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19BIT0292

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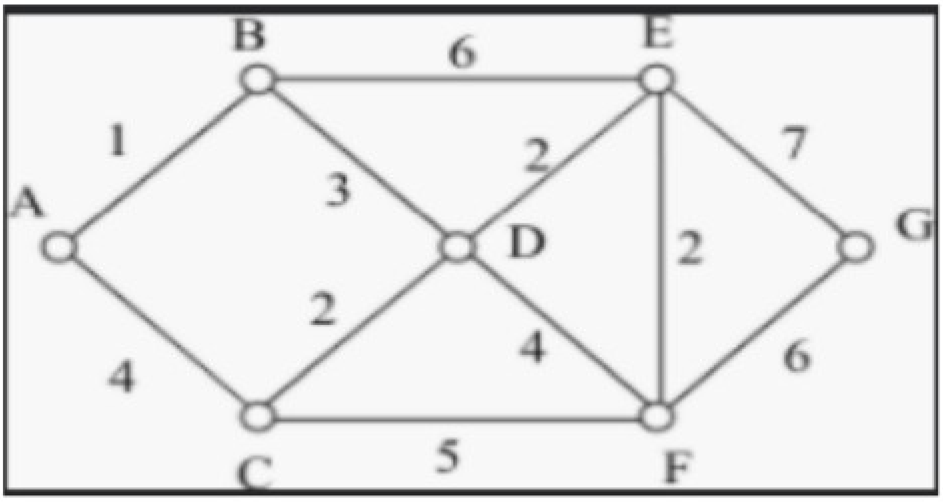
DIGITAL ASSIGNMENT-5

DATA STRUCTURES AND ALGORITHMS LABORATORY

CSE2011

L57+L58

Q1) Illustrate minimum spanning tree using Kruskal's algorithm for the following graph.



CODE

```
#include<stdio.h>
#include<stdlib.h>
int **edges,n,e;
int *parent,*rank;

int find(int i)
{
   if(parent[i]==i)
      return i;
   parent[i]=find(parent[i]);
   return parent[i];
}

void Union(int x,int y)
{
   int xroot=find(x);
   int yroot=find(y);
   if(xroot==yroot)
      return;
   if(rank[xroot]<rank[yroot])
      parent[xroot]=yroot;
   else if(rank[xroot]>rank[yroot])
```

```
        parent[yroot]=xroot;
    else
    {
        parent[yroot]=xroot;
        rank[xroot]++;
    }
}

int cmp(int **a,int **b)
{
    return (*a)[2]-(*b)[2];
}

void kruskal()
{
    printf("\nEdges in the minimum spanning tree are:-");
    qsort(edges,e,sizeof(int*),cmp);
    int i,j,k=0;

    parent=malloc(n*sizeof(int));
    rank=malloc(n*sizeof(int));

    for(i=0;i<n;i++)
    {
        parent[i]=i;
        rank[i]=0;
    }

    for(i=0;i<e;i++)
    {
        int x=find(edges[i][0]);
        int y=find(edges[i][1]);
        if(x!=y)
        {
            printf("\n%c-%c %d",edges[i][0]+'A',edges[i][1]+'A',edges[i]
[2]);
            Union(x,y);
            k++;
        }

        if(k==n-1)
            break;
    }
    if(k!=n-1)
        printf("\nThe graph is not connected");


}

void take_input()
{
    int i,j;
    printf("Enter number of vertices: ");
    scanf("%d",&n);
    printf("Enter number of edges: ");
    scanf("%d",&e);
    edges=(int**)malloc(e*sizeof(int*));

    for(i=0;i<e;i++)
    {
        edges[i]=(int*)malloc(3*sizeof(int));
        char s,d,l;
        int w;
        printf("Enter weight, source and destination of edge %d: ",i+1);
        scanf("%d",&w);
        scanf("%c",&l);//to skip space
        scanf("%c",&s);
        scanf("%c",&l);//to skip space
        scanf("%c",&d);
        scanf("%c",&l);//to skip the newline character
        edges[i][0]=s-'A';
        edges[i][1]=d-'A';
        edges[i][2]=w;
    }
}

void default_input_test()
{
    // 7
    // 11
    // 1 A B
    // 4 A C
    // 2 C D
    // 3 B D
    // 6 B E
    // 5 C F
    // 2 D E
    // 4 D F
    // 2 F E
    // 7 G E
    // 6 G F

    n=7,e=11;
    edges=(int**)malloc(e*sizeof(int*));

    for(int i=0;i<e;i++)
        edges[i]=(int*)malloc(3*sizeof(int));

    edges[0][0]='A'-'A',edges[0][1]='B'-'A',edges[0][2]=1;
    edges[1][0]='A'-'A',edges[1][1]='C'-'A',edges[1][2]=4;
    edges[2][0]='C'-'A',edges[2][1]='D'-'A',edges[2][2]=2;
    edges[3][0]='B'-'A',edges[3][1]='D'-'A',edges[3][2]=3;
    edges[4][0]='B'-'A',edges[4][1]='E'-'A',edges[4][2]=6;
    edges[5][0]='C'-'A',edges[5][1]='F'-'A',edges[5][2]=5;
    edges[6][0]='D'-'A',edges[6][1]='E'-'A',edges[6][2]=2;
    edges[7][0]='D'-'A',edges[7][1]='F'-'A',edges[7][2]=4;
    edges[8][0]='F'-'A',edges[8][1]='E'-'A',edges[8][2]=2;
    edges[9][0]='G'-'A',edges[9][1]='E'-'A',edges[9][2]=7;
    edges[10][0]='G'-'A',edges[10][1]='F'-'A',edges[10][2]=6;
}

main()
{
//   default_input_test();
  take_input();
  kruskal();
}
```

