

Searching

Applikationsudvikling: CS101

Agenda

Searching & Time Complexity

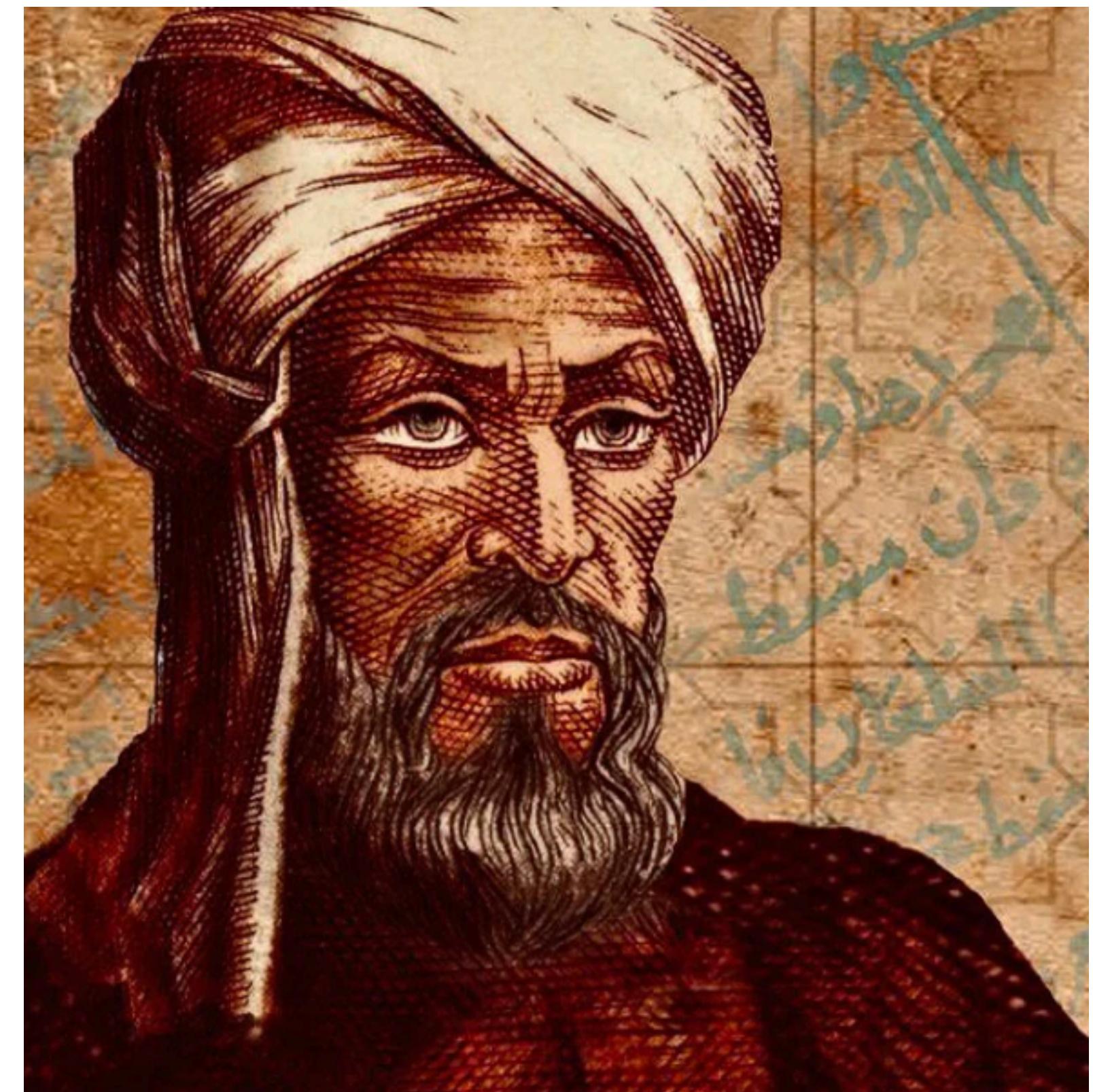
- Algorithms
- Time complexity
- Search algorithms
 - Linear Search - Pair programming
 - Binary Search - Pair programming
- Leetcode: TwoSum - Pair programming

