CS50 for MBAs

Algorithms, Data Structures

Last Time

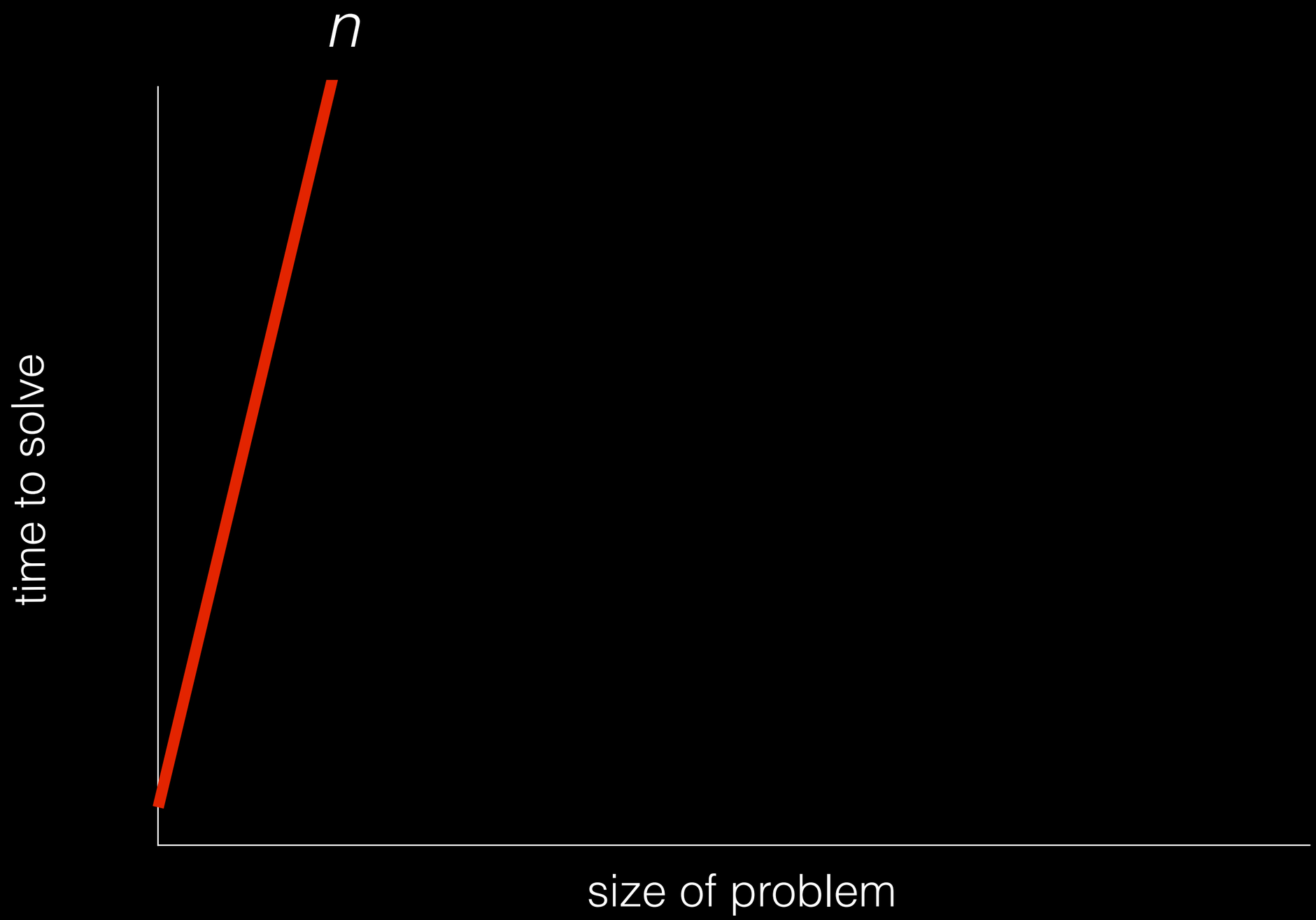
