Write-up	Correctness of Program	Documentation of Program	Viva	Timely Completion	Total	Dated Sign of Subject Teacher
2	2	2	2	2	10	

Assignment No. 10 Date of Performance: ……

AIM: A business house has several offices in different countries; they want to lease Phone lines to connect them with each other and the phone company charges different rent to connect different pairs of cities. Business house want to connect all Its offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.

OBJECTIVES:

1. To understand minimum spanning tree of a Graph.
2. To understand how Prim's algorithm works.

CONCEPTS TO BE USED:

- Arrays
- Function to construct head list & adjacency matrix for a graph.
- Function to display adjacency matrix of a graph.
- Function to generate minimum spanning tree for a graph using Prim's algorithm.

THEORY:

Spanning Tree: A Spanning Tree of a graph G = (V, E) is a sub graph of G having all vertices of G and no cycles in it.

Minimal Spanning Tree: The cost of a graph is the sum of the costs of the edges in the weighted graph. A spanning tree of a graph G= (V, E) is called minimal cost spanning tree or simply the minimal spanning tree of G if its cost is minimum. When a graph G is connected, depth first or breadth first search starting at any vertex visits all the vertices in G. The edges of G are partitioned into two sets i.e. T for the tree edges & B

for back edges. T is the set of tree edges and B for back edges. T is the set of edges used or traversed during the search & B is the set of remaining edges. The edges of G in T form a tree which includes all the vertices of graph G and this tree is called as spanning tree.

Algorithm

Prim's Algorithm: All vertices of a connected graph are included in the minimum spanning tree. Prim's algorithm starts from one vertex and grows the rest of tree by adding one vertex at a time by adding associated edge in T. This algorithm iteratively adds edges until all vertices are visited.

```
void prims (vertex i)
Start
Initialize visited [ ] to 0 for (i=0;i<n; i++)
visited [ i ] = 0;
Find minimum edge from i for (j=0;j<n; j++)
{
if (min > a [i] [j])
{
min = a[i] [j]
= i;
= j;
}
}
Print the edge between i and j with weight.
Make visit [i++] = x
visit [j++] = y
Find next minimum edge starting from nodes of visit array.
Repeat step 6 until all the nodes are visited.
End.
```


Testing: Test program for following test cases

For each test case:

Display the total number of comparisons required to construct the graph in computer memory.

Display the results as given in the sample o/p above.

Finally conclude on time & time space complexity for the construction of the graph and for generation of minimum spanning tree using Prim‘s algorithm.

Time Complexity:

For the construction of an undirected graph with _n‘ vertices and _e‘ edges using adjacency list is O (n + e), since for every vertex _v‘ in G we need to store all adjacent edges to vertex v.

In Prim‘s algorithm to get minimum spanning tree from an undirected graph with _n‘ vertices using adjacency matrix is $O(n^2)$.

Using Kruskal‘s algorithm

using adjacency matrix = O(n2).

using adjacency list=O(eloge)

Applications of spanning Trees:

To find independent set of circuit equations for an electrical network. By adding an edge from set B to spanning tree we get a cycle and then Kirchoff‘s second law is used on the resulting cycle to obtain a circuit equation.

Using the property of spanning trees, we can select the spanning tree with (n-1) edges such that total cost is minimum if each edge in a graph represents cost.

Analysis of project planning

Identification of chemical compounds

Statistical mechanics, genetics, cybernetics, linguistics, social sciences

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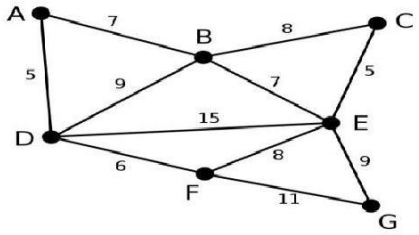
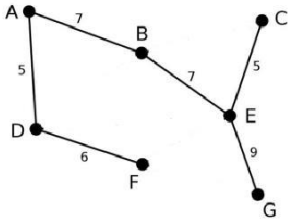
OUTCOME: The cost of spanning tree of graph G is the sum of the costs of the edges in that tree. Any connected graph with n vertices must have at least n-1 edges and all connected graphs with n-1 edges are trees.

INPUT: Enter the no. of nodes in graph. Create the adjacency LIST

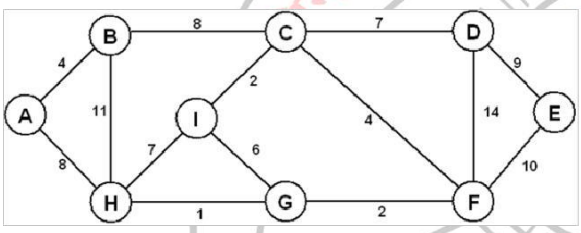
OUTPUT: Display result of each operation with error checking.

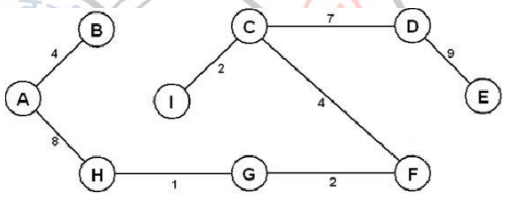
INPUT **OUTPUT**





Cost of MST – 39





Cost of MST - 37

FAQS:

1. Explain the Prim's algorithm for minimum spanning tree.
2. What are the traversal techniques?
3. What are the graph representation techniques?
