Assignment No 3

Code

Selection Sort :

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

// Function to perform Selection Sort
void selectionSort(vector<int> &arr) {
    int n = arr.size();
    for (int i = 0; i < n - 1; i++) {
        int minIndex = i;
        for (int j = i + 1; j < n; j++) {
            if (arr[j] < arr[minIndex]) {
                minIndex = j;
            }
        }
        swap(arr[i], arr[minIndex]);
    }
}

// Function to print an array
void printArray(const vector<int> &arr) {
    for (int num : arr) {
        cout << num << " ";
    }
    cout << endl;
}

int main() {
    vector<int> arr = {64, 25, 12, 22, 11};
    cout << "Original array: ";
    printArray(arr);

    selectionSort(arr);

    cout << "Sorted array: ";
    printArray(arr);

    return 0;
}
```

Output :

```
PS C:\Users\nkolh\OneDrive\Desktop\6th sem practicals\AI\Code> cd "c
:\Users\nkolh\OneDrive\Desktop\6th sem practicals\AI\Code\" ; if ($?
) { g++ Assignment3_selection_sort.cpp -o Assignment3_selection_sort
 } ; if ($?) { .\Assignment3_selection_sort }
Original array: 64 25 12 22 11
Sorted array: 11 12 22 25 64
PS C:\Users\nkolh\OneDrive\Desktop\6th sem practicals\AI\Code>
```

Ln 18, Col 1 Spaces: 4 UTF-8 CRLF {} C++ Win32

Prim's Minimal Spanning Tree Algorithm :

```
#include <iostream>
#include <vector>
#include <climits>

using namespace std;

int main(){

    int v=0, e=0;

    cout<<"Enter no of Vertices : ";
    cin>>v;
    cout<<"Enter no of Edges : ";
    cin>>e;

    vector<vector<pair<int,int>>> adj(v);

    for (int i = 0; i < e; i++){
        int s,d,w;
        cout<<"Enter source, Destination and weight : ";
        cin>>s>>d>>w;
        adj[s].push_back(make_pair(d, w));
        adj[d].push_back(make_pair(s,w));

    }

    vector<int> key(v);
    vector<bool> mst(v);
    vector<int> parent(v);

    for (int  i = 0; i < v; i++){
        key[i]=INT_MAX;
        mst[i]=false;
```

```
    parent[i]=-1;

}

key[0]=0;
parent[0]=-1;

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

    //find minimum from key
    int mini=INT_MAX;
    int u;
    for (int j = 0; j < v; j++){
        if(mst[j]==false && key[j]<mini){
            mini=key[j];
            u=j;
        }
    }

    //set mst[u]=true

    mst[u]=true;

    //explore adjacent nodes

    for (auto it: adj[u]){
        int v=it.first;
        int w=it.second;
        if(mst[v]==false && w<key[v]){
            key[v]=w;
            parent[v]=u;
        }
    }


}

cout << "Edges in MST:\n";
for (int i = 1; i < v; i++) {
    cout << parent[i] << " - " << i << " with weight " << key[i] << endl;
}

int minCost = 0;

for (int i = 0; i < v; i++) {
```

```
        if (key[i] != INT_MAX)
            minCost += key[i];
    }

    cout << "Minimum Spanning Tree Cost: " << minCost << endl;

    return 0;
}
```

Output :