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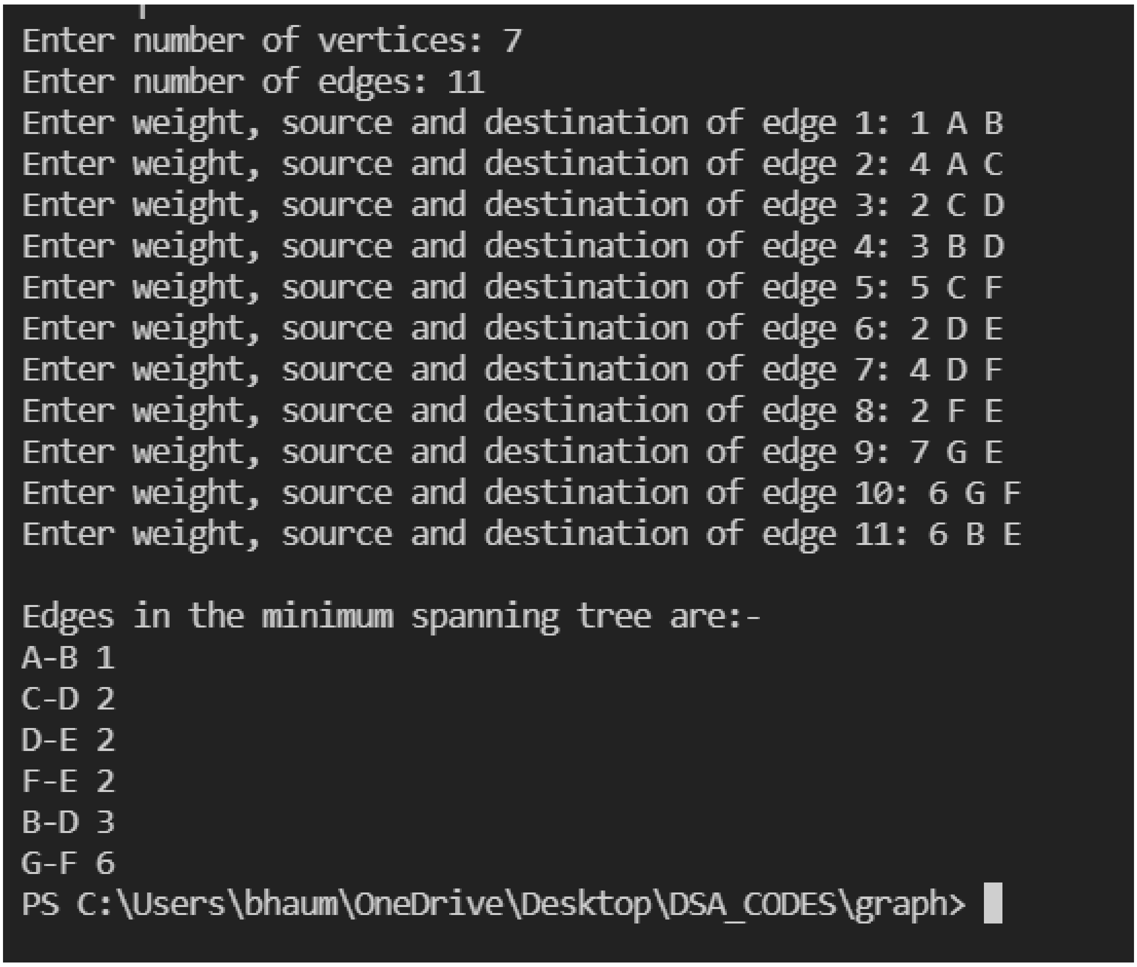
OUTPUT



```
Enter number of vertices: 7
Enter number of edges: 11
Enter weight, source and destination of edge 1: 1 A B
Enter weight, source and destination of edge 2: 4 A C
Enter weight, source and destination of edge 3: 2 C D
Enter weight, source and destination of edge 4: 3 B D
Enter weight, source and destination of edge 5: 5 C F
Enter weight, source and destination of edge 6: 2 D E
Enter weight, source and destination of edge 7: 4 D F
Enter weight, source and destination of edge 8: 2 F E
Enter weight, source and destination of edge 9: 7 G E
Enter weight, source and destination of edge 10: 6 G F
Enter weight, source and destination of edge 11: 6 B E

Edges in the minimum spanning tree are:-
A-B 1
C-D 2
D-E 2
F-E 2
B-D 3
G-F 6
PS C:\Users\bhaum\OneDrive\Desktop\DSA_CODES\graph>
```

