

Test Cases for Binary Search Tree

The following test cases were used to verify the functionality of the Binary Search Tree.

Test Case 1: Insert a new contact

Description:

Inserting a contact with the name "Alice" and phone number "555-1234" into an empty BST.

Input:

```
bst.insert("Alice", "555-1234")
```

Expected Output:

```
Inserted Alice as the root node.
```

```
Current tree (In-order Traversal):
```

```
Alice: 555-1234
```

Observation:

The tree correctly adds "Alice" as the root.

Test Case 2: Search for an existing contact

Description:

Searching for the contact "Alice" after insertion.

Input:

```
bst.search("Alice")
```

Expected Output:

```
Alice found with phone number 555-1234.  
Search result: Alice's phone number is 555-1234.
```

Observation:

The search returns the correct phone number for "Alice."

Test Case 3: Search for a non-existing contact

Description:

Searching for a contact "David" that hasn't been inserted.

Input:

```
bst.search("David")
```

Expected Output:

```
David not found.  
Search result: Name not found.
```

Observation:

The search correctly identifies that "David" is not in the tree.

Test Case 4: Delete a contact with one child

Description:

Deleting "Bob" (a node with only one child).

Input:

```
bst.delete("Bob")
```

Expected Output:

```
Found Bob. Deleting...  
Bob has only a right child. Replacing with right child.
```

Current tree (In-order Traversal):
Alice: 555-1234
Charlie: 555-3456

Observation:

The node "Bob" is correctly deleted and replaced by its right child "Charlie."

Test Case 5: Delete a leaf node

Description:

Deleting "Charlie" (a leaf node).

Input:

```
bst.delete("Charlie")
```

Expected Output:

```
Found Charlie. Deleting...  
Charlie is a leaf node. Deleting directly.  
Current tree (In-order Traversal):  
Alice: 555-1234
```

Observation:

The tree correctly deletes the leaf node "Charlie."

Test Case 6: In-order Traversal of the Tree

Description:

Displaying the tree using in-order traversal after multiple insertions and deletions.

Input:

```
bst.inorder_traversal()
```

Expected Output:

Alice: 555-1234

Observation:

The traversal prints the remaining node(s) in the tree in lexicographical order.

Conclusion:

All tests were successful, and the Binary Search Tree operations behave as expected.