```
PS C:\Users\nkolh\OneDrive\Desktop\6th sem practicals\AI\Code
ment3_prims } ; if ($?) { .\Assignment3_prims }
Enter no of Vertices : 5
Enter no of Edges : 6
Enter source, Destination and weight : 0 1 3
Enter source, Destination and weight : 1 2 10
Enter source, Destination and weight : 1 3 2
Enter source, Destination and weight : 1 4 6
Enter source, Destination and weight : 2 3 4
Enter source, Destination and weight : 3 4 1
Edges in MST:
0 - 1 with weight 3
3 - 2 with weight 4
1 - 3 with weight 2
3 - 4 with weight 1
Minimum Spanning Tree Cost: 10
```

Kruskal's Minimal Spanning Tree Algorithm

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

bool cmp(vector<int> &a,vector<int> &b){
    return a[2]<b[2];
}

void makeSet(vector<int> &parent,vector<int> &rank,int v){
    for (int i = 0; i <v ; i++)
    {
        parent[i]=i;
        rank[i]=0;
    }
}

int findParent(int node,vector<int> &parent){
    if(parent[node]==node){
        return node;
    }
```

```
    return parent[node]=findParent(parent[node],parent);
}

void unionSet(int u,int v,vector<int> &parent,vector<int> &rank){
    u=findParent(u,parent);
    v=findParent(v,parent);

    if(rank[u]>rank[v]){
        parent[v]=u;
    }else if(rank[v]>rank[u]){
        parent[u]=v;
    }else{
        parent[v]=u;
        rank[u]++;
    }
}

int main(){

    int v = 0, e = 0;

    cout << "Enter no of Vertices : ";
    cin >> v;
    cout << "Enter no of Edges : ";
    cin >> e;

    vector<vector<int>> adj;

    for (int i = 0; i < e; i++) {
        int s, d, w;
        cout << "Enter source, Destination and weight : ";
        cin >> s >> d >> w;
        adj.push_back({s, d, w});
    }

    sort(adj.begin(), adj.end(), cmp);

    vector<int> parent(v);
    vector<int> rank(v);

    makeSet(parent, rank, v);

    int minCost = 0;

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

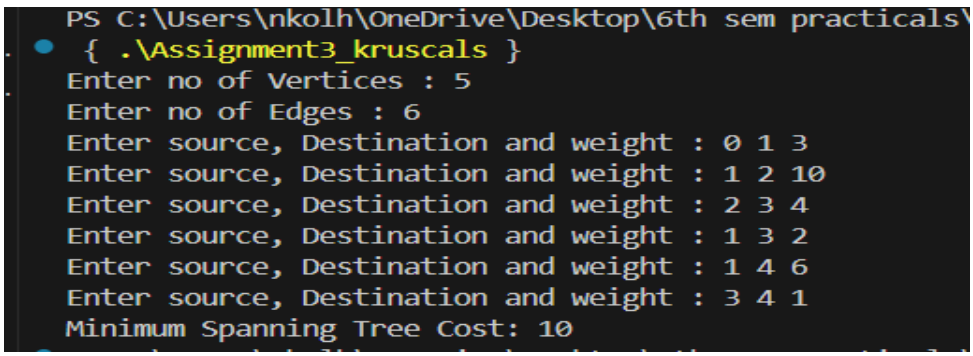
```
        int u = adj[i][0];
        int v = adj[i][1];
        int w = adj[i][2];

        if (findParent(u, parent) != findParent(v, parent)) {
            minCost += w;
            unionSet(u, v, parent, rank);
        }
    }

    cout << "Minimum Spanning Tree Cost: " << minCost << endl;

    return 0;
}
```

Output :



Dijkstra's Algorithm :

```
#include <iostream>
#include <vector>
#include <set>
#include <climits>

using namespace std;
int main(){

    int v=0, e=0;

    cout<<"Enter no of Vertices : ";
    cin>>v;
    cout<<"Enter no of Edges : ";
    cin>>e;

    vector<vector<pair<int,int>>> adj(v);
```

```
for (int i = 0; i < e; i++)
{
   int s,d,w;
   cout<<"Enter source, Destination and weight : ";
   cin>>s>>d>>w;
   adj[s].push_back(make_pair(d, w));
   adj[d].push_back(make_pair(s,w));

}

vector<int> dist(v);
for (int i = 0; i < v; i++)
{
   dist[i]=INT_MAX;
}

set<pair<int,int>> st;

dist[0]=0;
st.insert(make_pair(0,0));

while (!st.empty())
{
   pair<int,int> topNode = *st.begin();
   int distance=topNode.first;
   int node=topNode.second;
   st.erase(st.begin());

   for (auto neighbor : adj[topNode.second])
   {
      if(distance+neighbor.second<dist[neighbor.first]){
         auto record=st.find(make_pair(dist[neighbor.first],neighbor.first));
         if(record!=st.end()){
            st.erase(record);
         }
         dist[neighbor.first]=distance+neighbor.second;
         st.insert(make_pair(dist[neighbor.first],neighbor.first));
      }
   }
}

for (int i = 0; i < v; i++)
{
   cout<<dist[i]<<"  ";
}
```

```
    cout<<endl;

    return 0;
}
```

Output :