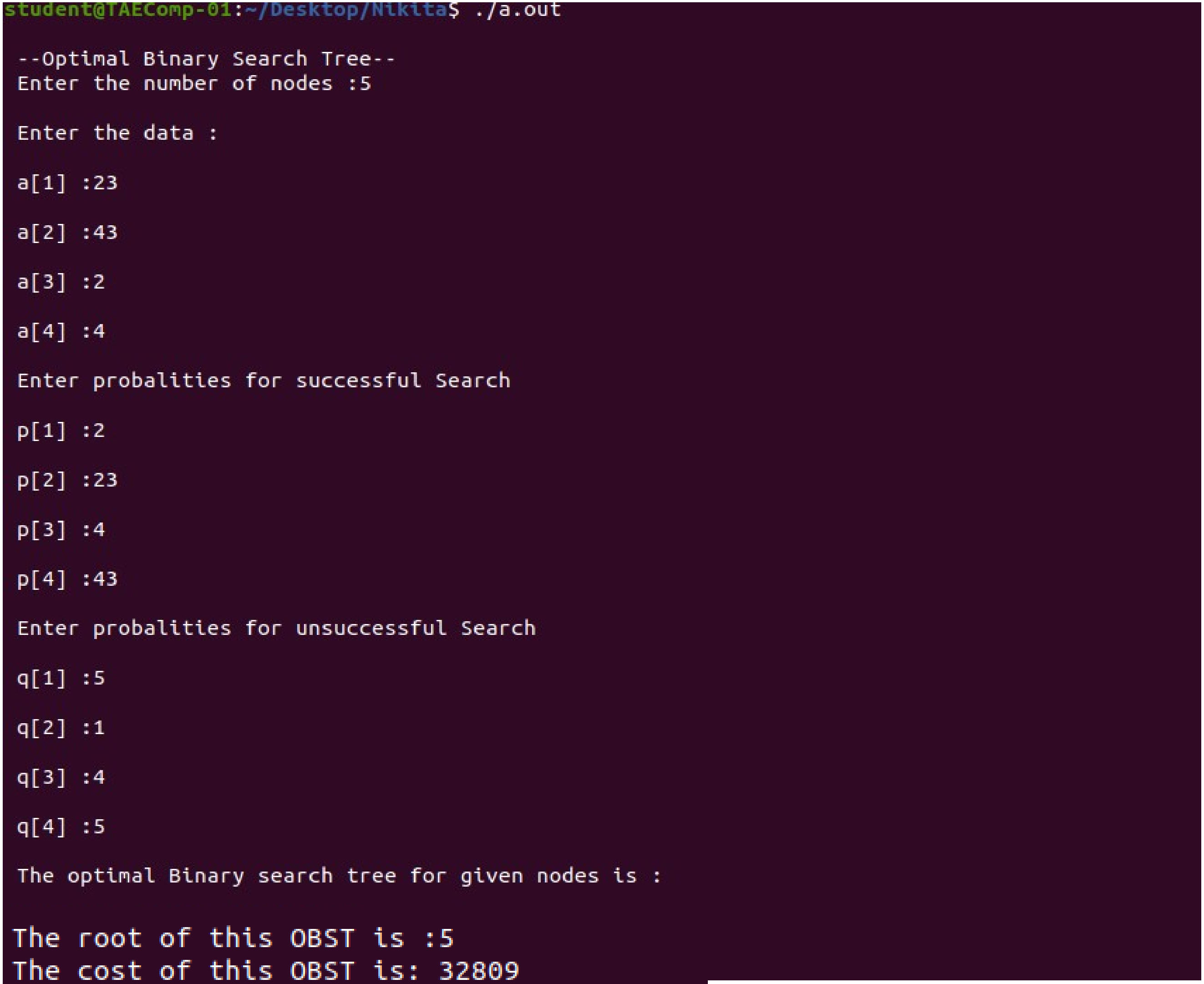
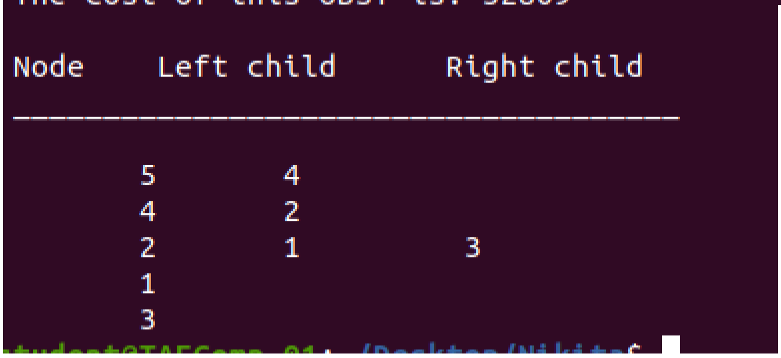
Assignment No : 8

```
#include<iostream>
#define SIZE 10
using namespace std;

class optimal
{
   public:
   int p[SIZE];
   int q[SIZE];
   int a[SIZE];
   int w[SIZE][SIZE];
   int c[SIZE][SIZE];
   int r[SIZE][SIZE];
   int n;
   int front,rear,queue[20];

   optimal()
   {
      front = rear = -1;
   }
   void getdata();
   int minvalue(int,int);
   void OBST();
   void buildtree();
};

void optimal::getdata()
{
   int i;
   cout<<"\n --Optimal Binary Search Tree--";
   cout<<"\n Enter the number of nodes :";
   cin>>n;
   cout<<"\n Enter the data :\n";
   for(i=1;i<n;i++)
   {
     cout<<"\n a["<<i<<"] :";
     cin>>a[i];
   }
   cout<<"\n Enter probalities for successful Search \n";
   for(i=1;i<n;i++)
   {
     cout<<"\n p["<<i<<"] :";
     cin>>p[i];
```

```
    }
    cout<<"\n Enter probalities for unsuccessful Search \n";
    for(i=1;i<n;i++)
    {
       cout<<"\n q["<<i<<"] :";
       cin>>q[i];
    }
}
int optimal::minvalue(int i, int j)
{
    int m,k;
    int min = 32000;
    for(m=r[i][j-1];m<=r[i+1][j];m++)
    {
         if((c[i][m-1]+c[m][j])<min)
         {
             min = c[i][m-1]+c[m][j];
             k=m;
         }
    }
    return k;
}

void optimal::OBST()
{
    int i,j,k,m;
     for(i=0;i<n;i++)
      {

          w[i][i]=q[i];
          r[i][i]=c[i][i]=0;
          w[i][i+1]=q[i]+q[i+1]+p[i+1];
          r[i][i+1]=i+1;
          c[i][i+1]=q[i]+q[i+1]+p[i+1];
      }
      w[n][n]=q[n];
      r[n][n]=c[n][n]=0;
      for(m=2;m<=n;m++)
      {
           for(i=0;i<=n-m;i++)
           {
                j=i+m;
                w[i][j]=w[i][j-1]+p[j]+q[j];
                k=minvalue(i,j);
                c[i][j]=w[i][j]+c[i][k-1]+c[k][j];
