# Lab Assignment 25 (Binary Search Trees)

1. Write a Java project named **Lab25A** that will create our own tree node class and use it to build a binary search tree.
   * Create a secondary class named **TreeItem** with the following:
     1. 3 instance variables:
        1. An integer value
        2. Two TreeItem variables: **left** and **right**
     2. A constructor that receives an integer parameter. It should fill the integer instance variables and set the TreeItem variables to null.
     3. An int method that returns the value of the integer instance variable
     4. A String method named toString that returns a string with the integer instance variable (and a label).
   * Create another new class named **BinarySearchTree** with the following:
     1. An instance variable named **root** (data type TreeItem)
     2. A constructor with no parameters that sets root equal to null
     3. A boolean method that
        1. Receives one integer parameter
        2. Inserts the integer parameter value in the tree
        3. Use the “Inserting an Element to a Binary Tree” code in the PowerPoint notes to guide you.
        4. Remember that our tree node data type is called **TreeItem**, not TreeNode, so you’ll need to change a few things
     4. A boolean method that
        1. Receives one integer parameter and the TreeItem root
        2. Searches for that value in the tree
        3. Returns a true if it is found and false otherwise
        4. Use the “Searching an Element in a Binary Search Tree” code in the PowerPoint as a guide.
     5. A void method that
        1. Uses the inorder algorithm to look at every node in our tree
        2. It should print the value of all nodes and how many children they have. (They will have 0-2 children depending on whether left or right are null.)
        3. If you go to the “BST Class” slide in the PowerPoint and click on the green box, it will show you code for BST. You can look at the 2 **inorder** methods there to get an idea of how to do this.
   * Back in the main method of the main class:
     1. Create a new BinarySearchTree object
     2. Read a set of values from the text file (Lab25A.txt) and use the tree’s insertion method to place them in the tree
     3. Ask the user for an integer and call the tree’s searchingmethod to see if it is in the tree.
     4. Call the tree’s void method to print all the node values and number of children.
   * You will also need to draw a diagram in PowerPoint, Word or a similar program to show what your tree will look like based on the values inserted and the order they were added. Name this file Lab25A\_Diagram.
2. Write a Java project named **Lab25B** that will create a BinarySearchTree tree of string values and use the methods to fill and print it.
   * Make **TreeItem** and **BinarySearchTree** classes and copy the code from Lab25A into them
     1. In the TreeItem class change the int instance variable to be a String variable and make any changes necessary to the methods to handle this new data type.
   * In the BinarySearchTree class
     1. Add a new int instance variable named **size** and set it = 0.
     2. Increase size by 1 every time you insert a new node.
     3. Go to the “BST Class” slide in the PowerPoint and click on the green box see the code for code for BST.
     4. Copy all of the **inorder**, **preorder** and **postorder** methods into your BinarySearchTree class. (Don’t copy the @Override lines above them.)
     5. Adapt the methods to work with the TreeItem class instead of TreeNode
     6. Add an int method with no parameters that returns size.
   * In the main method:
     1. Create a new BinarySearchTree tree
     2. Read the values from the text file (Lab25B.txt)
     3. Add each value to the tree
     4. After adding all the values, print the size of the tree (using the new function)
     5. Print the tree inorder, preorder & postorder. Make sure to state which order you are printing for each one.
   * You will also need to draw a diagram in PowerPoint, Word or a similar program to show what your tree will look like based on the values inserted and the order they were added. Name this file Lab25B\_Diagram.