Assignment No. 8

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Programme:

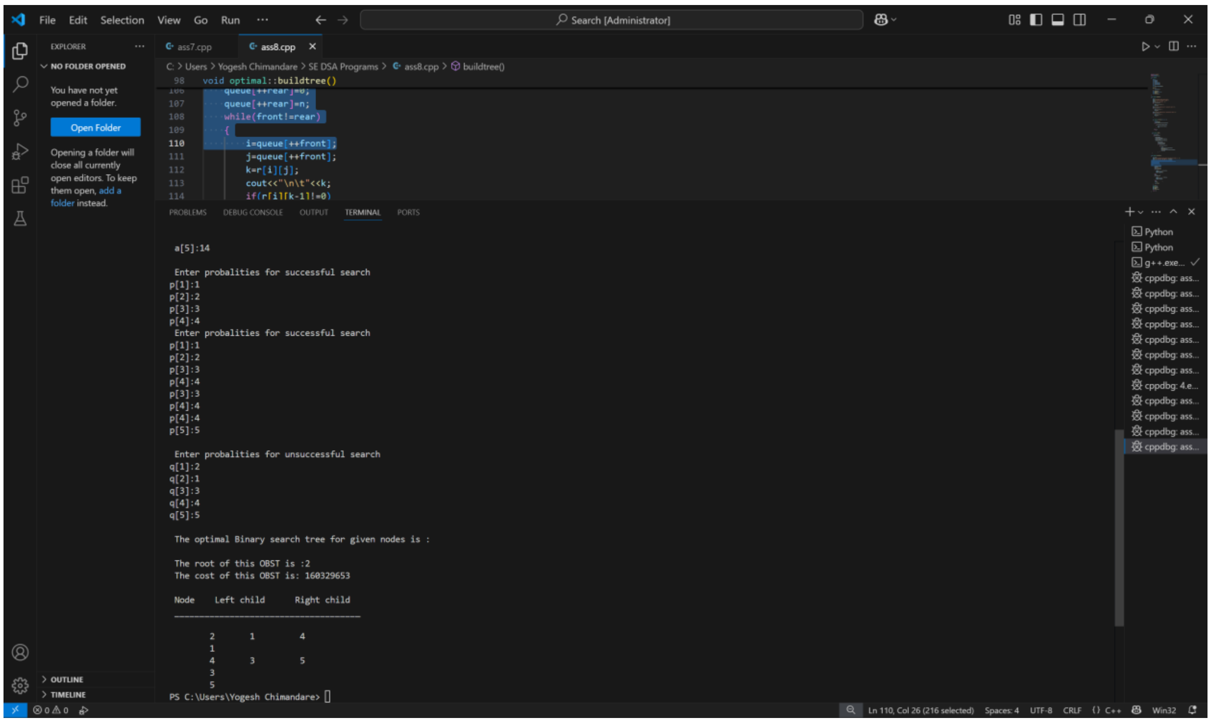
```
#include <iostream>

#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<<"p["<<i<<"]:";
        cin>>p[i];
            }
    cout<<"\n Enter probalities for unsuccessful search \n";
    for(i=1;i<=n;i++)
    {
        cout<<"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;

}
```

Output:



C: > Users > Yogesh Chimandare > SE DSA Programs > ass8.cpp > buildtree()

```cpp
void optimal::buildtree()
    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)
```

```
 a[5]:14

 Enter probalities for successful search
p[1]:1
p[2]:2
p[3]:3
p[4]:4
 Enter probalities for successful search
p[1]:1
p[2]:2
p[3]:3
p[4]:4
p[3]:3
p[4]:4
p[4]:4
p[5]:5

 Enter probalities for unsuccessful search
q[1]:2
q[2]:1
q[3]:3
q[4]:4
q[5]:5

 The optimal Binary search tree for given nodes is :

 The root of this OBST is :2
 The cost of this OBST is: 160329653

 Node    Left child      Right child
 ------------------------------------

       2       1         4
       1
       4       3         5
       3
       5
PS C:\Users\Yogesh Chimandare> 
```