BinaryTrees1

0.2.0

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1 Class Index 1

1.1 Class List . . . 1

2 File Index 3

2.1 File List . . . 3

3 Class Documentation 5

3.1 BTNode Class Reference . . . 5

3.1.1 Detailed Description . . . 6

3.1.2 Constructor & Destructor Documentation . . . 6

3.1.2.1 BTNode() [1/2] . . . 6

3.1.2.2 BTNode() [2/2] . . . 6

3.1.3 Member Function Documentation . . . 6

3.1.3.1 nodeData() . . . 7

3.1.3.2 nodeName() . . . 7

3.1.3.3 nodeNum() . . . 7

3.1.4 Member Data Documentation . . . 7

3.1.4.1 count . . . 7

3.1.4.2 left . . . 8

3.1.4.3 num . . . 8

3.1.4.4 parent . . . 8

3.1.4.5 right . . . 8

4 File Documentation 9

4.1 /home/addis/BinaryTreeStart/src/binSearch.cpp File Reference . . . 9

4.1.1 Detailed Description . . . 10

4.1.2 Function Documentation . . . 10

4.1.2.1 addNode() [1/2] . . . 10

4.1.2.2 addNode() [2/2] . . . 11

4.1.2.3 genExampleBalanced() . . . 11

4.1.2.4 genExampleLeft() . . . 12

4.1.2.5 genExampleRight() . . . 12

4.1.2.6 genExampleTree() . . . 12

4.1.2.7 main() . . . 13

4.1.2.8 printBT() [1/2] . . . 13

4.1.2.9 printBT() [2/2] . . . 13

4.1.2.10 printTree() . . . 14

4.2 /home/addis/BinaryTreeStart/src/main.cpp File Reference . . . 14

4.2.1 Detailed Description . . . 15

4.2.2 Function Documentation . . . 15

4.2.2.1 depth() . . . 15

4.2.2.2 genExampleTree() . . . 16

4.2.2.3 height() . . . 16

4.2.2.4 main() 17
4.2.2.5 nonRecursiveTraverse() 17
4.2.2.6 traverse() 18

Index **19**

Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

BTNode 5

Chapter 2

File Index

2.1 File List

Here is a list of all files with brief descriptions:

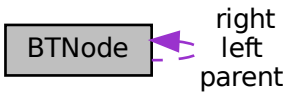
/home/addis/BinaryTreeStart/src/binSearch.cpp
This is a demonstration of binary search trees 9
/home/addis/BinaryTreeStart/src/main.cpp
This is a demonstration of simple binary trees 14

Chapter 3

Class Documentation

3.1 BTNode Class Reference

Collaboration diagram for BTNode:



Public Member Functions

- BTNode (int dataVal)
- char nodeName ()
- int nodeData ()
- BTNode ()
- int nodeNum ()

Public Attributes

- BTNode * left
- BTNode * right
- BTNode * parent
- int num

Static Public Attributes

- static int count = 0

3.1.1 Detailed Description

Binary Tree Node

This is from Open Data Structures in C++ by Pat Morin

Definition at line 19 of file binSearch.cpp.

3.1.2 Constructor & Destructor Documentation

3.1.2.1 BTNode() [1/2]

```
BTNode::BTNode (
            int dataVal )  [inline]
```

BTNode constructor

Definition at line 28 of file binSearch.cpp.

```
28                      {
29       cout « "name = " « name « endl;
30       left = NULL;
31       right = NULL;
32       parent = NULL;
33       objName = name++;
34       data = dataVal;
35   }
```

3.1.2.2 BTNode() [2/2]

```
BTNode::BTNode ( )  [inline]
```

BTNode constructor

Definition at line 29 of file main.cpp.

```
29           {
30       left = NULL;
31       right = NULL;
32       parent = NULL;
33       num = count++;
34   }
```

3.1.3 Member Function Documentation

3.1.3.1 nodeData()

```
int BTNode::nodeData ( )  [inline]
```

This reports the node's data

Definition at line 47 of file binSearch.cpp.

```
47                      {
48          return(data);
49      }
```

3.1.3.2 nodeName()

```
char BTNode::nodeName ( )  [inline]
```

This reports the node's name

Definition at line 40 of file binSearch.cpp.

```
40                      {
41          return(objName);
42      }
```

3.1.3.3 nodeNum()

```
int BTNode::nodeNum ( )  [inline]
```

This reports the node's number

Definition at line 39 of file main.cpp.

```
39                  {
40          return(num);
41      }
```

3.1.4 Member Data Documentation

3.1.4.1 count

```
int BTNode::count = 0  [static]
```

Definition at line 24 of file main.cpp.