Algorithms & Data structures

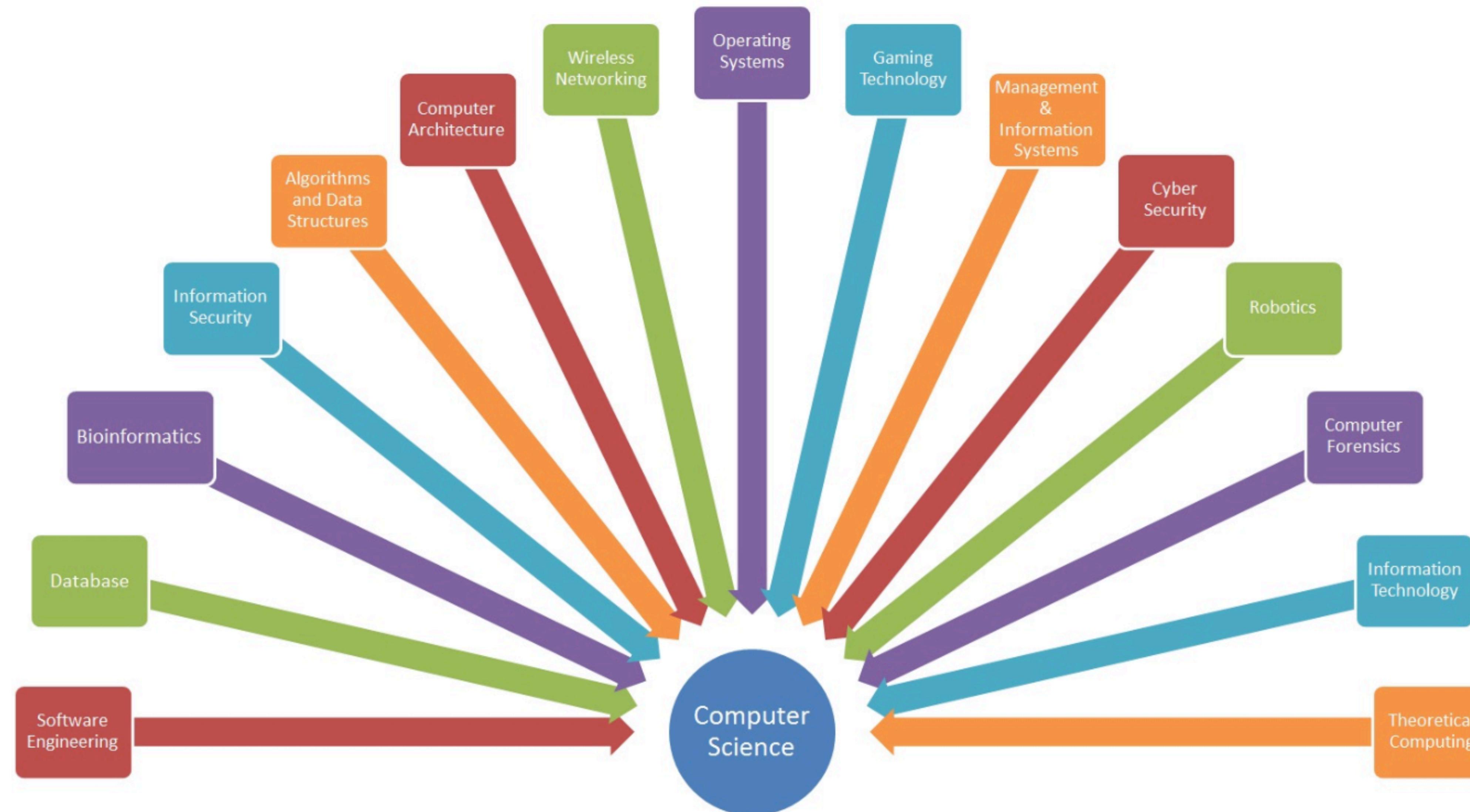
Definition

- In mathematics and computer science, an **algorithm** (/ˈælgərɪðəm/ ⓘ) is a finite sequence of rigorous instructions, typically used to solve a class of specific problems or to perform a computation. ⓘ

<https://en.wikipedia.org/wiki/Algorithm>



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In these modules & exercises

Preface - algorithms

- Solutions are **everywhere**
- It would be considered fraud to generate code with chat-gpt
- It would be considered fraud to take code from the web
- Work low-level - no libraries or shortcuts are needed
- You know and have everything you need
- Pen and paper - problem solving

Make it work
Make it right
Make it **fast**



Kent Beck

What is meant by fast?

What makes time complex?

Time complexity

- “The Yoda of Silicon Valley” - Donald Knuth
- “Despite all of the complicating factors in understanding the running times of our programs, it is possible, in principle to build a mathematical model to describe the running time of any program”

Sedgewick, R., & Wayne, K. (2011). *Algorithms* (4th ed.). Boston, MA: Addison-Wesley Educational.