Q2) Apply division hashing technique using the hash function H(k)=3k+2 mod h , h is the height of the hash table, and create one to one mapping between elements given {18, 17, 16, 91, 15, 18, 23, 27, 29, 21} with the index values of hash table having size of 10. Also remove the collision, using linear probing, if any.

CODE

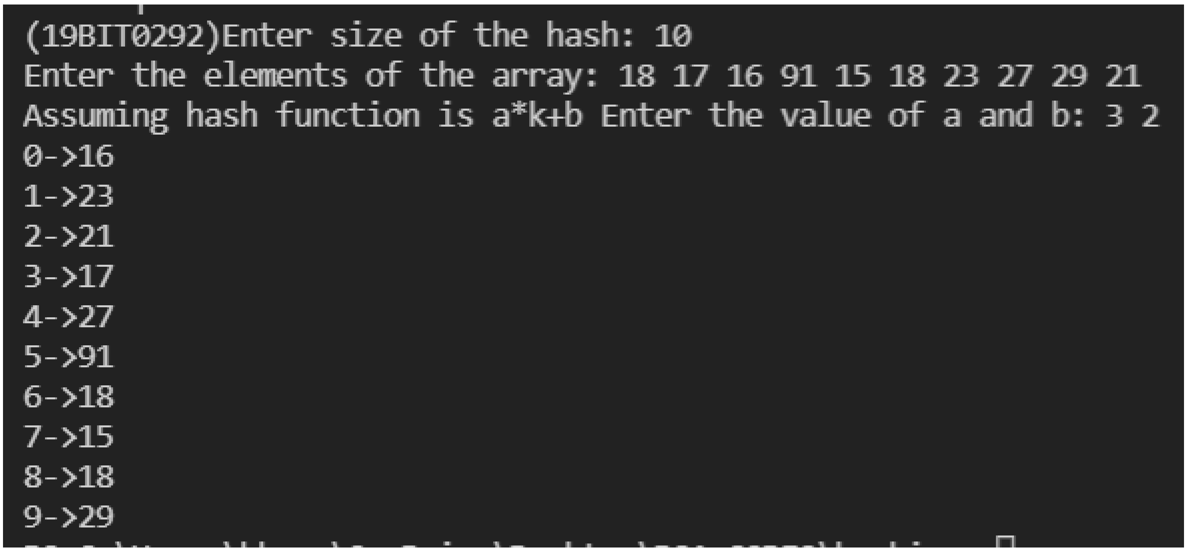
```
#include<stdio.h>
#include<stdlib.h>
int *arr,h;
int *hash_table;
int a,b;

void take_input()
```

```
{
    printf("(19BIT0292)Enter size of the hash: ");
    scanf("%d",&h);
    arr = (int *)malloc(h*sizeof(int));
    hash_table = (int *)calloc(h,sizeof(int));
    printf("Enter the elements of the array: ");
    for(int i=0;i<h;i++)
        scanf("%d",&arr[i]);
    printf("Assuming hash function is a*k+b Enter the value of a and b:
");
    scanf("%d%d",&a,&b);
}

void fill_hash_table_linear_probing()
{
    for(int i=0;i<h;i++)
    {
        int index = (a*arr[i]+b)%h;
        while(hash_table[index]!=0)
            index = (index+1)%h;
        hash_table[index] = arr[i];
    }
}

void print_hash_table()
{
    for(int i=0;i<h;i++){
        printf("%d->%d ",i,hash_table[i]);
    printf("\n");
    }
}

main()
{
    take_input();
    fill_hash_table_linear_probing();
    print_hash_table();
}
```

CLICK HERE FOR GITHUB

LINK

OUTPUT



```
(19BIT0292)Enter size of the hash: 10
Enter the elements of the array: 18 17 16 91 15 18 23 27 29 21
Assuming hash function is a*k+b Enter the value of a and b: 3 2
0->16
1->23
2->21
3->17
4->27
5->91
6->18
7->15
8->18
9->29
```