

CSE 3004 DAA LAB TASK - 1

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PRIMS ALGORITHM

Prim's Algorithm is used to find the minimum spanning tree from a graph. Prim's algorithm finds the subset of edges that includes every vertex of the graph such that the sum of the weights of the edges can be minimized. ... The edges with the minimal weights causing no cycles in the graph got selected.

CODE:

```
import java.lang.*;
import java.util.*;
import java.io.*;
class Main {
    private static final
    int countOfVertices = 9;
    int findMinKeyVertex(int keys[], Boolean setOfMST[]) {
```

```

int minimum_index = -1;
int minimum_value = Integer.MAX_VALUE;
for (int vertex = 0; vertex < countOfVertices; vertex++)
if (setOfMST[vertex] == false && keys[vertex] < minimum_value)
{
    minimum_value = keys[vertex];
    minimum_index = vertex;

}
return minimum_index;
}
void showMinimumSpanningTree(int mstArray[], int graphArray[][])
{
    System.out.println("Edge \t\t Weight");

    for (int j = 1; j < countOfVertices; j++)
        System.out.println(mstArray[j] + " <-> " + j + "\t\t" +
graphArray[j][mstArray[j]]);
}
void designMST(int graphArray[][]) {
int mstArray[] = new int[countOfVertices];
int keys[] = new int[countOfVertices];
Boolean setOfMST[] = new Boolean[countOfVertices];
for (int j = 0; j < countOfVertices; j++)
{
    keys[j] = Integer.MAX_VALUE; setOfMST[j] = false;
}
keys[0] = 0; // it select as first vertex
mstArray[0] = -1; // set first value of mstArray to -1 to make it root of
MST
for (int i = 0; i < countOfVertices - 1; i++) {
int edge = findMinKeyVertex(keys, setOfMST);
setOfMST[edge] = true;

```

```

for (int vertex = 0; vertex < countOfVertices; vertex++)

    if (graphArray[edge][vertex] != 0 && setOfMST[vertex] == false &&
graphArray[edge][vertex] < keys[vertex]) {
        mstArray[vertex] = edge;
        keys[vertex] = graphArray[edge][vertex]; }
    }
showMinimumSpanningTree(mstArray, graphArray); }
public static void main(String[] args) {
    Main mst = new Main();
    int graphArray[][] = new int[][]{
        { 0, 4, 0, 0, 0, 0, 0, 8, 0 },
        { 4, 0, 8, 0, 0, 0, 0, 11, 0 },
        { 0, 8, 0, 7, 0, 4, 0, 0, 2 },
        { 0, 0, 7, 0, 9, 14, 0, 0, 0 },
        { 0, 0, 0, 9, 0, 10, 0, 0, 0 },
        { 0, 0, 4, 14, 10, 0, 2, 0, 0 },
        { 0, 0, 0, 0, 0, 2, 0, 1, 6 },
        { 8, 11, 0, 0, 0, 0, 1, 0, 7 },
        { 0, 0, 2, 0, 0, 0, 6, 7, 0 }};
    mst.designMST(graphArray);
    }
}

