**LAB CYCLE-5**

**SUBMITTED BY**

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**PROGRAM-1**

**Q1:** Prim’s Algorithm for finding the minimum cost spanning tree

**PROGRAM CODE:**

#include<stdio.h>

#include<stdbool.h>

#define INF 9999999

// number of vertices in graph

#define V 5

// create a 2d array of size 5x5

//for adjacency matrix to represent graph

int G[V][V] = {

{0, 9, 75, 0, 0},

{9, 0, 95, 19, 42},

{75, 95, 0, 51, 66},

{0, 19, 51, 0, 31},

{0, 42, 66, 31, 0}};

int main() {

int no\_edge; // number of edge

// create a array to track selected vertex

// selected will become true otherwise false

int selected[V];

// set selected false initially

memset(selected, false, sizeof(selected));

// set number of edge to 0

no\_edge = 0;

// the number of egde in minimum spanning tree will be

// always less than (V -1), where V is number of vertices in

//graph

// choose 0th vertex and make it true

selected[0] = true;

int x; // row number

int y; // col number

// print for edge and weight

printf("Edge : Weight\n");

while (no\_edge < V - 1) {

//For every vertex in the set S, find the all adjacent vertices

// , calculate the distance from the vertex selected at step 1.

// if the vertex is already in the set S, discard it otherwise

//choose another vertex nearest to selected vertex at step 1.

int min = INF;

x = 0;

y = 0;

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

if (selected[i]) {

for (int j = 0; j < V; j++) {

if (!selected[j] && G[i][j]) { // not in selected and there is an edge

if (min > G[i][j]) {

min = G[i][j];

x = i;

y = j;

}

}

}

}

}

printf("%d - %d : %d\n", x, y, G[x][y]);

selected[y] = true;

no\_edge++;

}

return 0;

}

**PROGRAM-2**

**Q2:** Kruskal’s Algorithm using the disjoint set data structure.

**PROGRAM CODE:**

#include <stdio.h>

#define MAX 30

typedef struct edge {

int u, v, w;

} edge;

typedef struct edge\_list {

edge data[MAX];

int n;

} edge\_list;

edge\_list elist;

int Graph[MAX][MAX], n;

edge\_list spanlist;

void kruskalAlgo();

int find(int belongs[], int vertexno);

void applyUnion(int belongs[], int c1, int c2);

void sort();

void print();

// Applying Krushkal Algo

void kruskalAlgo() {

int belongs[MAX], i, j, cno1, cno2;

elist.n = 0;

for (i = 1; i < n; i++)

for (j = 0; j < i; j++) {

if (Graph[i][j] != 0) {

elist.data[elist.n].u = i;

elist.data[elist.n].v = j;

elist.data[elist.n].w = Graph[i][j];

elist.n++;

}

}

sort();

for (i = 0; i < n; i++)

belongs[i] = i;

spanlist.n = 0;

for (i = 0; i < elist.n; i++) {

cno1 = find(belongs, elist.data[i].u);

cno2 = find(belongs, elist.data[i].v);

if (cno1 != cno2) {

spanlist.data[spanlist.n] = elist.data[i];

spanlist.n = spanlist.n + 1;

applyUnion(belongs, cno1, cno2);

}

}

}

int find(int belongs[], int vertexno) {

return (belongs[vertexno]);

}

void applyUnion(int belongs[], int c1, int c2) {

int i;

for (i = 0; i < n; i++)

if (belongs[i] == c2)

belongs[i] = c1;

}

// Sorting algo

void sort() {

int i, j;

edge temp;

for (i = 1; i < elist.n; i++)

for (j = 0; j < elist.n - 1; j++)

if (elist.data[j].w > elist.data[j + 1].w) {

temp = elist.data[j];

elist.data[j] = elist.data[j + 1];

elist.data[j + 1] = temp;

}

}

// Printing the result

void print() {

int i, cost = 0;

for (i = 0; i < spanlist.n; i++) {

printf("\n%d - %d : %d", spanlist.data[i].u, spanlist.data[i].v, spanlist.data[i].w);

cost = cost + spanlist.data[i].w;

}

printf("\nSpanning tree cost: %d", cost);

}

int main() {

int i, j, total\_cost;

n = 6;

Graph[0][0] = 0;

Graph[0][1] = 4;

Graph[0][2] = 4;

Graph[0][3] = 0;

Graph[0][4] = 0;

Graph[0][5] = 0;

Graph[0][6] = 0;

