

数据结构与算法实验报告

实验二



学 生：
学 号：
年 级：2023 级
专 业：软件工程

重庆大学大数据与软件学院

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1. 实验目的：

练习二叉树的程序实现。

掌握调试程序的方法，跟踪程序的执行过程。

2. 实验要求

完成实验中要求的内容，实验报告书写格式尽量美观整洁。

所有程序需经过上机调试通过。

注意程序编写规范，如：必要的注释行，缩进排列等。

提交项目压缩包和实验报告。

3. 实验内容：

- (1) 定义二叉树的结点类 BinNode;
- (2) 实现二叉检索树的结点类 BSTNode;
- (3) 实现二叉检索树 BST，并设计程序进行测试;
- (4) 编写一个函数，计算二叉树的高度;

选做：


编写一个函数，根据二叉树的前序遍历和中序遍历序列，重建二叉树。

4. 核心代码和实验结果

代码见压缩文件

(1) (2) BSTNode 作为 BinNode 的一个实现方式

```
// Return true if it is a leaf, false otherwise
bool isLeaf() { return (lc == NULL) && (rc == NULL); }
;
int main()
{
    BSTNode<int, char> eg1(1, 'a'), eg2(2, 'b'), eg3(3, 'c');
    eg1.setElement('A');
    eg2.setElement('B');
    eg2.setLeft(&eg1);
    eg2.setRight(&eg3);
    cout << eg2.left()->element() << endl;
    cout << eg2.right()->element() << endl;
    cout << eg2.element() << endl;
    return 0;
}
```

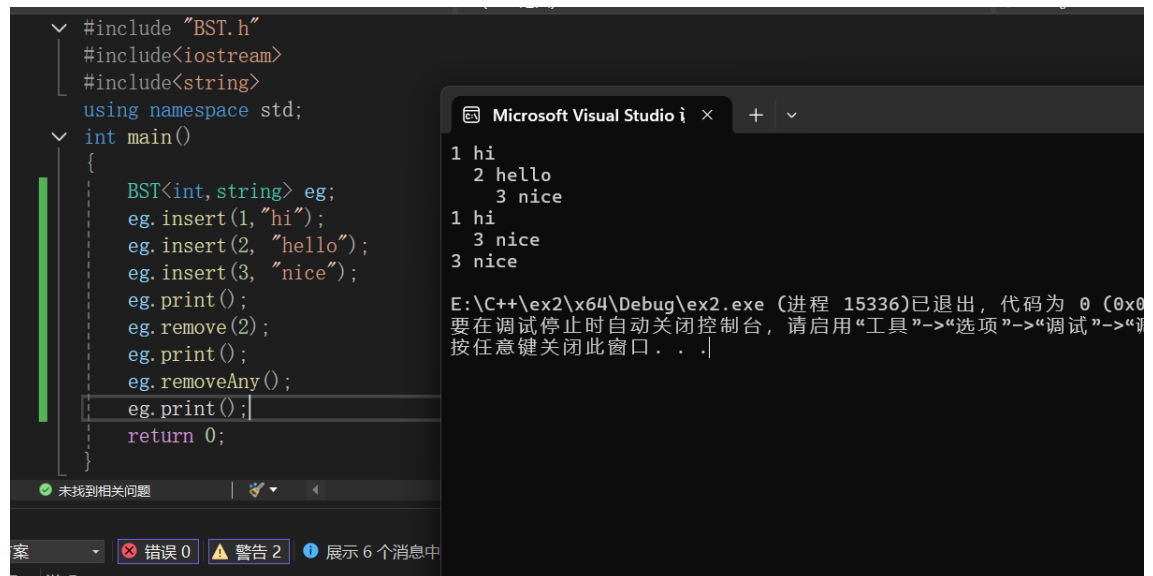


Microsoft Visual Studio

A
C
B

E:\C++\ex2\x64\Debug\ex2.exe (进程 28912)已退出，要在调试停止时自动关闭控制台，请启用“工具”->“选项”按任意键关闭此窗口...

(3)



The screenshot shows the Microsoft Visual Studio IDE. On the left, the source code for a C++ program is displayed. The program includes `BST.h`, `<iostream>`, and `<string>`, and uses the `std` namespace. The `main` function creates a `BST<int, string>` object `eg`, inserts three elements ("hi", "hello", "nice"), prints them, removes the element "hello", prints again, removes any remaining elements, prints a third time, and returns 0. On the right, the output window shows the execution results: "1 hi", "2 hello", "3 nice", followed by "1 hi", "3 nice", and "3 nice". Below the output, a message states that the program `E:\C++\ex2\x64\Debug\ex2.exe` (process 15336) has exited with code 0 (0x0).

```
#include "BST.h"
#include<iostream>
#include<string>
using namespace std;

int main()
{
    BST<int, string> eg;
    eg.insert(1, "hi");
    eg.insert(2, "hello");
    eg.insert(3, "nice");
    eg.print();
    eg.remove(2);
    eg.print();
    eg.removeAny();
    eg.print();
    return 0;
}
```

1 hi
2 hello
3 nice
1 hi
3 nice
3 nice

E:\C++\ex2\x64\Debug\ex2.exe (进程 15336)已退出, 代码为 0 (0x0)。要在调试停止时自动关闭控制台, 请启用“工具”->“选项”->“调试”->“调试停止时自动关闭控制台”。按任意键关闭此窗口。 . . |

(4)



The screenshot shows the Microsoft Visual Studio IDE. On the left, the source code for a C++ program is displayed. The program defines a `BSTNode<int, string>` structure and creates six nodes (`eg1` through `eg6`) with the value "hi". It then sets the left and right pointers for these nodes to form a binary tree structure. Finally, it prints the height of the tree using `height(&eg1)`. On the right, the output window shows the execution results: "4". Below the output, a message states that the program `E:\C++\ex2\x64\Debug\ex2.exe` (process 16200) has exited with code 0 (0x0).

```
int main()
{
    BSTNode<int, string> eg1(1, "hi"), eg2(2, "hi"), eg3(3, "hi"), eg4(4, "hi"), eg5(5, "hi"), eg6(6, "hi");
    eg1.setLeft(&eg2);
    eg1.setRight(&eg3);
    eg2.setLeft(&eg4);
    eg2.setRight(&eg5);
    eg5.setRight(&eg6);
    cout << height(&eg1) << endl;
}
```

4

E:\C++\ex2\x64\Debug\ex2.exe (进程 16200)已退出, 代码为 0 (0x0)。要在调试停止时自动关闭控制台, 请启用“工具”->“选项”->“调试”->“调试停止时自动关闭控制台”。按任意键关闭此窗口。 . . .