```

SCREENSHOTS:

```
8 import java.lang.*;
9 import java.util.*;
10 import java.io.*;
11 class Main {
12     private static final
13     int countOfVertices = 9;
14     int findMinKeyVertex(int keys[], Boolean setOfMST[]) {
15         int minimum_index = -1;
16         int minimum_value = Integer.MAX_VALUE;
17         for (int vertex = 0; vertex < countOfVertices; vertex++)
18             if (setOfMST[vertex] == false && keys[vertex] < minimum_value)
19             {
20                 minimum_value = keys[vertex];
21                 minimum_index = vertex;
22             }
23         return minimum_index;
24     }
25     void showMinimumSpanningTree(int mstArray[], int graphArray[][])
26     {
27         System.out.println("Edge \t\t Weight");
28
29         for (int j = 1; j < countOfVertices; j++)
30             System.out.println(mstArray[j] + " <-> " + j + "\t\t" + graphArray[j][mstArray[j]]);
31     }
32     void designMST(int graphArray[][]) {
33         int mstArray[] = new int[countOfVertices];
34         int keys[] = new int[countOfVertices];
35         Boolean setOfMST[] = new Boolean[countOfVertices];
36         for (int j = 0; j < countOfVertices; j++)
37         {
38             keys[j] = Integer.MAX_VALUE; setOfMST[j] = false;
39         }
40         keys[0] = 0; // it select as first vertex
41         mstArray[0] = -1; // set first value of mstArray to -1 to make it root of MST
42     }
```

```
32     }
33     void designMST(int graphArray[][]) {
34         int mstArray[] = new int[countOfVertices];
35         int keys[] = new int[countOfVertices];
36         Boolean setOfMST[] = new Boolean[countOfVertices];
37         for (int j = 0; j < countOfVertices; j++)
38         {
39             keys[j] = Integer.MAX_VALUE; setOfMST[j] = false;
40         }
41         keys[0] = 0; // it select as first vertex
42         mstArray[0] = -1; // set first value of mstArray to -1 to make it root of MST
43         for (int i = 0; i < countOfVertices - 1; i++) {
44             int edge = findMinKeyVertex(keys, setOfMST);
45             setOfMST[edge] = true;
46             for (int vertex = 0; vertex < countOfVertices; vertex++)
47             {
48                 if (graphArray[edge][vertex] != 0 && setOfMST[vertex] == false && graphArray[edge][vertex] < keys[vertex]) {
49                     mstArray[vertex] = edge;
50                     keys[vertex] = graphArray[edge][vertex]; }
51             }
52         showMinimumSpanningTree(mstArray, graphArray); }
53     public static void main(String[] args) {
54         Main mst = new Main();
55         int graphArray[][] = new int[][]{
56             { 0, 4, 0, 0, 0, 0, 0, 8, 0 },
57             { 4, 0, 8, 0, 0, 0, 0, 11, 0 },
58             { 0, 8, 0, 7, 0, 4, 0, 0, 2 },
59             { 0, 0, 7, 0, 0, 9, 14, 0, 0 },
60             { 0, 0, 0, 9, 0, 10, 0, 0, 0 },
61             { 0, 0, 4, 14, 10, 0, 2, 0, 0 },
62             { 0, 0, 0, 0, 0, 2, 0, 1, 6 },
63             { 8, 11, 0, 0, 0, 0, 1, 0, 7 },
64             { 0, 0, 2, 0, 0, 0, 6, 7, 0 }};
65         mst.designMST(graphArray); }
66 }
```

```

8 import java.lang.*;
9 import java.util.*;
10 import java.io.*;
11 class Main {
12     private static final
13     int countOfVertices = 9;
14     int findMinKeyVertex(int keys[], Boolean setOfMST[]) {
15         int minimum_index = -1;
16         int minimum_value = Integer.MAX_VALUE;
17         for (int vertex = 0; vertex < countOfVertices; vertex++)
18             if (setOfMST[vertex] == false && keys[vertex] < minimum_value)
19             {
20                 minimum_value = keys[vertex];
21                 minimum_index = vertex;
22             }
23     }

```

input

Edge	Weight
0 <-> 1	4
1 <-> 2	8
2 <-> 3	7
3 <-> 4	9
2 <-> 5	4
5 <-> 6	2
6 <-> 7	1
2 <-> 8	2

...Program finished with exit code 0
Press ENTER to exit console.

input

Edge	Weight
0 <-> 1	4
1 <-> 2	8
2 <-> 3	7
3 <-> 4	9
2 <-> 5	4
5 <-> 6	2
6 <-> 7	1
2 <-> 8	2

...Program finished with exit code 0
Press ENTER to exit console.

ANALYSIS:

Prims algorithm:

Here to find $\minkey()$ functions utmost will visit the graph at $n(n-1) = n^2 - n$ times. ~~so~~ therefore

The time complexity is $O(n^2)$