3.1.4.2 left

```
BTNode * BTNode::left
```

Definition at line 21 of file binSearch.cpp.

3.1.4.3 num

```
int BTNode::num
```

Definition at line 23 of file main.cpp.

3.1.4.4 parent

```
BTNode * BTNode::parent
```

Definition at line 23 of file binSearch.cpp.

3.1.4.5 right

```
BTNode * BTNode::right
```

Definition at line 22 of file binSearch.cpp.

The documentation for this class was generated from the following files:

- /home/addis/BinaryTreeStart/src/binSearch.cpp
- /home/addis/BinaryTreeStart/src/main.cpp

Chapter 4

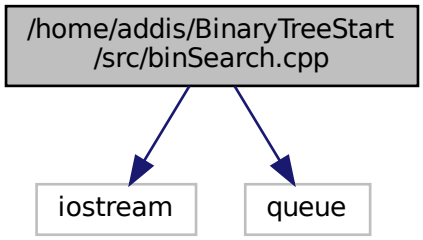
File Documentation

4.1 /home/addis/BinaryTreeStart/src/binSearch.cpp File Reference

This is a demonstration of binary search trees.

```
#include <iostream>
#include <queue>
```

Include dependency graph for binSearch.cpp:



Classes

- class BTNode

Functions

- BTNode * addNode (BTNode *rootNode, BTNode *n)
- BTNode * addNode (BTNode *rootNode, int dataval)
- BTNode * genExampleTree (BTNode *root)
- BTNode * genExampleRight (BTNode *rootNodeRight)
- BTNode * genExampleLeft (BTNode *rootNodeLeft)
- BTNode * genExampleBalanced (BTNode *rootNodeBalanced)
- void printTree (BTNode *rootNode)
- void printBT (const string &prefix, BTNode *node, bool isLeft)
- void printBT (BTNode *node)
- int main (int, char **)

4.1.1 Detailed Description

This is a demonstration of binary search trees.

This is a demo from CPTR 227 class

Author

Seth McNeill

Date

2021 March 02

4.1.2 Function Documentation

4.1.2.1 addNode() [1/2]

```
BTNode* addNode (
            BTNode * rootNode,
            BTNode * n )
```

This function adds a node to a binary search tree.

Parameters

rootNode	is the pointer to the tree's root node
n	is the node to add

Returns

pointer to rootNode if successful, NULL otherwise

Definition at line 67 of file binSearch.cpp.

```
67                                              {
68     BTNode* prev = NULL;
69     BTNode* w = rootNode;
70     if(rootNode == NULL) { // starting an empty tree
71         rootNode = n;
72     } else {
73         // Find the node n belongs under, prev, n's new parent
74         while(w != NULL) {
75             prev = w;
76             if(n->nodeData() < w->nodeData()){
77                 w = w->left;
78             } else if(n->nodeData() > w->nodeData()) {
79                 w = w->right;
80             } else { // data already in the tree
81                 return(NULL);
82             }
83         }
84         // now prev should contain the node that should be n's parent
85         // Add n to prev
86         if(n->nodeData() < prev->nodeData()) {
87             prev->left = n;
88         } else {
```

```
89              prev->right = n;
90          }
91      }
92      return(rootNode);
93  }
```

4.1.2.2 addNode() [2/2]

```
BTNode* addNode (
              BTNode * rootNode,
              int dataval )
```

