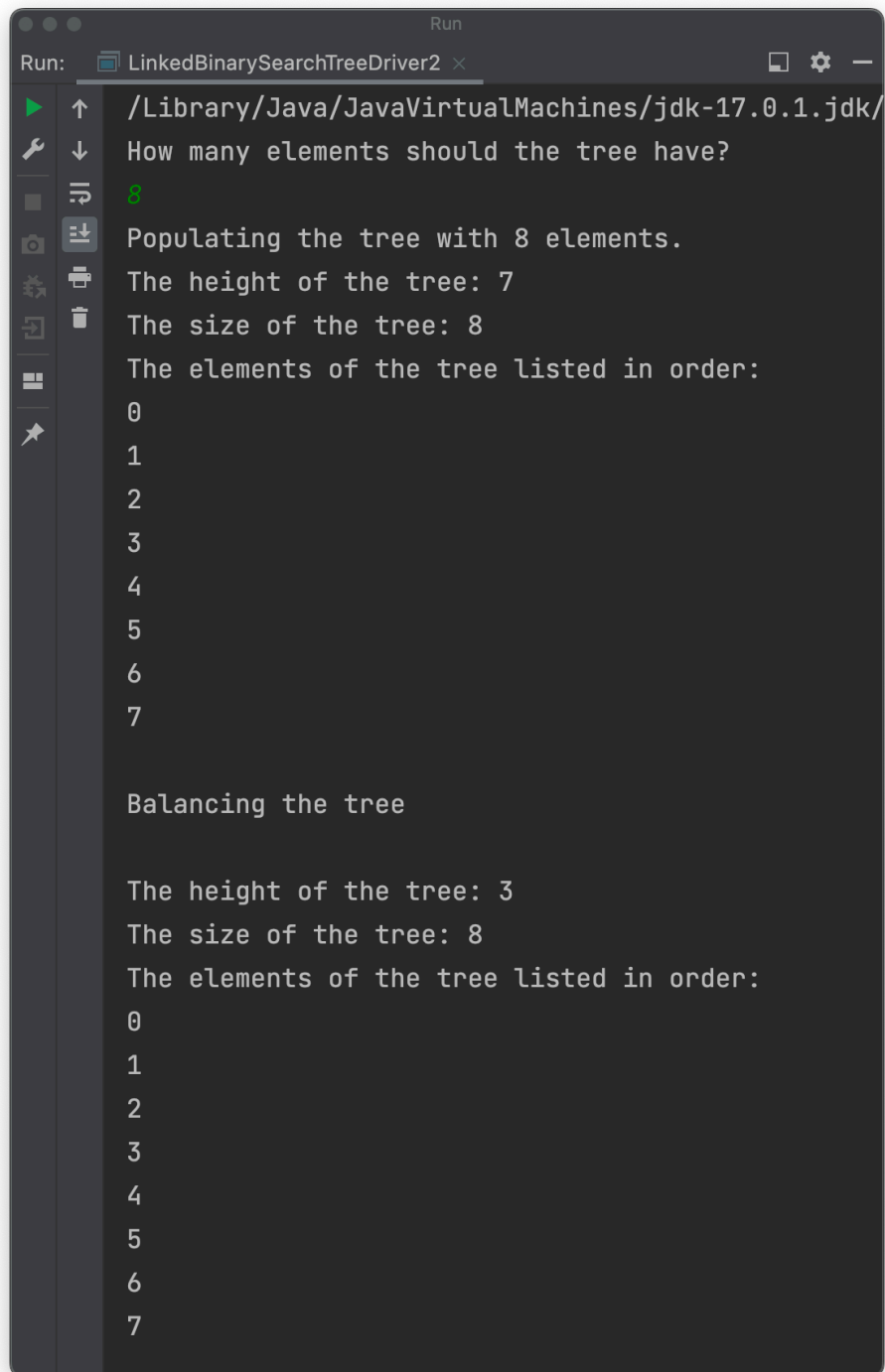


Assignment 4 — Question 2:

Balance Tree Test Exhibits

Create a degenerate tree with height before and after balancing:

