

California State University,
Monterey Bay

Week 7 – Programming Assignment
Binary Search Tree

Clarence Mitchell

CST370

Design and Analysis of Algorithms

Spring 2016

Instructor: Dr. Seetharam

Exercise Screen Shots

Test Run 1

```
Constructing empty BST
BST is empty

Now insert a bunch of integers into the BST.
Try items not in the BST and some that are in it:
Item to insert (-999 to stop): -999
BST is empty

Now testing the search() operation.
Try both items in the BST and some not in it:
Item to find (-999 to stop): 80
Not found
Item to find (-999 to stop): -999

Inorder traversal
BST is empty

Preorder traversal
BST is empty

There are 0 nodes in the BST

--- End of Program ---
Press any key to continue . . .
```

Explanation:

A run was made using 0 input nodes and resulted in the following

Recursive Search: Not Found message is displayed from the search when searching for 80

In Order Traversal: BST Empty message is displayed from the inOrder traversal

Pre Order Traversal: BST Empty message displayed from the preOrder traversal

Node Count: 0 nodes message is displayed from nodeCount

Test Run 2

```
Constructing empty BST
BST is empty

Now insert a bunch of integers into the BST.
Try items not in the BST and some that are in it:
Item to insert (-999 to stop): 80
Item to insert (-999 to stop): -999
BST is not empty

Now testing the search() operation.
Try both items in the BST and some not in it:
Item to find (-999 to stop): 80
Found
Item to find (-999 to stop): 90
Not found
Item to find (-999 to stop): -999

Inorder traversal
80

Preorder traversal
80

There are 1 nodes in the BST

--- End of Program ---
Press any key to continue . . .
```

Explanation:

A run was made using 1 input node of 80 and resulted in the following

Recursive Search: **Found** message is displayed from search when searching for 80

Not Found message is displayed from the search when searching for 90

In Order Traversal: The BST is traversed and the node data is outputted in the following order

80

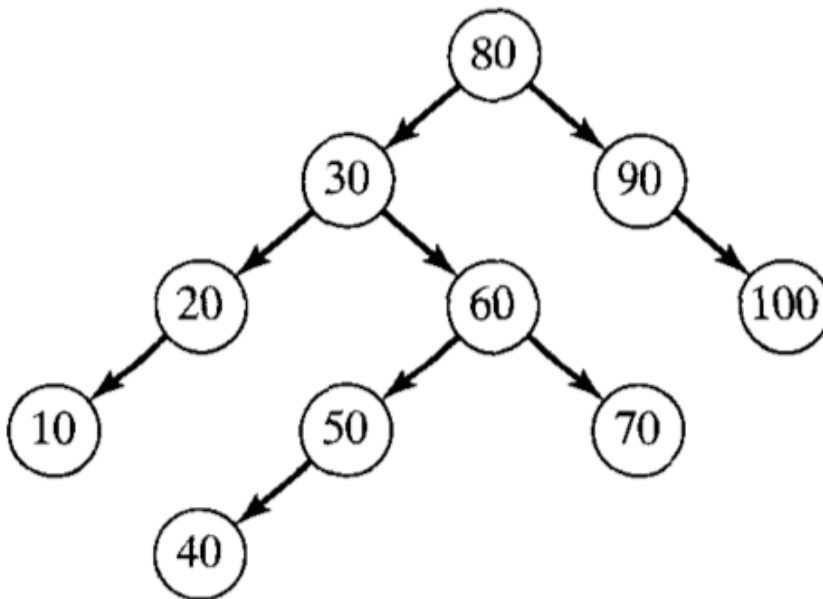
Pre Order Traversal: The BST is traversed and the node data is outputted in the following order

80

Node Count: The nodes are counted, and a message stating that there are **1 nodes** is displayed

Test Run 3

NOTE: The input for this test run is based on the following BST given in giving homework 7:



About Screen Displays: Since the original output from this test was lengthy, and for the purpose of reporting the test, the screen display has been broken into three (3) smaller displays.

DISPLAY 1

```
Constructing empty BST
BST is empty

Now insert a bunch of integers into the BST.
Try items not in the BST and some that are in it:
Item to insert (-999 to stop): 80
Item to insert (-999 to stop): 90
Item to insert (-999 to stop): 30
Item to insert (-999 to stop): 100
Item to insert (-999 to stop): 20
Item to insert (-999 to stop): 60
Item to insert (-999 to stop): 70
Item to insert (-999 to stop): 50
Item to insert (-999 to stop): 40
Item to insert (-999 to stop): 10
Item to insert (-999 to stop): -999
BST is not empty
```

Explanation:

The run was executed and the data is inputted at the beginning

DISPLAY 2

```
Now testing the search() operation.
Try both items in the BST and some not in it:
Item to find (-999 to stop): 80
Found
Item to find (-999 to stop): 100
Found
Item to find (-999 to stop): 70
Found
Item to find (-999 to stop): 40
Found
Item to find (-999 to stop): 10
Found
Item to find (-999 to stop): 60
Found
Item to find (-999 to stop): 30
Found
Item to find (-999 to stop): 5
Not found
Item to find (-999 to stop): 1
Not found
Item to find (-999 to stop): 110
Not found
Item to find (-999 to stop): 75
Not found
Item to find (-999 to stop): 65
Not found
Item to find (-999 to stop): -999
```

Explanation:

The search operation of the run was performed with the following results:

Recursive Search: Found message is displayed from search when searching for

80 (ROOT),

100, 70, 40, 10 (Leaf nodes)

60, 30 (Parent nodes with children nodes)

Not Found message is displayed from the search when searching for 90

5, 1 (Left most searches from ROOT to left subtree),

110 (Right most search from ROOT to right subtree)

75, 65 (Right most searches on left subtree)

DISPLAY 3

```
Inorder traversal
10 20 30 40 50 60 70 80 90 100

Preorder traversal
80 30 20 10 60 50 40 70 90 100

There are 10 nodes in the BST

--- End of Program ---
Press any key to continue . . .
```

Explanation:

The inOrder, preOrder and nodeCount operations of the run are performed with the following results:

In Order Traversal: The BST is traversed and the node data is outputted in the following order

10, 20, 30, 40, 50, 60, 70, 80, 90, 100

Pre Order Traversal: The BST is traversed and the node data is outputted in the following order

80, 30, 20, 10, 60, 50, 40, 70, 90, 100

Node Count: The nodes are counted, and a message stating that there are **10 nodes** is displayed