

## Assignment 5 – Part 2

(may be done by a team of at most two students)

Assigned: Monday, November 12

Due: Tuesday, November 20 (11:59 pm)

### Part 2: Design by Contract

Posted on [Piazza:Resources](#) → [Assignments](#) is a zip file [CFJ\\_BST\\_Iter.zip](#). Unzip this file to obtain a directory [CFJ\\_BST\\_Iter](#) which you may import into Eclipse by doing: File → Import → Existing Projects into Workspace. This directory contains a fully configured Java project; the added configurations permit the inclusion of [CoFoJa](#) contract annotations in the Java source.

The Java source file is called [BST\\_Contract.java](#) and it has the familiar [Tree](#) and [DupTree](#) classes as well as a class [BST\\_Iterator](#) which works on both trees and duptrees. The class [DupTree](#) extends [Tree](#) and the values in both types of trees are integers. Also included is an [@Invariant\(ordered\(\)\)](#) clause for class [Tree](#).

Your task in this part of the assignment is to write [CoFoJa](#) contracts ([@Requires](#) and [@Ensures](#) annotations) for the constructor of [BST\\_Iterator](#) and the two methods that modify its state, namely, [next\(\)](#) and [stack\\_left\\_spine\(\)](#).

**Writing Contracts.** The contracts should capture the basic requirements and properties of the iterator. That is, the [@Requires](#) and [@Ensures](#) clauses should effectively state that:

1. the iterator only works on binary search trees;
2. the values are returned in ascending order; and
3. the stack invariant (described in Lecture 9) is maintained.

Your contracts may refer to the fields [count](#), [value](#) and [stack](#) of [BST\\_Iterator](#) and may also refer to *functions that do not modify the state* of any object, such as [Tree.min\(\)](#), [Tree.max\(\)](#), [Tree.ordered\(\)](#), [BST\\_Iterator.hasNext\(\)](#), [Stack.isEmpty\(\)](#), [Stack.peek\(\)](#), etc.

**Running the Program.** In order to run your program, you need to give the name of the .jar file in the VM Arguments of the Run Configuration, as follows:

```
-javaagent:lib/cofoja+asm-1.3.1-20170424.jar
```

Run [BST\\_Contract.java](#) augmented with contracts and ensure that the program works correctly.

**What to Submit.** Prepare a top-level directory named [A5\\_Part2\\_UBITId1\\_UBITId2](#) if the assignment is done by a team of two students; otherwise, name it as [A5\\_Part2\\_UBITId](#) if the assignment is done solo. (Order the [UBITId](#)s in alphabetic order, in the former case.) In this directory, place the directory [BST\\_CFJ](#) containing the revised [BST\\_Contract.java](#) augmented with contracts. Compress the top-level directory and submit the compressed file using the [submit\\_cse522](#) command. Only one submission per team is required.

**End of Assignment 5 - Part 2**