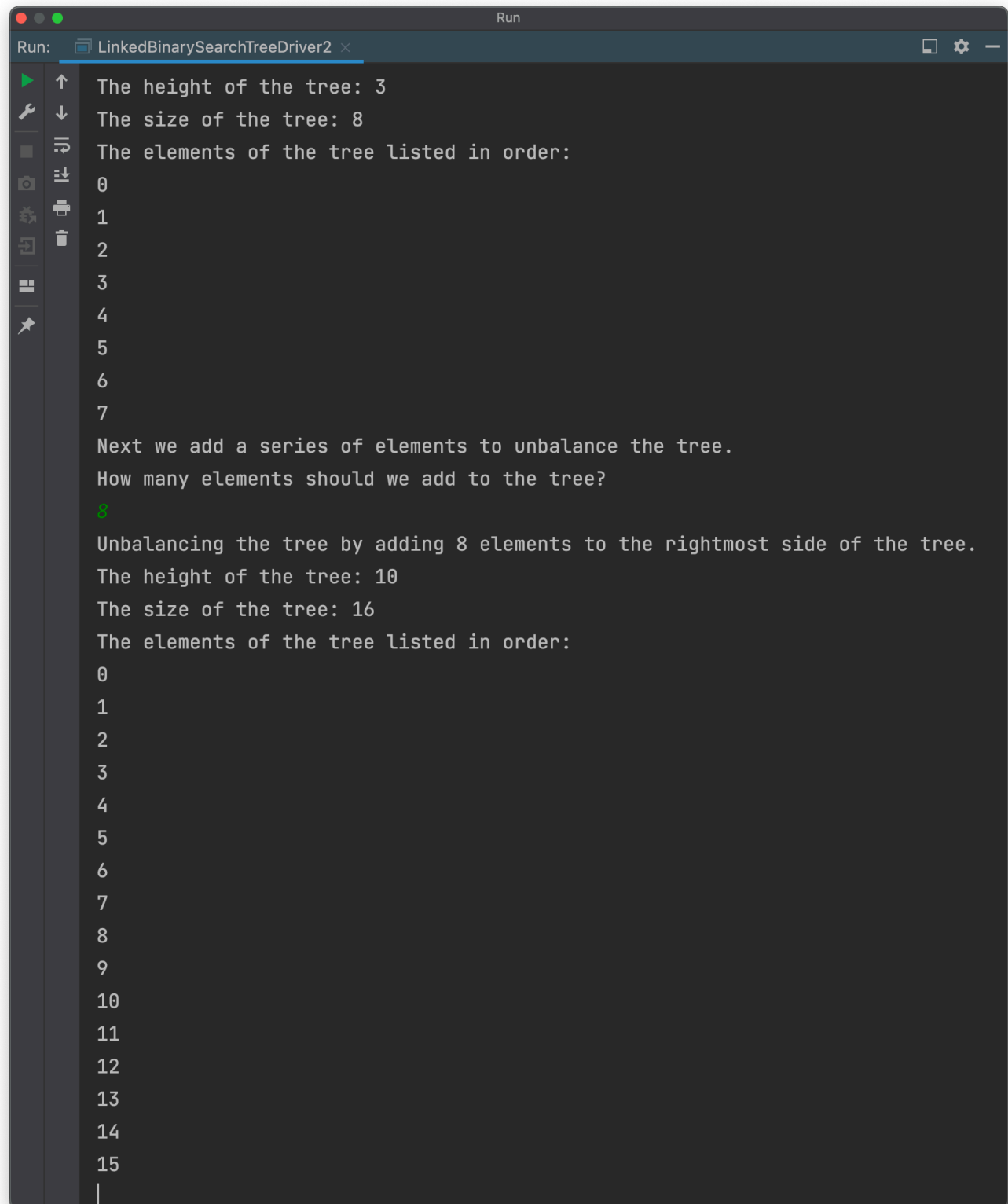


```
Run: LinkedBinarySearchTreeDriver2 x
/Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/
How many elements should the tree have?
8
Populating the tree with 8 elements.
The height of the tree: 7
The size of the tree: 8
The elements of the tree listed in order:
0
1
2
3
4
5
6
7

Balancing the tree

The height of the tree: 3
The size of the tree: 8
The elements of the tree listed in order:
0
1
2
3
4
5
6
7
```

