Experiment No. 6
Prim's Algorithm
Date of Performance:
Date of Submission:

Experiment No. 6

Title: Prim's Algorithm.

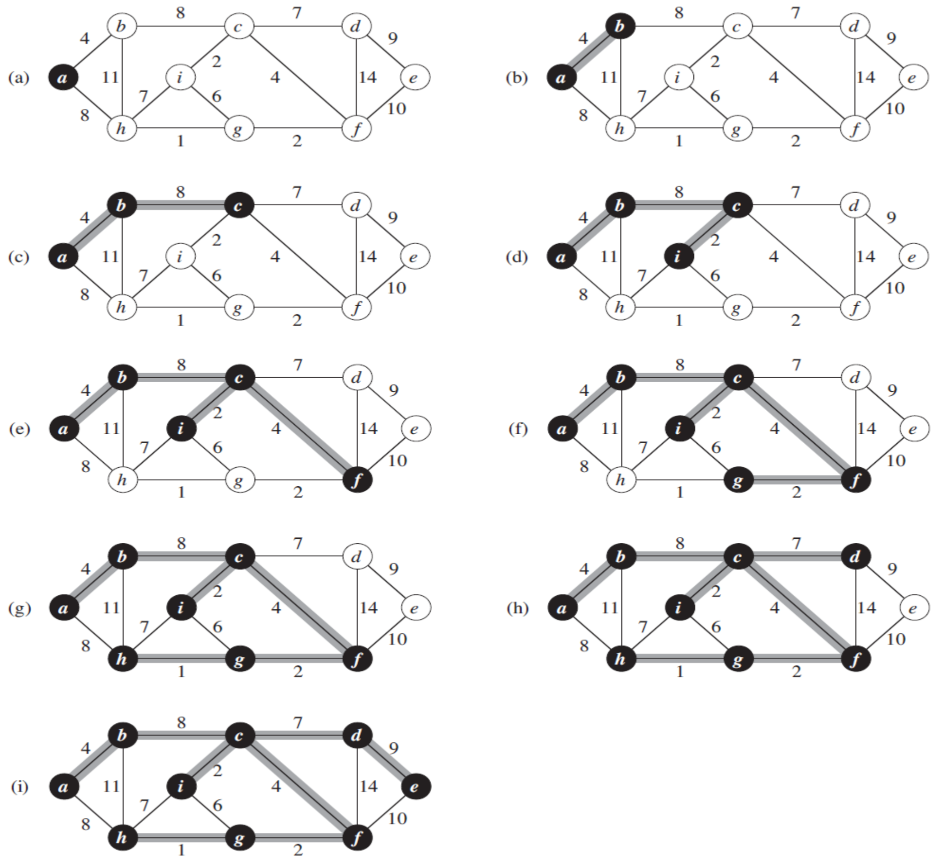
Aim: To study and implement Prim's Minimum Cost Spanning Tree Algorithm.

Objective: To introduce Greedy based algorithms

Theory:

Prim's algorithm is a greedy algorithm that finds a minimum spanning tree for a weighted undirected graph. This means it finds a subset of the edges that forms a tree that includes every vertex, where the total weight of all the edges in the tree is minimized. The algorithm operates by building this tree one vertex at a time, from an arbitrary starting vertex, at each step adding the cheapest possible connection from the tree to another vertex.

Example:



Algorithm and Complexity:

```
Algorithm Prim(E, cost, n, t)
// E is the set of edges in G. cost[1 : n, 1 : n] is the cost
// adjacency matrix of an n vertex graph such that cost[i, j] is
// either a positive real number or ∞ if no edge (i, j) exists.
// A minimum spanning tree is computed and stored as a set of
// edges in the array t[1 : n − 1, 1 : 2]. (t[i, 1], t[i, 2]) is an edge in
// the minimum-cost spanning tree. The final cost is returned.
{
    Let (k, l) be an edge of minimum cost in E;
    mincost := cost[k, l];
    t[1, 1] := k; t[1, 2] := l;
    for i := 1 to n do  // Initialize near.
        if (cost[i, l] < cost[i, k]) then near[i] := l;
        else near[i] := k;
    near[k] := near[l] := 0;
    for i := 2 to n − 1 do
    { // Find n − 2 additional edges for t.
        Let j be an index such that near[j] ≠ 0 and
        cost[j, near[j]] is minimum;
        t[i, 1] := j; t[i, 2] := near[j];
        mincost := mincost + cost[j, near[j]];
        near[j] := 0;
        for k := 1 to n do // Update near[ ].
            if ((near[k] ≠ 0) and (cost[k, near[k]] > cost[k, j]))
                then near[k] := j;
    }
    return mincost;
}
```

Time Complexity is O(n2), Where, n = number of vertices **Theory:**

Implemenation:

```
#include<stdio.h>

#include<conio.h>

int a,b,u,v,n,i,j,ne=1;

int visited[10]={0},min,mincost=0,cost[10][10];

void main()

{

	clrscr();

	printf("Enter the number of nodes:");
```

```
scanf("%d",&n);
printf("Enter the adjacency matrix:\n");
for(i=1;i<=n;i++)
for(j=1;j<=n;j++)
{
        scanf("\t%d",&cost[i][j]);
        if(cost[i][j]==0)
                cost[i][j]=999;
}
visited[1]=1;
while(ne < n)
{
for(i=1,min=999;i<=n;i++)
for(j=1;j<=n;j++)
        if(cost[i][j]< min)
        if(visited[i]!=0)
        {
                min=cost[i][j];
                a=u=i;
                b=v=j;
        }
        if(visited[u]==0 || visited[v]==0)
        {
                printf("\nEdge %d:(%d %d) cost:%d",ne++,a,b,min);
```

```
                mincost+=min;
                visited[b]=1;
            }
            cost[a][b]=cost[b][a]=999;
        }
        printf("\n Minimun cost=%d",mincost);
        getch();
}#include<stdio.h>
#include<conio.h>
int a,b,u,v,n,i,j,ne=1;
int visited[10]={0},min,mincost=0,cost[10][10];
void main()
{
        clrscr();
        printf("Enter the number of nodes:");
        scanf("%d",&n);
        printf("Enter the adjacency matrix:\n");
        for(i=1;i<=n;i++)
        for(j=1;j<=n;j++)
        {
            scanf("\t%d",&cost[i][j]);
            if(cost[i][j]==0)
                cost[i][j]=999;
        }
```

```
    visited[1]=1;
    while(ne < n)
    {
    for(i=1,min=999;i<=n;i++)
    for(j=1;j<=n;j++)
        if(cost[i][j]< min)
        if(visited[i]!=0)
        {
            min=cost[i][j];
            a=u=i;
            b=v=j;
        }
        if(visited[u]==0 || visited[v]==0)
        {
            printf("\nEdge %d:(%d %d) cost:%d",ne++,a,b,min);
            mincost+=min;
            visited[b]=1;
        }
        cost[a][b]=cost[b][a]=999;
    }
    printf("\n Minimun cost=%d",mincost);
    getch();
}
```

Output:

```
Enter the number of nodes:3
Enter the adjacency matrix:
1
2
3
4
5
6
7
8
9
```

```
Edge 1:(1 2) cost:2
Edge 2:(1 3) cost:3
 Minimun cost=5_
```

Conclusion: Implementing Prim's algorithm has proven to be effective in generating minimum spanning trees, efficiently connecting all nodes in a graph while minimizing total edge weight. This experiment underscores the algorithm's practical applicability in optimizing network connectivity, demonstrating its importance in various real-world scenarios.