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Subject: Data Structure and Algorithm Laboratory
Assignment No.9

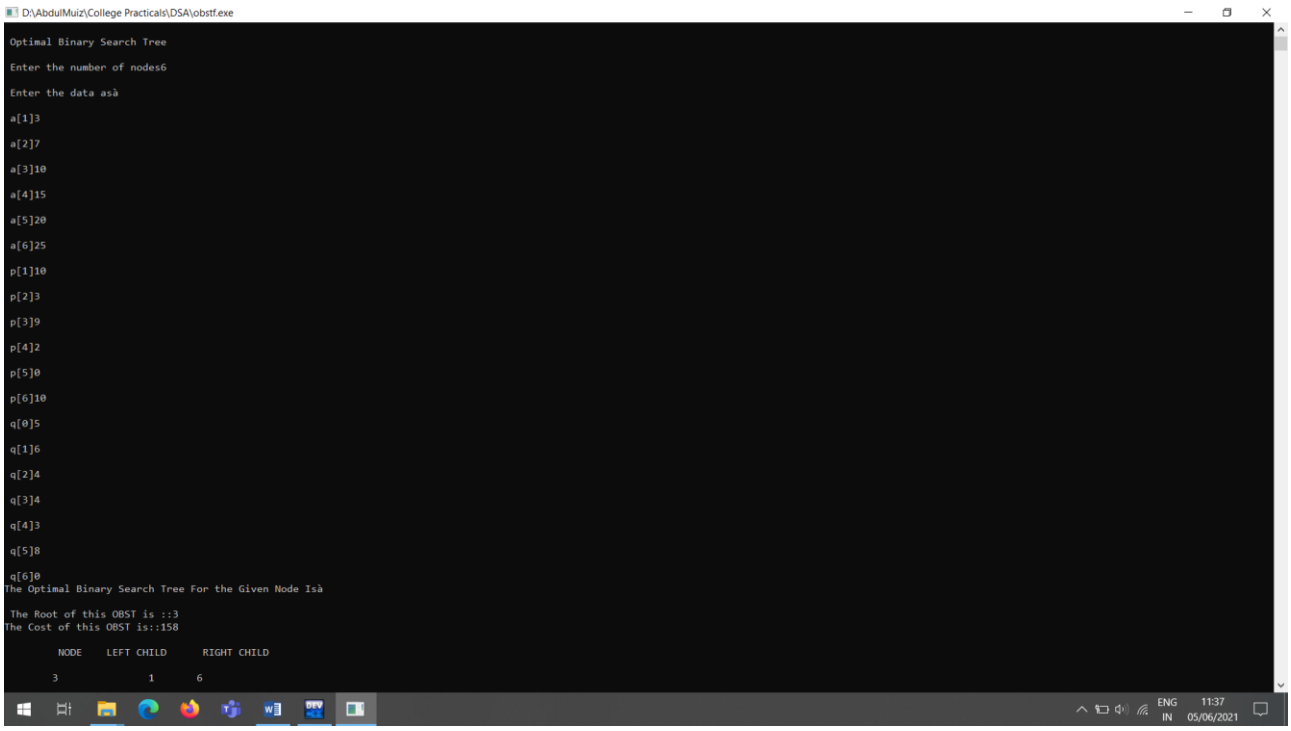
```
#include<iostream>

using namespace std;

#define SIZE 10


class OBST

{

int p[SIZE]; // Probabilities with which we search for an element

int q[SIZE];//Probabilities that an element is not found

int a[SIZE];//Elements from which OBST is to be built

int w[SIZE][SIZE];//Weight ‘w[i][j]’ of a tree having root

//’r[i][j]’

int c[SIZE][SIZE];//Cost ‘c[i][j] of a tree having root ‘r[i][j]

int r[SIZE][SIZE];//represents root

int n; // number of nodes

public:

/* This function accepts the input data */

void get_data()

{

int i;

cout<<"\n Optimal Binary Search Tree \n";

cout<<"\n Enter the number of nodes";

cin>>n;

cout<<"\n Enter the data as…\n";

for(i=1;i<=n;i++)

{

cout<<"\n a["<<i<<"]";

cin>>a[i];

}
```