Demonstrate insertions into a balanced tree that result in a degenerate tree:



The screenshot shows a Java IDE window titled "Run" with a tab for "LinkedListBinarySearchTreeDriver2". The output console displays the following text:

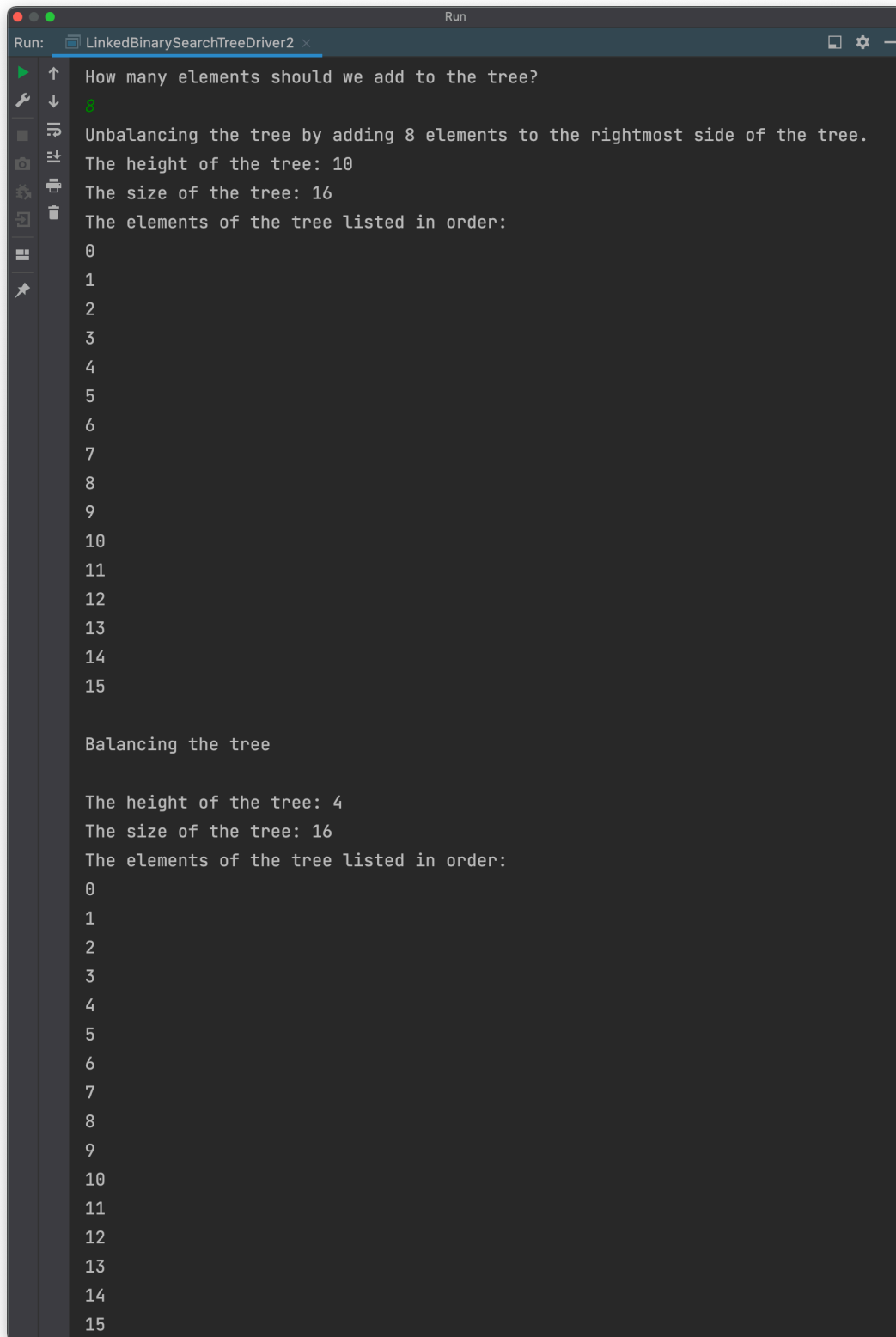
```
The height of the tree: 3
The size of the tree: 8
The elements of the tree listed in order:
0
1
2
3
4
5
6
7

Next we add a series of elements to unbalance the tree.
How many elements should we add to the tree?
8

Unbalancing the tree by adding 8 elements to the rightmost side of the tree.
The height of the tree: 10
The size of the tree: 16
The elements of the tree listed in order:
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
|
```

The output demonstrates that after adding 8 elements to the rightmost side of a tree with 8 elements, the height increases from 3 to 10 and the size increases from 8 to 16, resulting in a degenerate tree.