                r[i][j]=k;
           }
      }
}

void optimal::buildtree()
{
    int i,j,k;
    cout<<"\n The optimal Binary search tree for given nodes is : \n";
    cout<<"\n The root of this OBST is :"<<r[0][n];
    cout<<"\n The cost of this OBST is: "<<c[0][n];
    cout<<"\n\n Node \t Left child \t Right child";
    cout<<"\n _______________________________________"<<endl;
    queue[++rear]=0;
    queue[++rear]=n;
    while(front!=rear)
    {
        i=queue[++front];
        j=queue[++front];
        k=r[i][j];
        cout<<"\n\t"<<k;
        if(r[i][k-1]!=0)
        {
            cout<<"       "<<r[i][k-1];
            queue[++rear]=i;
            queue[++rear]=k-1;
        }
        else
        cout<<"      ";
        if(r[k][j]!=0)
        {
            cout<<"         "<<r[k][j];
            queue[++rear]=k;
            queue[++rear]=j;
        }
        else
        cout<<"          ";
    }
    cout<<endl;
}

int main()
{
    optimal obj;
    obj.getdata();
    obj.OBST();
    obj.buildtree();
    return 0;
}
```



```
student@TAEComp-01:~/Desktop/Nikita$ ./a.out

 --Optimal Binary Search Tree--
 Enter the number of nodes :5

 Enter the data :

 a[1] :23

 a[2] :43

 a[3] :2

 a[4] :4

 Enter probalities for successful Search

 p[1] :2

 p[2] :23

 p[3] :4

 p[4] :43

 Enter probalities for unsuccessful Search

 q[1] :5

 q[2] :1

 q[3] :4

 q[4] :5

 The optimal Binary search tree for given nodes is :

The root of this OBST is :5
The cost of this OBST is: 32809
```



```
Node     Left child       Right child

------------------------------------------

        5        4
        4        2
        2        1           3
        1
        3
student@TAEComp-01:~/Desktop/Nikita$
```