Adds a new node with the passed data value

Parameters

rootNode	pointer to root node
dataval	an integer for the new node's data

Returns

pointer to root node or NULL if not successful

Definition at line 103 of file binSearch.cpp.

```
103                                                 {
104     BTNode* newNode = new BTNode(dataval);
105     if(addNode(rootNode, newNode) == NULL) {
106         cout « dataval « " already in tree" « endl;
107     } else {
108         cout « dataval « " succesfully added" « endl;
109     }
110     return(rootNode);
111 }
```

4.1.2.3 genExampleBalanced()

```
BTNode* genExampleBalanced (
              BTNode * rootNodeBalanced )
```

Definition at line 146 of file binSearch.cpp.

```
146                                                 {
147     int classData[] = {6,11,4,7,9,13,3,5,12,14};
148     for(int ii = 0; ii < 11; ii++) {
149         addNode(rootNodeBalanced, classData[ii]);
150     }
151     return rootNodeBalanced;
152 }
```

4.1.2.4 genExampleLeft()

```
BTNode* genExampleLeft (
            BTNode * rootNodeLeft )
```

Definition at line 137 of file binSearch.cpp.

```
137                                                 {
138     int classData[] = {13,12,11,9,8,7,6,5,4,3,1};
139     for(int i = 0;i < 11; i++){
140         addNode(rootNodeLeft, classData[i]);
141     }
142
143     return rootNodeLeft;
144 }
```

4.1.2.5 genExampleRight()

```
BTNode* genExampleRight (
            BTNode * rootNodeRight )
```

Definition at line 128 of file binSearch.cpp.

```
128                                                  {
129     int classData[] = {3,4,5,6,7,8,9,11,12,13,14};
130     for(int i = 0;i < 11; i++){
131         addNode(rootNodeRight, classData[i]);
132     }
133
134     return rootNodeRight;
135 }
```

4.1.2.6 genExampleTree()

```
BTNode* genExampleTree (
            BTNode * root )
```

This generates a simple tree to play with

It is a bit of a hack.

Definition at line 118 of file binSearch.cpp.

```
118                                             {
119     //int inData[] = {1,2,3,4,5,6,7};
120     int inData[] = {4,6,5,7,2,1,3};
121     int classData[] = {1,3,4,5,6,7,8,9,11,12,13,14};
122     for(int ii = 0; ii < 7; ii++) {
123         addNode(root, inData[ii]);
124     }
125     return root;
126 }
```

4.1.2.7 main()

```
int main (
              int ,
              char **  )
```

Definition at line 225 of file binSearch.cpp.

```
225                     {
226     BTNode* rootNode = new BTNode(0); // pointer to the root node
227     BTNode* rootNodeRight = new BTNode(1);
228     BTNode* rootNodeLeft = new BTNode(14);
229     BTNode* rootNodeBalanced = new BTNode(8); // pointer to the root node
230     /*
231     genExampleTree(rootNode);
232     printBT(rootNode);
233     printTree(rootNode);
234
235 */
236     genExampleRight(rootNodeRight);
237     printBT(rootNodeRight);
238     printTree(rootNodeRight);
239
240     genExampleLeft(rootNodeLeft);
241     printBT(rootNodeLeft);
242     printTree(rootNodeLeft);
243
244     genExampleBalanced(rootNodeBalanced);
245     printBT(rootNodeBalanced);
246     printTree(rootNodeBalanced);
247 }
```

4.1.2.8 printBT() [1/2]

```
void printBT (
              BTNode * node )
```

An overload to simplify calling printBT

Parameters

node	is the root node of the tree to be printed

Definition at line 219 of file binSearch.cpp.

```
220 {
221     printBT("", node, false);
222 }
```

4.1.2.9 printBT() [2/2]

```
void printBT (
              const string & prefix,
              BTNode * node,
              bool isLeft )
```

Print a binary tree

This example is modified from: https://stackoverflow.com/a/51730733

Parameters

prefix	is a string of characters to start the line with
node	is the current node being printed
isLeft	bool true if the node is a left node

Definition at line 196 of file binSearch.cpp.

```
197 {
198     if( node != NULL )
199     {
200         cout « prefix;
201 
202         cout « (isLeft ? "| --" : "L--" );
203 
204         // print the value of the node
205         //cout « node->nodeName() « ':' « node->nodeData() « std::endl;
206         cout « node->nodeData() « std::endl;
207 
208         // enter the next tree level - left and right branch
209         printBT( prefix + (isLeft ? "|    " : "     "), node->left, true);
210         printBT( prefix + (isLeft ? "|    " : "     "), node->right, false);
211     }
212 }
```

4.1.2.10 printTree()

```
void printTree (
             BTNode * rootNode )
```

Prints out a representtation of a binary search tree

Parameters

rootNode	is a pointer to the root node

Definition at line 161 of file binSearch.cpp.

