Running time? ____________    Bound by? ___________

What happens when we run the bugged code above?

How do we fix the code?

Removing an element from a BST:

_one_remove(40)
_one_remove(25)
_one_remove(10)
_one_remove(13)

<table>
<thead>
<tr>
<th>One-child Remove</th>
<th>Two-child remove</th>
</tr>
</thead>
</table>

BST Analysis:
Every operation we have studied on a BST depends on:

...what is this in terms of the amount of data, \( n \)?

The relationship between the height \( h \) and size \( n \):

Q: Prove the maximum number of nodes \( n \) given a tree of height \( h \).
Q: Prove the minimum number of nodes ($n$) in tree of height $h$?

**Final BST Analysis**
For every height-based algorithm on a BST:

Lower Bound:

Upper Bound:

Why use this over a linked list?

Q: How does our data determine the height?

1 3 2 4 5 7 6  vs.  4 2 3 6 7 1 5

Q: How many different ways are there to insert data into a BST?

Q: What is the average height of every arrangement?

<table>
<thead>
<tr>
<th>operation</th>
<th>BST Avg. Case</th>
<th>BST Worst Case</th>
<th>Sorted Array</th>
<th>Sorted List</th>
</tr>
</thead>
<tbody>
<tr>
<td>find</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>insert</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>delete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>traverse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Height Balance on BST**

What tree makes you happier?

We define the **height balance** ($b$) of a BST to be:

We define a BST tree $T$ to be **height balanced** if:

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**CS 225 – Things To Be Doing:**

1. Theory Exam 2 starts next Tuesday (topic list is online)
2. MP3 due Monday, Feb. 26; MP4 released on Tuesday
3. lab_trees is due Sunday, Feb. 25
4. Daily POTDs