Chapter 5, Binary search trees:

- Binary search trees intro (lab and Today)
- The balanced BST problem (Monday, Mar 11)
- AVL trees (Monday, Mar 11, and Wednesday, Mar 13)
- Traditional red-black trees (Friday, Mar 15)
- Left-leaning red-black trees (Monday, Mar 18)
- “Wrap-up” BST (Wednesday, Mar 20)

Today:

- The quest for a better map, motivation for BST
- BST definition and iterative implementation
- BST performance and the balanced BST problem
- Introduction to the code base
Coming up:

* Catch up on older projects?
* Do **SSSP** project (due today, Fri, Mar 1)

*Due Tues, Mar 12 (end of day)*
*Read Section 5.(1 & 2)*
*Do Exercises 5.(2 & 6)*
*Take quiz*

*Do **BST rotations** project (due Wed, Mar 13)*
```java
public interface Map<K, V> extends Iterable<K> {
    void put(K key, V val);
    V get(K key);
    boolean containsKey(K key);
    void remove(K key);
}
```

List \( \Theta(n) \)
BST \( \Theta(lg\ n) \)
Hashtable \( \Theta(1) \)
<table>
<thead>
<tr>
<th></th>
<th>Unsorted</th>
<th>Sorted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find</td>
<td>$\Theta(n)$</td>
<td>$\Theta(lg , n)$</td>
</tr>
<tr>
<td>Array</td>
<td>Insert</td>
<td>$\Theta(1)$ expected, $\Theta(n)$ worst</td>
</tr>
<tr>
<td></td>
<td>Delete</td>
<td>$\Theta(n)$</td>
</tr>
<tr>
<td></td>
<td>Find</td>
<td>$\Theta(n)$</td>
</tr>
<tr>
<td>Linked structure</td>
<td>Insert</td>
<td>$\Theta(1)$</td>
</tr>
<tr>
<td></td>
<td>Delete</td>
<td>$\Theta(1)$</td>
</tr>
</tbody>
</table>
Map

BSTMap<K,V,I>

Node

<<interface>>
implements
RealNode
key:K
value: V
left, right: Node
info: I

Balancer<K,V,I>

putFixup(Node): Node
removeFixup(Node): Node
rootFixup(Node): Node
newInfo(Node): I

NodeInfo

<<interface>>
recompute()

AVLInfo
RBIInfo

AVLBalancer
TradRBBalancer
LLRBBalancer

RealNode

key:K
value: V
left, right: Node
info: I

Node

balance: Balancer
root: Node
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