

1. Arrays and Strings

HashTables

This is a data structure that we can use to store data in key-value format with direct access to its items on average in constant time. Here are the time complexities for the following instructions:

Algorithm	Average	Worst case
List	$O(n)$	$O(n)$
Search	$O(1)$	$O(n)$
Insert	$O(1)$	$O(n)$
Delete	$O(1)$	$O(n)$

These should be top of mind on most algorithm questions as they are very versatile and fast.

Example: Two Sum

Given an array of int `nums` and an int `target` return the indices of the two numbers such that they add up to the target

```
public int twoSum(int[] nums, int target){
    HashMap<Integer, Integer> map = new HashMap<>();
    int[] result = new int[2]; //Stores the result

    for(int i = 0; i < nums.length; i++) {
        int compliment = target - nums[i];

        if(map.containsKey(compliment)){
            result[0] = i; // set result[0] to current index
            result[1] = map.get(compliment); // returns the value of the key
        } else {
            map.put(nums[i], i); //storing the current num as the key,
                                // and the index as the value
        }
    }

    return result;
}
```

ArrayList & Resizable Arrays

Know that arraylists are an essential data structure in interviews. Know that resizing an array is usually done by doubling which is $O(N)$, but then amortizes to (1) since it rarely happens.

StringBuilder

StringBuilders are you frined whenever a question involves string manipulation.

For example what is the runtime for concatonating a string?

```
1 String joinWords(String[] words) {  
2     String sentence = "";  
3     for (String w : words) {  
4         sentence = sentence + w;  
5     }  
6     return sentence;  
7 }
```

When using the String class each concatenation creates a new copy of the string and the two strings are copied over character by character. -> $O(x + 2x + 3x + \dots + nx)$ which reduces to $O(xn^2)$. So if we recall our runtime graph, we know thats bad.

StringBuilder, alleviates that issue. It creates a resizeable array of all teh strings copyin them back to a string only when necessary. Which translates to our operations becoming faster as we are not copying over and over.

Interview Questions, Chapter 1

link to repo....