

INTRO TO COMPETITIVE PROGRAMMING

WORKSHOP #3

WEDNESDAY, MAY 15TH • 5:00 – 6:00 PM

Lower Napier – LG21



WHO'S HERE?

Everyone is going to have slightly different experience

- Who came last time?
- No programming experience?
- Currently doing IP/Matlab?
- Current doing OOP?
- Finished OOP?

WORKSHOP STRUCTURE

Intro to Competitive Programming Talk

~45 Minutes

- *What are Vectors?*
- *How to sort in C++*
- *What are Maps and Sets?*
- *Example Problems*

QUESTIONS?

C++ BASIC DATA TYPES

Data Type	What it stores
int	An integer between $-2 * 10^9$ and $2 * 10^9$
long long	An integer between $-9 * 10^{18}$ and $9 * 10^{18}$
float	A decimal number usually with about 7 decimal digits
double	A decimal number usually with about 15 decimal digits
string	Any text, e.g. the word "monkey"
Arrays (e.g. int[100])	Fixed size list used to store a bunch of the same data type together

VECTORS IN C++

```
vector<int> v;  
v.push_back(3); // [3]  
v.push_back(2); // [3,2]  
v.push_back(5); // [3,2,5]
```

```
cout << v[0] << "\n"; // 3  
cout << v[1] << "\n"; // 2  
cout << v[2] << "\n"; // 5
```

```
for (int i = 0; i < v.size(); i++) {  
    cout << v[i] << "\n";  
}
```

SORTING ARRAYS AND VECTORS

1	3	8	2	9	2	5	6
---	---	---	---	---	---	---	---

1	2	2	3	5	6	8	9
---	---	---	---	---	---	---	---

```
vector<int> v = {4,2,5,3,5,8,3};  
sort(v.begin(),v.end());
```

```
int n = 7; // array size  
int a[] = {4,2,5,3,5,8,3};  
sort(a,a+n);
```

MAPS

A **map** is a generalized array that consists of key-value-pairs. While the keys in an ordinary array are always the consecutive integers $0, 1, \dots, n - 1$, where n is the size of the array, the keys in a map can be of any data type and they do not have to be consecutive values.

```
map<string,int> m;  
m["monkey"] = 4;  
m["banana"] = 3;  
m["harpsichord"] = 9;  
cout << m["banana"] << "\n"; // 3
```


FUNCTIONS IN C++

```
int factorial(int a) {  
    int result = 1;  
    for (int i = 1; i <= a; i++) {  
        result *= i;  
    }  
    return result;  
}
```

RECURSION IN C++

```
int factorial(int a) {  
    if (a == 1) {  
        return 1;  
    }  
    return a * factorial(a-1);  
}
```

SOLVING A PROBLEM WITH RECURSION

Practice Problem on HackerRank:

Recursion: Fibonacci Numbers

[https://www.hackerrank.com/challenges/
ctci-fibonacci-numbers/problem](https://www.hackerrank.com/challenges/ctci-fibonacci-numbers/problem)

FIBONACCI SEQUENCE

The Fibonacci Sequence is
0, 1, 1, 2, 3, 5, 8, 13, 21, 34...

Therefore...

$$f(0) = 0$$

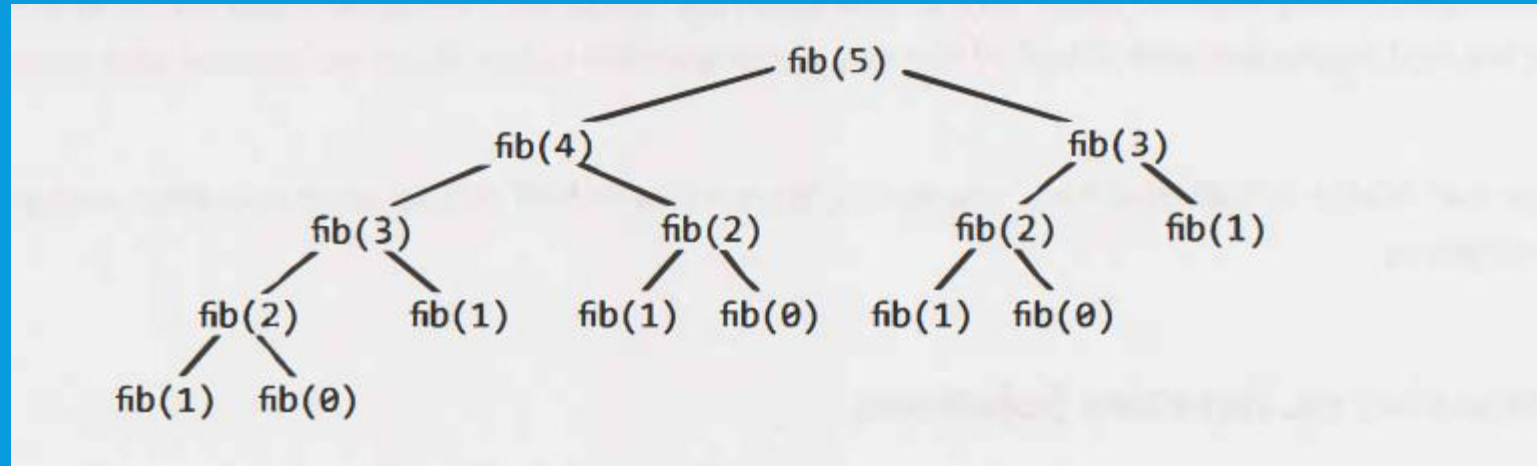
$$f(1) = 1$$

$$f(n) = f(n-1) + f(n-2)$$

FIBONACCI RECURSION

```
1  int fibonacci(int i) {  
2      if (i == 0) return 0;  
3      if (i == 1) return 1;  
4      return fibonacci(i - 1) + fibonacci(i - 2);  
5  }
```

FIBONACCI RECURSIVE CALL TREE



SOLVING A PROBLEM WITH RECURSION

Practice Problem on HackerRank:

Recursion: Davis' Staircase

[https://www.hackerrank.com/challenges/
ctci-recursive-staircase/problem](https://www.hackerrank.com/challenges/ctci-recursive-staircase/problem)

CACHING RESULTS

Instead of calculating the result every time we call the function, we can just generate the result whenever we call the function with new parameters.

We can store the results in a map, which starts empty.

$1 \rightarrow 1$

$2 \rightarrow 2$

$3 \rightarrow 4$

$4 \rightarrow 7$

$5 \rightarrow 13$

$6 \rightarrow 24$

...

QUESTIONS?

RESOURCES

Competitive Programmer's Handbook

by Antti Laaksonen

<https://cses.fi/book/book.pdf>

Cracking the Coding Interview

by Gary Laakmann McDowell

WEBSITES

HackerRank

<https://www.hackerrank.com>

As well as...

TopCoder

Coderbyte

LeetCode

Codewars

Codeforces

UWA: pcs.org.au

CodeChef

GeeksForGeeks

AtCoder

Project Euler

NEXT COMPETITION

**SAT
18TH
MAY
2019**

CONTEST #3

ANZAC ROUND

11:30PM-5PM @ INKARNI WARDLI