HelloWorld.kt





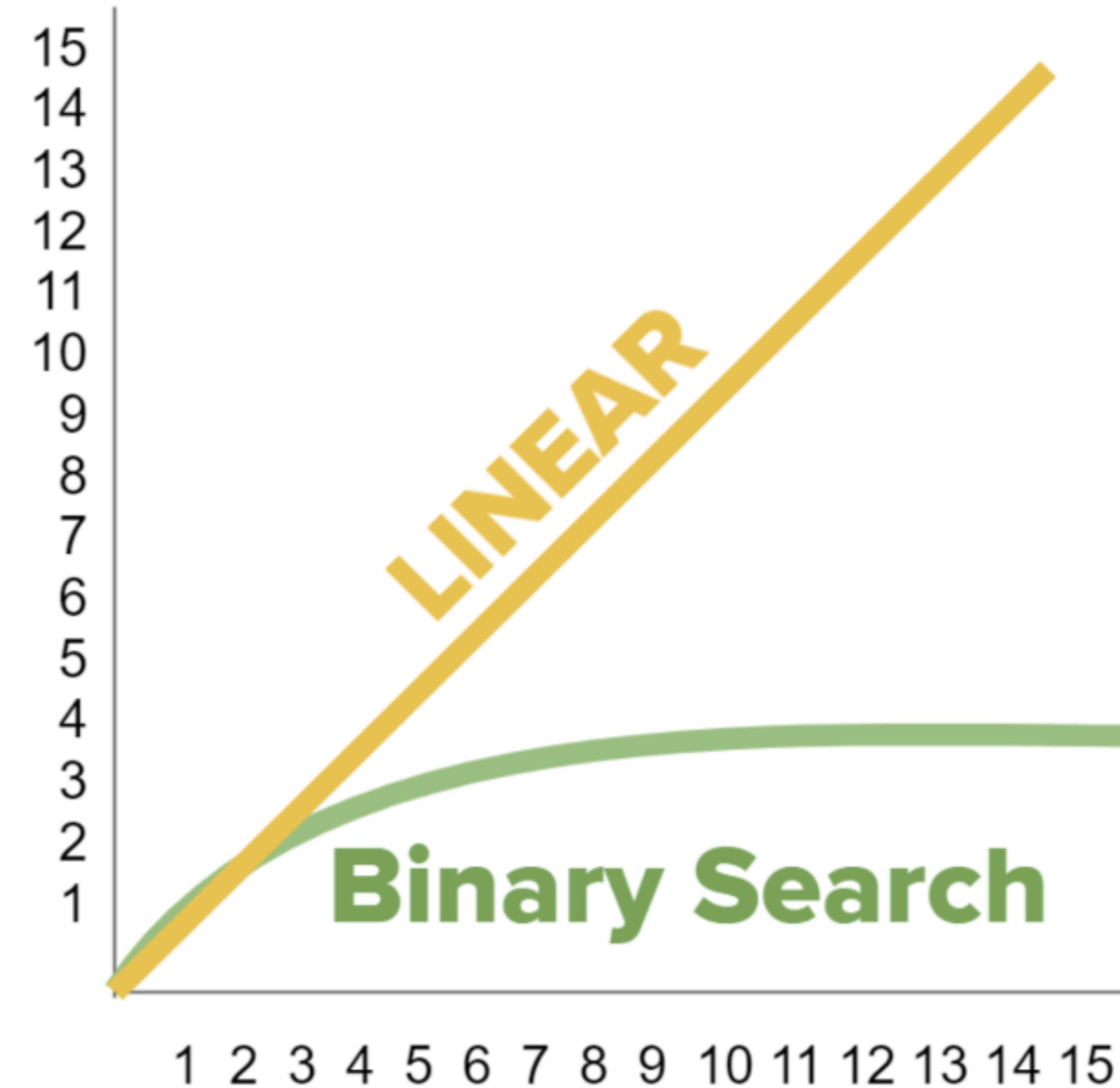
What is meant by fast?

Linear Search example

https://www.w3schools.com/dsa/dsa_algo_linearsearch.php

Remember: Represent index
positions with variables

Linear Search runtime = $O(N)$

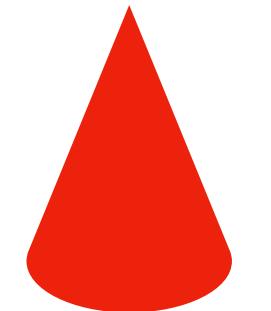
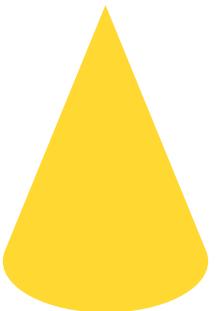