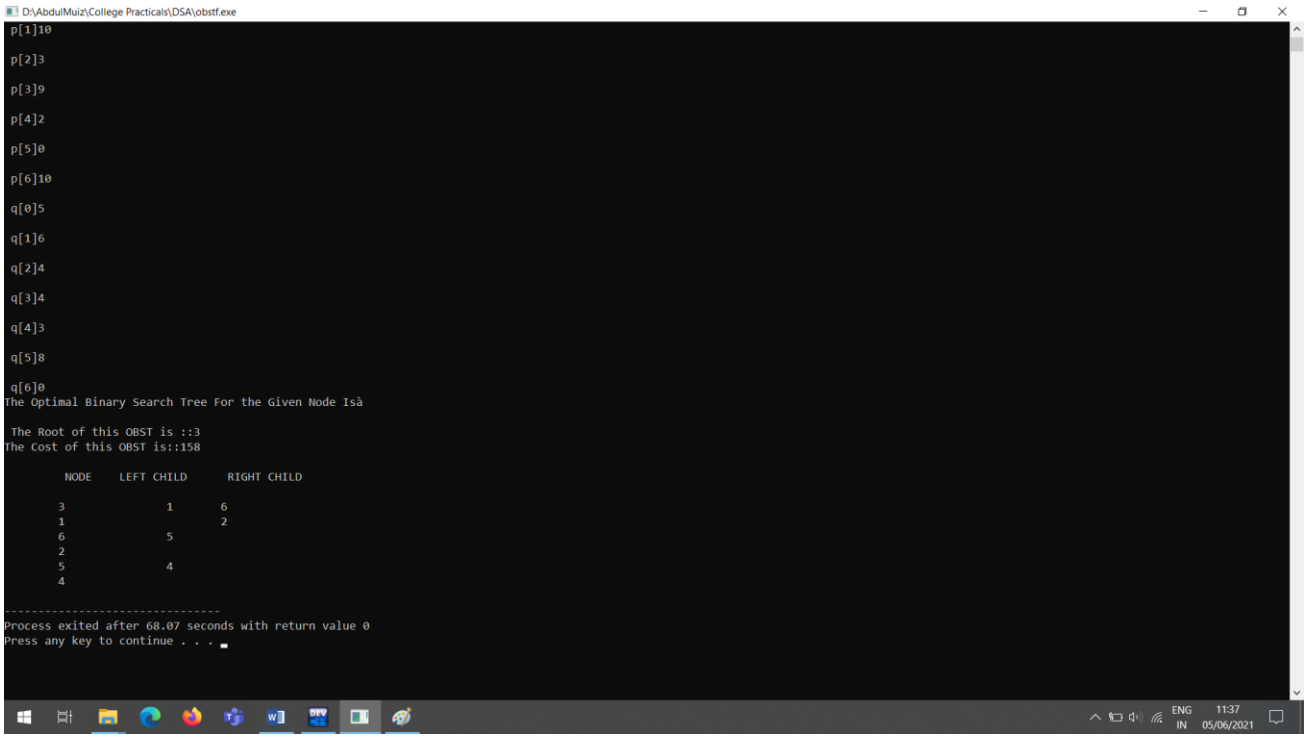
```
for(i=1;i<=n;i++)
{
cout<<"\n p["<<i<<"]";
cin>>p[i];
}
for(i=0;i<=n;i++)
{
cout<<"\n q["<<i<<"]";
cin>>q[i];
}
}

/* This function returns a value in the range ‘r[i][j-1]’ to ‘r[i+1][j]’so
that the cost ‘c[i][k-1]+c[k][j]’is minimum */
int Min_Value(int i,int j)
{
int m,k;
int minimum=32000;
for(m=r[i][j-1];m<=r[i+1][j];m++)
{
if((c[i][m-1]+c[m][j])<minimum)
{
minimum=c[i][m-1]+c[m][j];
k=m;
}
}
return k;
}

/* This function builds the table from all the given probabilities It
basically computes C,r,W values */
```

```
void build_OBST()
{
int i,j,k,l,m;
for(i=0;i<n;i++)
{
//initialize
w[i][i]=q[i];
r[i][i]=c[i][i]=0;
//Optimal trees with one node
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;
//Find optimal trees with ‘m’ nodes
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=Min_Value(i,j);
c[i][j]=w[i][j]+c[i][k-1]+c[k][j];
r[i][j]=k;
}
}
}

/* This function builds the tree from the tables made by the OBST function */
void build_tree()
```

```
{
int i,j,k;
int queue[20],front=-1,rear=-1;
cout<<"The Optimal Binary Search Tree For the Given Node Is…\n";
cout<<"\n The Root of this OBST is ::"<<r[0][n];
cout<<"\nThe Cost of this OBST is::"<<c[0][n];
cout<<"\n\n\t NODE \t LEFT CHILD \t RIGHT CHILD ";
cout<<"\n";
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<<"\t\t"<<r[i][k-1];
queue[++rear]=i;
queue[++rear]=k-1;
}
else
cout<<"\t\t";
if(r[k][j]!=0)
{
cout<<"\t"<<r[k][j];
queue[++rear]=k;
queue[++rear]=j;
}
else
```

```
cout<<"\t";
}//end of while
cout<<"\n";
}
};//end of the class
/*This is the main function */

int main()
{
OBST obj;
obj.get_data();
obj.build_OBST();
obj.build_tree();
return 0;
}
```




D:\AbdulMuiz\College Practicals\DSA\obstf.exe
p[1]10
p[2]3
p[3]9
p[4]2
p[5]0
p[6]10
q[0]5
q[1]6
q[2]4
q[3]4
q[4]3
q[5]8
q[6]0
The Optimal Binary Search Tree For the Given Node Isà
The Root of this OBST is ::3
The Cost of this OBST is::158
NODE LEFT CHILD RIGHT CHILD
3 1 6
1 2
6 5
2
5 4
4
Process exited after 68.07 seconds with return value 0
Press any key to continue . . .
ENG
IN
11:37
05/06/2021