Balance the tree again:

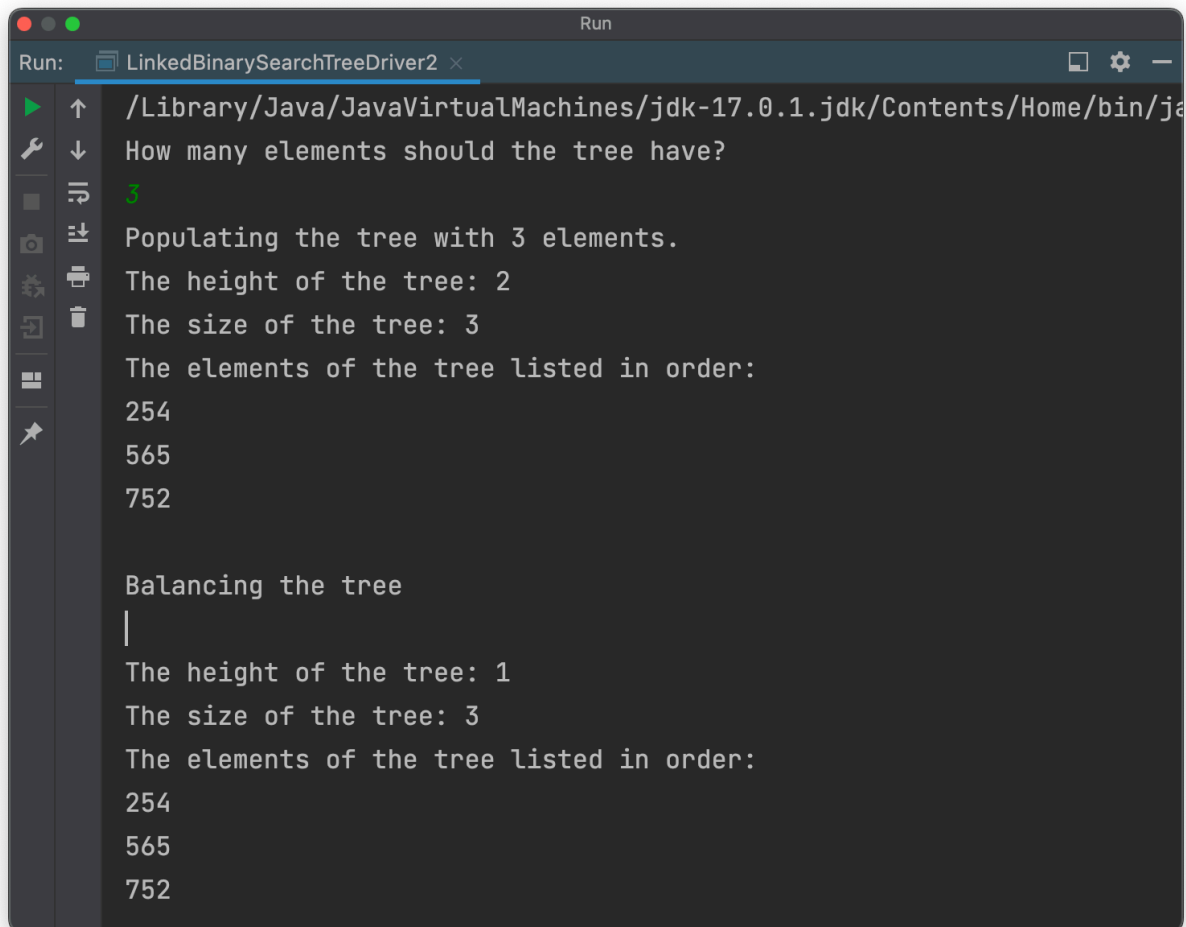


The screenshot shows a Java IDE window titled "Run: LinkedBinarySearchTreeDriver2". The output console displays the following text:

```
How many elements should we add to the tree?  
8  
Unbalancing the tree by adding 8 elements to the rightmost side of the tree.  
The height of the tree: 10  
The size of the tree: 16  
The elements of the tree listed in order:  
0  
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
  
Balancing the tree  
  
The height of the tree: 4  
The size of the tree: 16  
The elements of the tree listed in order:  
0  