TwoSum Problem for tomorrow

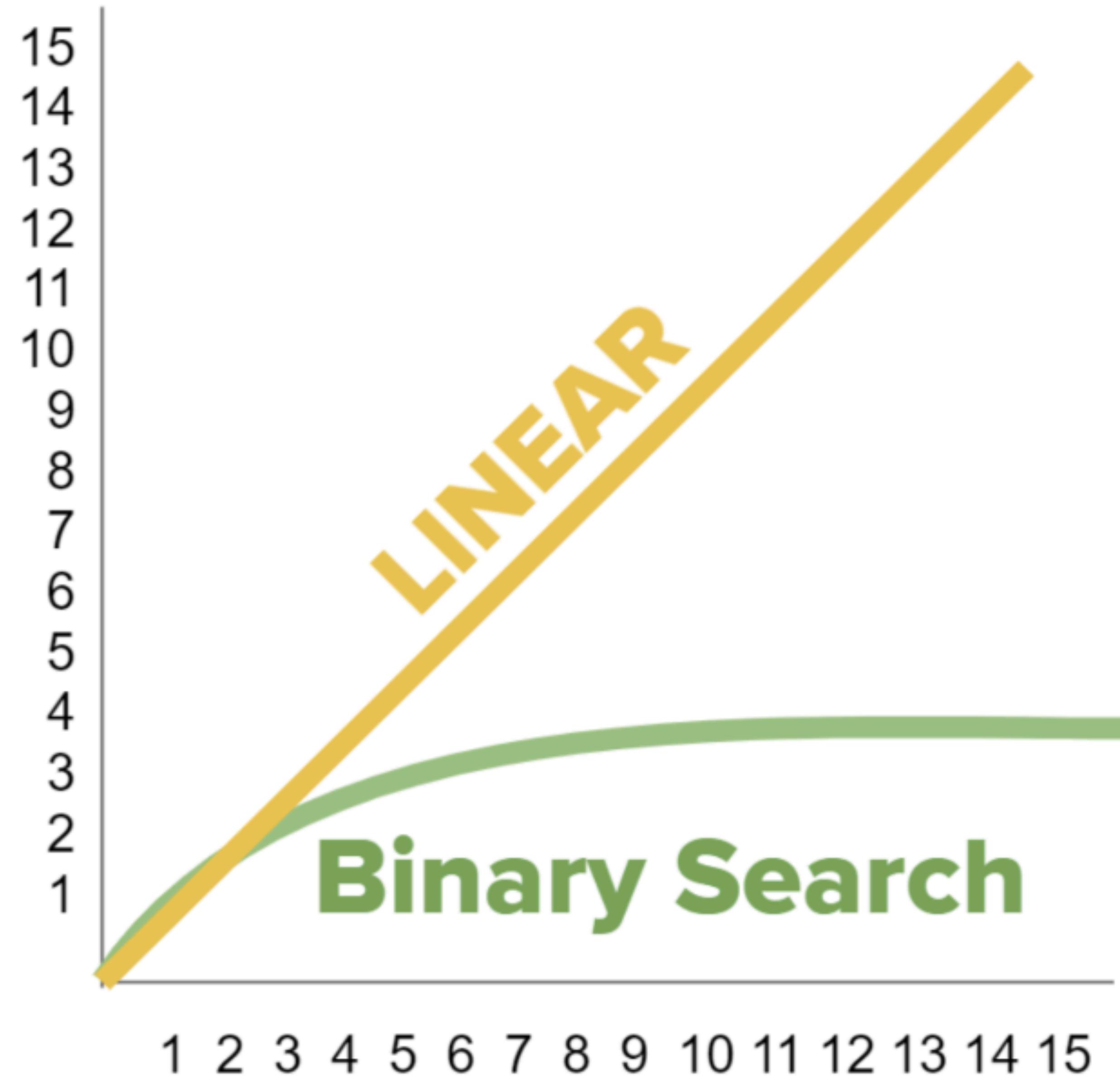
```
for (i in arr.indices) {  
    for (j in arr.indices)  
        }  
    }
```

Target = 8

[4] [5] [4] [7] [2] [3] [4]



Binary Search
Eliminate more
than one



Binary Search

Search 23

0	1	2	3	4	5	6	7	8	9
2	5	8	12	16	23	38	56	72	91

$23 > 16$
take 2nd half

L=0	1	2	3	M=4	5	6	7	8	H=9
	5	8	12	16	23	38	56	72	91

$23 > 56$
take 1st half

0	1	2	3	4	L=5	M=7	8	H=9	
2	5	8	12	16	23	38	56	72	91

Found 23,
Return 5

0	1	2	3	4	L=5,M=5	H=6	7	8	9
2	5	8	12	16	23	38	56	72	91