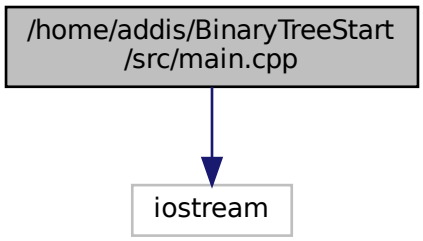
```
161                                  {
162     queue<BTNode*> todo; // the queue of nodes left to visit
163     BTNode* cur; // current node
164     BTNode* prev; // The previous node
165 
166     todo.push(rootNode);
167 
168     while(!todo.empty()) {
169         cur = todo.front();
170         // Print current node
171         cout « cur->nodeName() « ':' « cur->nodeData() « '\t';
172         // add cur->left to queue
173         if(cur->left != NULL) {
174             todo.push(cur->left);
175         }
176         // add cur->right to queue
177         if(cur->right != NULL) {
178             todo.push(cur->right);
179         }
180         // remove cur from queue
181         todo.pop();
182     }
183     cout « endl;
184 }
```

4.2 /home/addis/BinaryTreeStart/src/main.cpp File Reference

This is a demonstration of simple binary trees.

```
#include <iostream>
```

Include dependency graph for main.cpp:



Classes

- class BTNode

Functions

- int depth (BTNode ∗u)
- void traverse (BTNode ∗rootNode)
- void nonRecursiveTraverse (BTNode ∗rootNode)
- int height (BTNode ∗u)
- BTNode ∗ genExampleTree (BTNode ∗root)
- int main (int, char ∗∗)

4.2.1 Detailed Description

This is a demonstration of simple binary trees.

This is a demo from CPTR 227 class

Author

Seth McNeill

Date

2021 February 24

4.2.2 Function Documentation

4.2.2.1 depth()

```
int depth (
            BTNode * u )
```

Calculates the depth (number of steps between node and root) of a node

Parameters

pointer	to BTNode to measure the depth of

Returns

integer count of depth

Definition at line 54 of file main.cpp.

```
54                          {
55     int d = 0; // depth counter
56     while(u != NULL) {
57         u = u->parent;
58         d++;
59     }
60     return(--d);
61 }
```

4.2.2.2 genExampleTree()

```
BTNode* genExampleTree (
            BTNode * root )
```

This generates a simple tree to play with

It is a bit of a hack.

Definition at line 134 of file main.cpp.

```
134                                         {
135     BTNode* one = new BTNode();
136     BTNode* two = new BTNode();
137     BTNode* three = new BTNode();
138     BTNode* four = new BTNode();
139     BTNode* five = new BTNode();
140     BTNode* six = new BTNode();
141     cout « "Created the nodes" « endl;
142     root->left = one;
143     cout « "Added root->left" « endl;
144     one->parent = root;
145     root->right = two;
146     two->parent = root;
147     two->left = three;
148     three->parent = two;
149     two->right = four;
150     four->parent = two;
151     one->left = five;
152     five->parent = one;
153     five->left = six;
154     six->parent = five;
155     cout « "root's number: " « root->nodeNum() « endl;
156     cout « "one's number: " « one->nodeNum() « endl;
157     cout « "two's number: " « two->nodeNum() « endl;
158     cout « "three's number: " « three->nodeNum() « endl;
159     cout « "four's number: " « four->nodeNum() « endl;
160     cout « "five's number: " « five->nodeNum() « endl;
161     cout « "six's number: " « six->nodeNum() « endl;
162     cout « "six's depth is " « depth(six) « endl;
163     cout « "root's height is " « height(root) « endl;
164     return root;
165 }
```