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15
```

A second iteration with initially randomized numbers

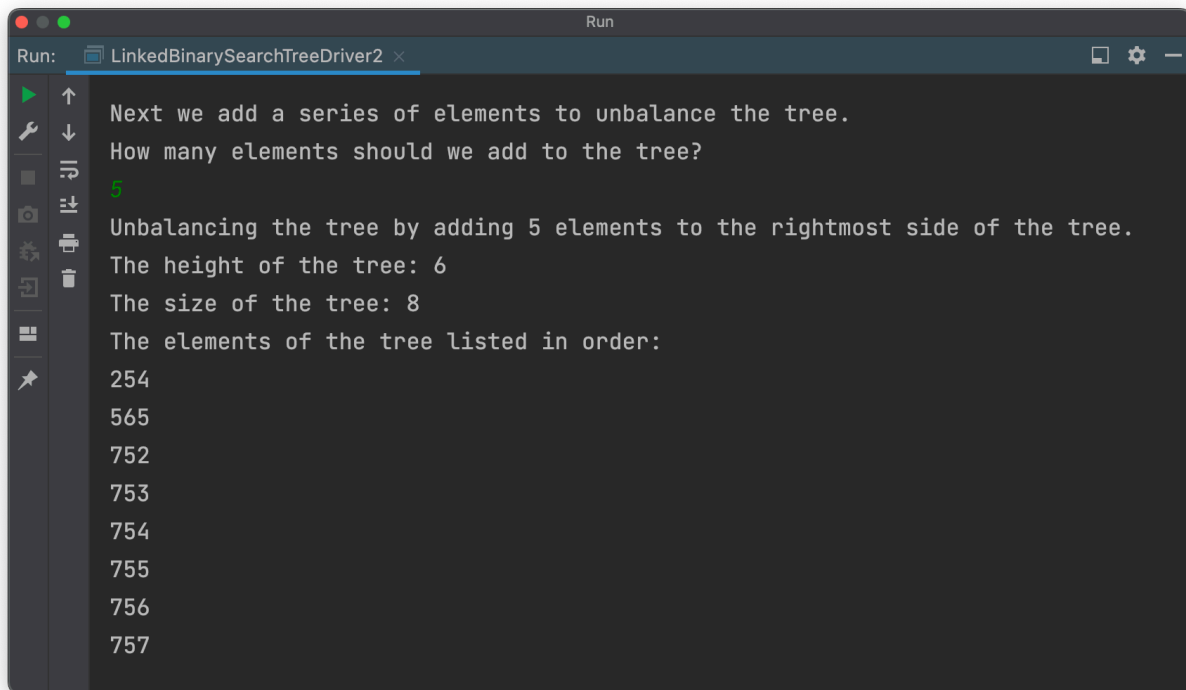
Create a degenerate tree with height before and after balancing:



```
Run: LinkedBinarySearchTreeDriver2 x
/Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/Contents/Home/bin/java
How many elements should the tree have?
3
Populating the tree with 3 elements.
The height of the tree: 2
The size of the tree: 3
The elements of the tree listed in order:
254
565
752

Balancing the tree
|
The height of the tree: 1
The size of the tree: 3
The elements of the tree listed in order:
254
565
752
```

