedEdge(3, 4, 3);

// g.AddWeightedEdge(4, 2, 4);

// g.AddWeightedEdge(4, 3, 3);

// g.AddWeightedEdge(5, 2, 2);

// g.AddWeightedEdge(5, 4, 3);

g.kruskal();

g.print();

return 0;

}