Specification of program “bst”

Name

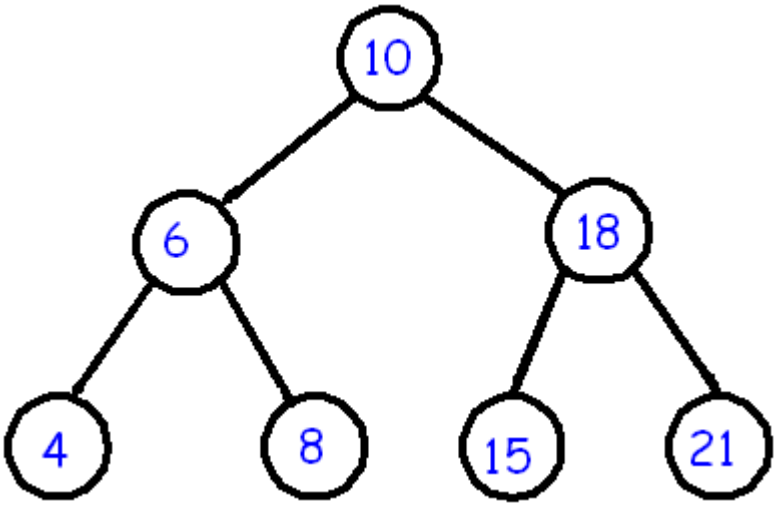
bst - Verifies if a provided list of numbers represent a valid binary search tree.

Usage

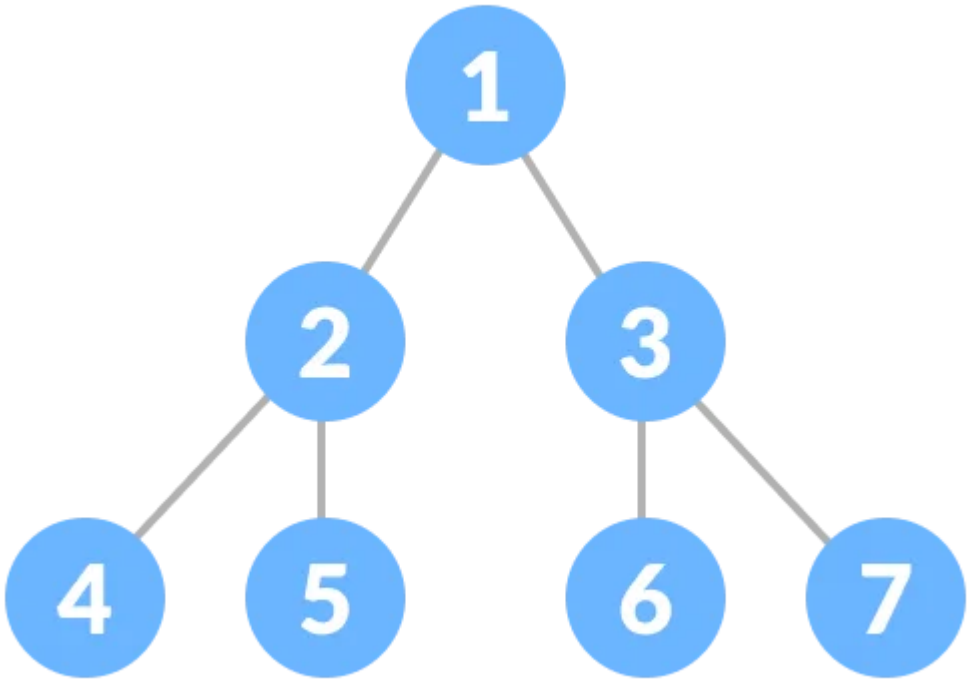
bst input-file [options]

Description

bst reads a **list of integers** from an input file and verifies a if the provided **integer** values build a valid binary search tree (BST) when visited following a breadth-first search. The result tree is printed with each level in a different line.



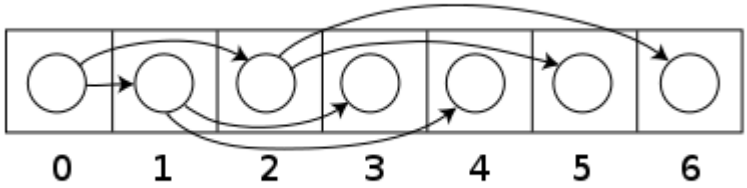
The presented tree, which is a valid BST, would be represented by the following input string: `10 6 18 4 8 15 21`



On the other hand, this image, that would be represented by `1 2 3 4 5 6 7`, does not represent a valid BST

The program should visit this string provided in a text file and print `valid` or `invalid`.

Tree representation follows this logic:



Options

Options should be provided through the command line.

- `-f[ile] <filename>` - redirect the program output to the specified file.

The options below should only be executed if the given tree is a valid binary search tree. Each operation should print the result in a new line. Each presented expected output takes the valid BST image shown in the `Description` as reference.

- `-t[op]` - prints the top view of the tree. Expected output `4 6 10 18 21`
- `-b[ottom]` - prints the bottom view of the tree. `4 8 15 21`
- `-r[ight]` - prints the right side view of the tree. `10 18 21`
- `-l[eft]` - prints the left side view of the tree. `10 6 4`
- `-d[iameter]` - prints the diameter of the tree. Expected output (one of the following):
    - `4 6 10 18 21`

    - `4 6 10 18 15`
    - `8 6 10 18 21`
    - `8 6 10 18 15`
- `-h[eight]` - prints the height of the tree. Expected output `3`

Input Data

- File containing a **list of integers** (the string provided in the input file must not contain floating point numbers or anything that isn't an integer) separated by a space.
- No number must exceed 10000.
- The provided binary tree must be **complete** (every parent node has 2 and only 2 children nodes). In complete binary trees the number of elements equals to `2^h – 1` where `h` is the height of the tree. The tree should not have a height superior to 10, meaning that the number of provided elements should not exceed 1023 (2^10 - 1).

Limitations

- The commands that are passed on the command line must be the same as in the specification, or the program will not function correctly.