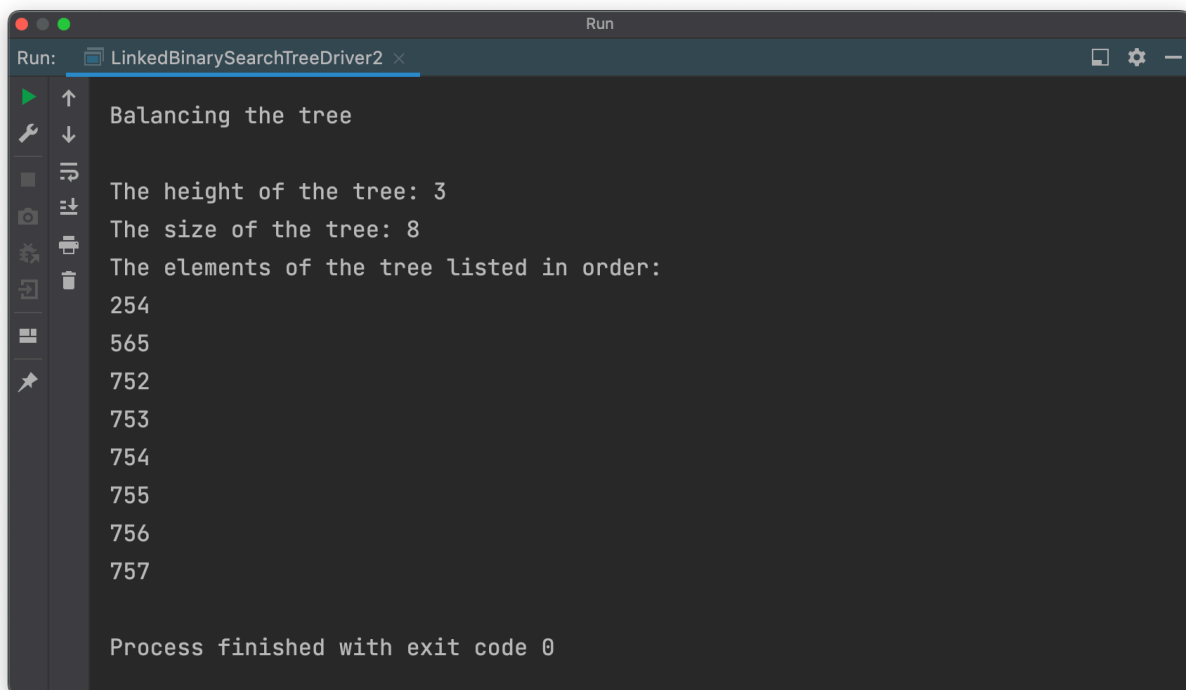
Demonstrate insertions into a balanced tree that result in a degenerate tree:



A terminal window titled "Run" with a tab "LinkBinarySearchTreeDriver2". The output shows a series of prompts and responses. First, a prompt "Next we add a series of elements to unbalance the tree." is followed by "How many elements should we add to the tree?". The response is "5". Then, the text "Unbalancing the tree by adding 5 elements to the rightmost side of the tree." is displayed. This is followed by three lines of output: "The height of the tree: 6", "The size of the tree: 8", and "The elements of the tree listed in order:". Finally, a list of eight numbers is shown: 254, 565, 752, 753, 754, 755, 756, and 757.

```
Run: LinkBinarySearchTreeDriver2 x
Next we add a series of elements to unbalance the tree.
How many elements should we add to the tree?
5
Unbalancing the tree by adding 5 elements to the rightmost side of the tree.
The height of the tree: 6
The size of the tree: 8
The elements of the tree listed in order:
254
565
752
753
754
755
756
757
```

Balance the tree again:



A terminal window titled "Run" with a tab "LinkBinarySearchTreeDriver2". The output shows the process of balancing the tree. It starts with the prompt "Balancing the tree". This is followed by three lines of output: "The height of the tree: 3", "The size of the tree: 8", and "The elements of the tree listed in order:". Finally, the same list of eight numbers is shown: 254, 565, 752, 753, 754, 755, 756, and 757. At the bottom, it says "Process finished with exit code 0".

```
Run: LinkBinarySearchTreeDriver2 x
Balancing the tree
The height of the tree: 3
The size of the tree: 8
The elements of the tree listed in order:
254
565
752
753
754
755
756
757
Process finished with exit code 0
```