Graph[1][0] = 4;

Graph[1][1] = 0;

Graph[1][2] = 2;

Graph[1][3] = 0;

Graph[1][4] = 0;

Graph[1][5] = 0;

Graph[1][6] = 0;

Graph[2][0] = 4;

Graph[2][1] = 2;

Graph[2][2] = 0;

Graph[2][3] = 3;

Graph[2][4] = 4;

Graph[2][5] = 0;

Graph[2][6] = 0;

Graph[3][0] = 0;

Graph[3][1] = 0;

Graph[3][2] = 3;

Graph[3][3] = 0;

Graph[3][4] = 3;

Graph[3][5] = 0;

Graph[3][6] = 0;

Graph[4][0] = 0;

Graph[4][1] = 0;

Graph[4][2] = 4;

Graph[4][3] = 3;

Graph[4][4] = 0;

Graph[4][5] = 0;

Graph[4][6] = 0;

Graph[5][0] = 0;

Graph[5][1] = 0;

Graph[5][2] = 2;

Graph[5][3] = 0;

Graph[5][4] = 3;

Graph[5][5] = 0;

Graph[5][6] = 0;

kruskalAlgo();

print();

}

**PROGRAM-3**

**Q3:** Single Source shortest path algorithm using any heap structure that supports mergeable heap operations

**PROGRAM CODE:**

#include <stdio.h>

#define INFINITY 9999

#define MAX 10

void Dijkstra(int Graph[MAX][MAX], int n, int start);

void Dijkstra(int Graph[MAX][MAX], int n, int start) {

int cost[MAX][MAX], distance[MAX], pred[MAX];

int visited[MAX], count, mindistance, nextnode, i, j;

// Creating cost matrix

for (i = 0; i < n; i++)

for (j = 0; j < n; j++)

if (Graph[i][j] == 0)

cost[i][j] = INFINITY;

else

cost[i][j] = Graph[i][j];

for (i = 0; i < n; i++) {

distance[i] = cost[start][i];

pred[i] = start;

visited[i] = 0;

}

distance[start] = 0;

visited[start] = 1;

count = 1;

while (count < n - 1) {

mindistance = INFINITY;

for (i = 0; i < n; i++)

if (distance[i] < mindistance && !visited[i]) {

mindistance = distance[i];

nextnode = i;

}

visited[nextnode] = 1;

for (i = 0; i < n; i++)

if (!visited[i])

if (mindistance + cost[nextnode][i] < distance[i]) {

distance[i] = mindistance + cost[nextnode][i];

pred[i] = nextnode;

}

count++;

}

// Printing the distance

for (i = 0; i < n; i++)

if (i != start) {

printf("\nDistance from source to %d: %d", i, distance[i]);

}

}

int main() {

int Graph[MAX][MAX], i, j, n, u;

n = 7;

Graph[0][0] = 0;

Graph[0][1] = 0;

Graph[0][2] = 1;

Graph[0][3] = 2;

Graph[0][4] = 0;

Graph[0][5] = 0;

Graph[0][6] = 0;

Graph[1][0] = 0;

Graph[1][1] = 0;

Graph[1][2] = 2;

Graph[1][3] = 0;

Graph[1][4] = 0;

Graph[1][5] = 3;

Graph[1][6] = 0;

Graph[2][0] = 1;

Graph[2][1] = 2;

Graph[2][2] = 0;

Graph[2][3] = 1;

Graph[2][4] = 3;

Graph[2][5] = 0;

Graph[2][6] = 0;

Graph[3][0] = 2;

Graph[3][1] = 0;

Graph[3][2] = 1;

Graph[3][3] = 0;

Graph[3][4] = 0;

Graph[3][5] = 0;

Graph[3][6] = 1;

Graph[4][0] = 0;

Graph[4][1] = 0;

Graph[4][2] = 3;

Graph[4][3] = 0;

Graph[4][4] = 0;

Graph[4][5] = 2;

Graph[4][6] = 0;

Graph[5][0] = 0;

Graph[5][1] = 3;

Graph[5][2] = 0;

Graph[5][3] = 0;

Graph[5][4] = 2;

Graph[5][5] = 0;

Graph[5][6] = 1;

Graph[6][0] = 0;

Graph[6][1] = 0;

Graph[6][2] = 0;

Graph[6][3] = 1;

Graph[6][4] = 0;

Graph[6][5] = 1;

Graph[6][6] = 0;

u = 0;

Dijkstra(Graph, n, u);

return 0;

}