4.2.2.3 height()

```
int height (
            BTNode * u )
```

This calculates the height (max number of steps until leaf node)

Parameters

pointer	to a BTNode

Returns

integer count of height

Definition at line 120 of file main.cpp.

```
120                         {
121     if (u == NULL) {
122         cout « "Reached NULL end of branch" « endl;
123         return(-1);
124     }
125     cout « "Calculating the height of node " « u->nodeNum() « endl;
126     return(1 + max(height(u->left), height(u->right)));
127 }
```

4.2.2.4 main()

```
int main (
              int ,
              char **  )
```

Definition at line 168 of file main.cpp.

```
168                         {
169     BTNode* rootNode = new BTNode(); // pointer to the root node
170     genExampleTree(rootNode);
171     cout « endl « "Traversing the binary tree" « endl;
172     traverse(rootNode);
173     cout « endl « "Non-recursive traversing" « endl;
174     nonRecursiveTraverse(rootNode);
175 }
```

4.2.2.5 nonRecursiveTraverse()

```
void nonRecursiveTraverse (
              BTNode * rootNode )
```

Traverses all nodes in a binary tree non-recursively

Parameters

A	pointer to the root node of interest

Definition at line 85 of file main.cpp.

```
85                                          {
86     BTNode* u = rootNode; // Current node of interest
87     BTNode* prev = NULL;  // Previously looked at node
88     BTNode* next;         // The next node to look at
89
90     while(u != NULL) {
91         cout « "Traversing node " « u->nodeNum() « endl;
92         if(prev ==  u->parent) {
93             if(u->right != NULL) {
```

```
94                  next = u->right;
95              } else if(u->left != NULL) {
96                  next = u->left;
97              } else {
98                  next = u->parent;
99              }
100         } else if(prev == u->right) {
101             if(u->left != NULL){
102                 next = u->left;
103             } else {
104                 next = u->parent;
105             }
106         } else {
107             next = u->parent;
108         }
109         prev = u;
110         u = next;
111     }
112 }
```

4.2.2.6 traverse()

```
void traverse (
              BTNode * rootNode )
```

Traverses all the nodes in a binary tree.

Parameters

A	pointer to the root node of interest

Definition at line 69 of file main.cpp.

```
69                                  {
70     if(rootNode == NULL) {
71         cout « "reached NULL" « endl;
72         return;
73     }
74     cout « "Traversing node " « rootNode->nodeNum() « endl;
75     traverse(rootNode->right);
76     traverse(rootNode->left);
77 }
```

Index

/home/addis/BinaryTreeStart/src/binSearch.cpp, 9
/home/addis/BinaryTreeStart/src/main.cpp, 14

addNode
    binSearch.cpp, 10, 11

binSearch.cpp
    addNode, 10, 11
    genExampleBalanced, 11
    genExampleLeft, 11
    genExampleRight, 12
    genExampleTree, 12
    main, 12
    printBT, 13
    printTree, 14
BTNode, 5
    BTNode, 6
    count, 7
    left, 7
    nodeData, 6
    nodeName, 7
    nodeNum, 7
    num, 8
    parent, 8
    right, 8

count
    BTNode, 7

depth
    main.cpp, 15

genExampleBalanced
    binSearch.cpp, 11
genExampleLeft
    binSearch.cpp, 11
genExampleRight
    binSearch.cpp, 12
genExampleTree
    binSearch.cpp, 12
    main.cpp, 16

height
    main.cpp, 16

left
    BTNode, 7

main
    binSearch.cpp, 12
    main.cpp, 17

main.cpp
    depth, 15
    genExampleTree, 16
    height, 16
    main, 17
    nonRecursiveTraverse, 17
    traverse, 18

nodeData
    BTNode, 6
nodeName
    BTNode, 7
nodeNum
    BTNode, 7
nonRecursiveTraverse
    main.cpp, 17
num
    BTNode, 8

parent
    BTNode, 8
printBT
    binSearch.cpp, 13
printTree
    binSearch.cpp, 14

right
    BTNode, 8

traverse
    main.cpp, 18