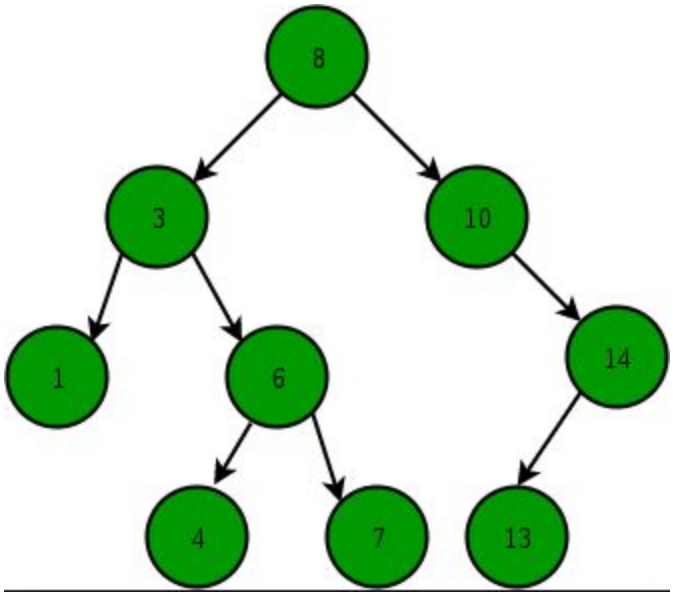
RHM ASSIGNMENT

Finding Optimal Cost for Constructing Binary Tree



AMIT GUPTA

MIT2018063

INTRODUCTION

This assignment is for Constructing Binary Search Tree with Optimal Cost. Binary Search Tree is a very commonly used Data Structure.

Some of uses of Binary Search Trees are:

1. It is used in implementing search algorithms,
2. It is used in implementing Dictionary,
3. It is used to represent Arithmetic operations,
4. It is used in implementing Sorting Algorithms,
5. It is used in implementing some other Advanced Data structures, and so on.

So it becomes very important to construct Binary search tree with very minimal cost so that cost of implementing any other algorithm or data structure using binary search tree become optimal.

We have Used the concept of Dynamic Programming to Over all cost of Constructing the Binary Search Tree.

ANALYSIS

Example 1

Input: keys[] = {10, 12}, freq[] = {34, 50}

There can be following two possible BSTs

```
    10                12
     \               /
      12            10
      I             II
```

Frequency of searches of 10 and 12 are 34 and 50 respectively.

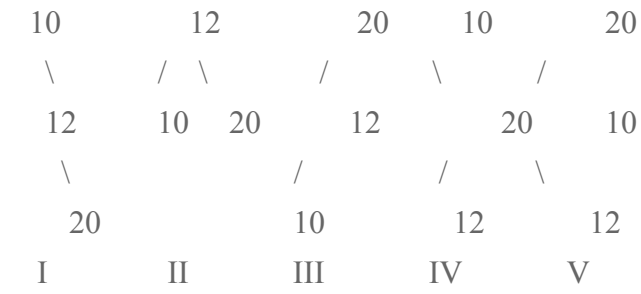
The cost of tree I is 34*1 + 50*2 = 134

The cost of tree II is 50*1 + 34*2 = 118

Example 2

Input: keys[] = {10, 12, 20}, freq[] = {34, 8, 50}

There can be following possible BSTs



Among all possible BSTs, cost of the fifth BST is minimum.

Cost of the fifth BST is 1*50 + 2*34 + 3*8 = 142

How to Run the Code:

Steps:

1. Go to the following link: https://github.com/iiita-amitgupta/USTsir_RHM_assignment/tree/master
2. Copy the Code from here and Paste in any C compiler (like VIM).
3. Compile the Code and Run.

   IF you are running the code using VIM the see the following images of examples:

Example 1.

```
genius@genius-Aspire-E5-573:~$ vi OptimalBST.c
genius@genius-Aspire-E5-573:~$ gcc OptimalBST.c
genius@genius-Aspire-E5-573:~$ ./a.out
Enter number of inputs want to enter: 2
Enter the values: 10 20
Enter the frequencies of the values: 34 50
The Optimal Cost for constructing the BST is: 118
```

Example 2.

```
genius@genius-Aspire-E5-573:~$ ./a.out
Enter number of inputs want to enter: 3
Enter the values: 10 12 20
Enter the frequencies of the values: 34 8 50
The Optimal Cost for constructing the BST is: 142
genius@genius-Aspire-E5-573:~$
```

DATA

Input	Output	
Enter number of inputs want to enter: 2 Enter the values: 10 20 Enter the frequencies of the values: 34 50	The Optimal Cost for constructing the BST is: 118	
Enter number of inputs want to enter: 3 Enter the values: 10 12 20 Enter the frequencies of the values: 34 8 50	The Optimal Cost for constructing the BST is: 142	

RESULTS

This Program gives the optimal Cost for Constructing The Binary Search Tree.

REFERENCES

1. Data Structure and Algorithms by A V Aho, J D Ullman, J E Hopcroft.
2. https://www.geeksforgeeks.org/binary-search-tree-set-1-search-and-insertion/
3. https://discuss.codechef.com/questions/87192/applications-of-binary-search-trees
4. https://www.techiedelight.com/find-optimal-cost-to-construct-binary-search-tree/
5. https://medium.com/@codingfreak/top-50-dynamic-programming-practice-problems-4208fed71aa3