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Algorithms and Data Structures for Beginners

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Sets and Maps

Sets and Maps, similar to stacks and queues, are interfaces that can be implemented using trees. Implementing them with trees allows for a $O(log\ n)$ time for operations.

Sets

Imagine we have a phone book with three names - `Alice, Brad, Collin`. We could store these using dynamic arrays but a set ensures that we have unique values in our data structure, and implementing it using a tree ensures that our keys are sorted alphabetically.

Maps

A map on the other hand operates on key-value pairs. Going back to our phone book example, not only can we store names, but also map them to their phone numbers. Again, the data structure is sorted by the key. Because the key maps to a value, we can find all of the information associated with a key. The value here doesn't have to be a phone number, it can also be an object, etc.

The operations performed on a TreeMap run in $O(log\ n)$ time. The mapping for the phonebook would look like the following.

```
{'Alice' : 123, 'Brad' : 345, 'Collin' : 678}
```

Implementation in different languages

Java and C++ have built-in TreeMap data structures, but with Python and JavaScript, an external library is required to be imported.

Python

```python
from sortedcontainers import SortedDict
treemap = SortedDict({'c': 3, 'a': 1, 'b': 2})
```

Java

```java
TreeMap<String, String> treeMap = new TreeMap<String, String>();
```

JavaScript

```javascript
const TreeMap = require("treemap-js");
```

```
let map = new TreeMap();
```

C++

```
map<string, string> treeMap;
```

Closing Notes

This chapter is a bit lack luster because it is just an introduction to the concept of sets and maps.

Trees are just one way of implementing sets and maps. You can even use hashing to implement these interfaces. We shall talk about hashing in the upcoming chapters. TreeMaps are also not super common in interviews but if your language of choice is Python or JavaScript that does not have a built-in TreeMap, it is unlikely that your interviewer asks you to implement it from scratch.

That is all we will cover in this course as far as trees go. However, the algorithms we covered such as depth-first search and breadth-first search will be used again in graphs.

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