Lab 12

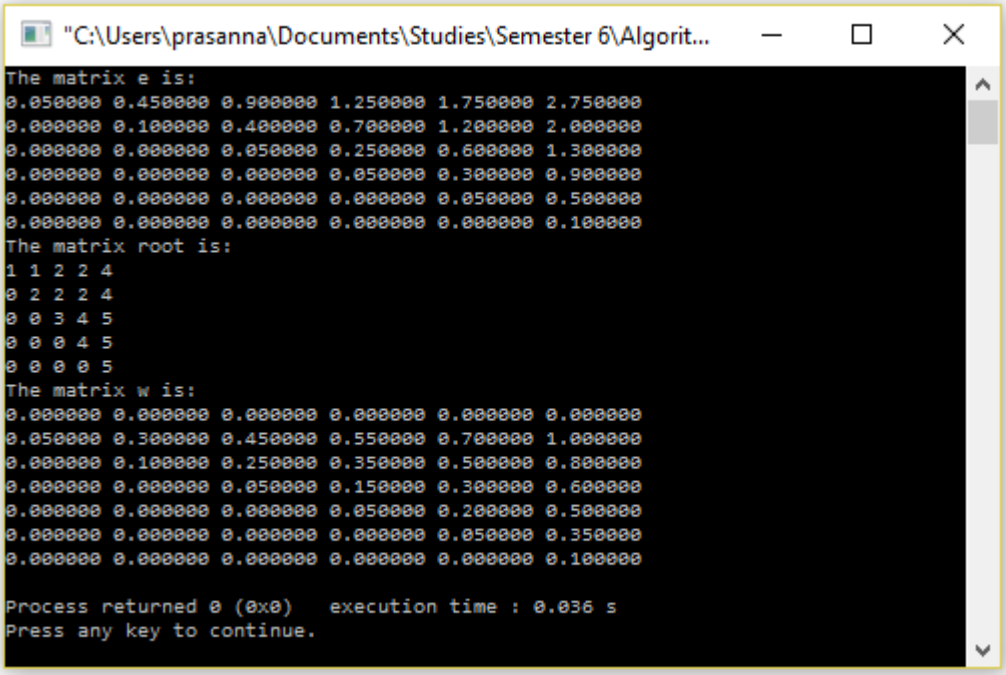
Prasanna Natarajan
1410110298

Code:

```
/*
Name        :   Prasanna Natarajan
Roll Number :   1410110298
Inputs      :   A vector p and q of length N and N+1
Outputs     :   The matrices containing the root and e value of the most optimal BST
Description :   This algorithm is taken from Introduction to Algorithm By Cormen Pg.402
*/

#include<stdio.h>
#include<stdlib.h>
#include<limits.h>

#define N 5

// defining global variables
double e[N+2][N+1];
double w[N+2][N+1];
int root[N+1][N+1];

//function declarations
void optimal_bst(double p[],double q[], int n);

int main(){
   // user inputs
   double TempP[N] = {0.15,0.10,0.05,0.1,0.2};
   double q[N+1] = {0.05,0.10,0.05,0.05,0.05,0.10};
   int i;
   double p[N+1];
   p[0] = 0;
   for(i=0;i<N;i++){
       p[i+1] = TempP[i];
       //printf("%lf",p[i+1]);
   }
   //initialising all the matrices
   int j;
   for(i=0;i<=N+1;i++){
       for(j=0;j<N+1;j++){
           e[i][j] = 0;
       }
   }
   for(i=0;i<N+1;i++){
       for(j=0;j<N+1;j++){
           root[i][j] = 0;
       }
   }
   for(i=0;i<N+2;i++){
       for(j=0;j<N+1;j++){
           w[i][j] = 0;
       }
   }
   // calling optimal bst to populate the matrices
   optimal_bst(p,q,N);

   printf("The matrix e is: \n");
   for(i=1;i<=N+1;i++){
       for(j=0;j<N+1;j++){
           printf("%lf ",e[i][j]);
       }
```

```
        printf("\n");
    }

    printf("The matrix root is: \n");
    for(i=1;i<N+1;i++){
        for(j=1;j<N+1;j++){
            printf("%d ",root[i][j]);
        }
        printf("\n");
    }

    printf("The matrix w is: \n");
    for(i=0;i<N+2;i++){
        for(j=0;j<N+1;j++){
            printf("%lf ",w[i][j]);
        }
        printf("\n");
    }
    return 0;
}

void optimal_bst(double p[],double q[], int n){
    int i =0;
    // initialising some values(diagonal elements) of e and w
    for(i=1;i<n+2;i++){
        e[i][i-1] = q[i-1];
        w[i][i-1] = q[i-1];
    }
    int l;
    for(l=1;l<n+1;l++){
        for(i=1;i<=n-l+1;i++){
            int j = i+l-1;
            e[i][j] = 1000000.0;
            w[i][j] = w[i][j-1]+p[j]+q[j];
            int r;
            for(r=i;r<=j;r++){
                double t = e[i][r-1] + e[r+1][j] + w[i][j];
                if(t<e[i][j]){
                    e[i][j] = t;
                    root[i][j] = r;
                }
            }
        }

    }
}
```

Screenshot:


"C:\Users\prasanna\Documents\Studies\Semester 6\Algorit...
The matrix e is:
0.050000 0.450000 0.900000 1.250000 1.750000 2.750000
0.000000 0.100000 0.400000 0.700000 1.200000 2.000000
0.000000 0.000000 0.050000 0.250000 0.600000 1.300000
0.000000 0.000000 0.000000 0.050000 0.300000 0.900000
0.000000 0.000000 0.000000 0.000000 0.050000 0.500000
0.000000 0.000000 0.000000 0.000000 0.000000 0.100000
The matrix root is:
1 1 2 2 4
0 2 2 2 4
0 0 3 4 5
0 0 0 4 5
0 0 0 0 5
The matrix w is:
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.050000 0.300000 0.450000 0.550000 0.700000 1.000000
0.000000 0.100000 0.250000 0.350000 0.500000 0.800000
0.000000 0.000000 0.050000 0.150000 0.300000 0.600000
0.000000 0.000000 0.000000 0.050000 0.200000 0.500000
0.000000 0.000000 0.000000 0.000000 0.050000 0.350000
0.000000 0.000000 0.000000 0.000000 0.000000 0.100000
Process returned 0 (0x0) execution time : 0.036 s
Press any key to continue.