Programming Languages

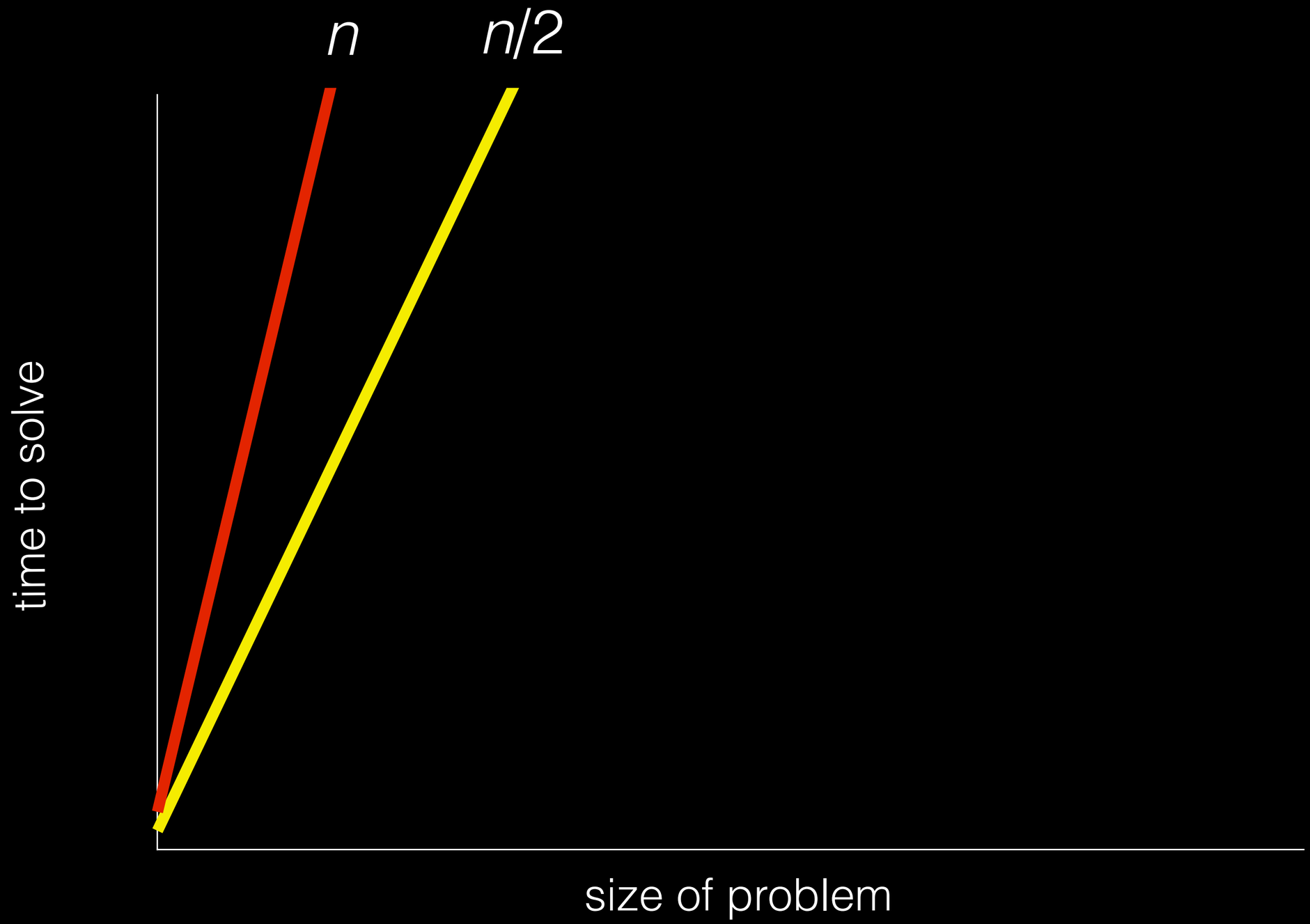
- imprecision, overflow
- compiled, interpreted

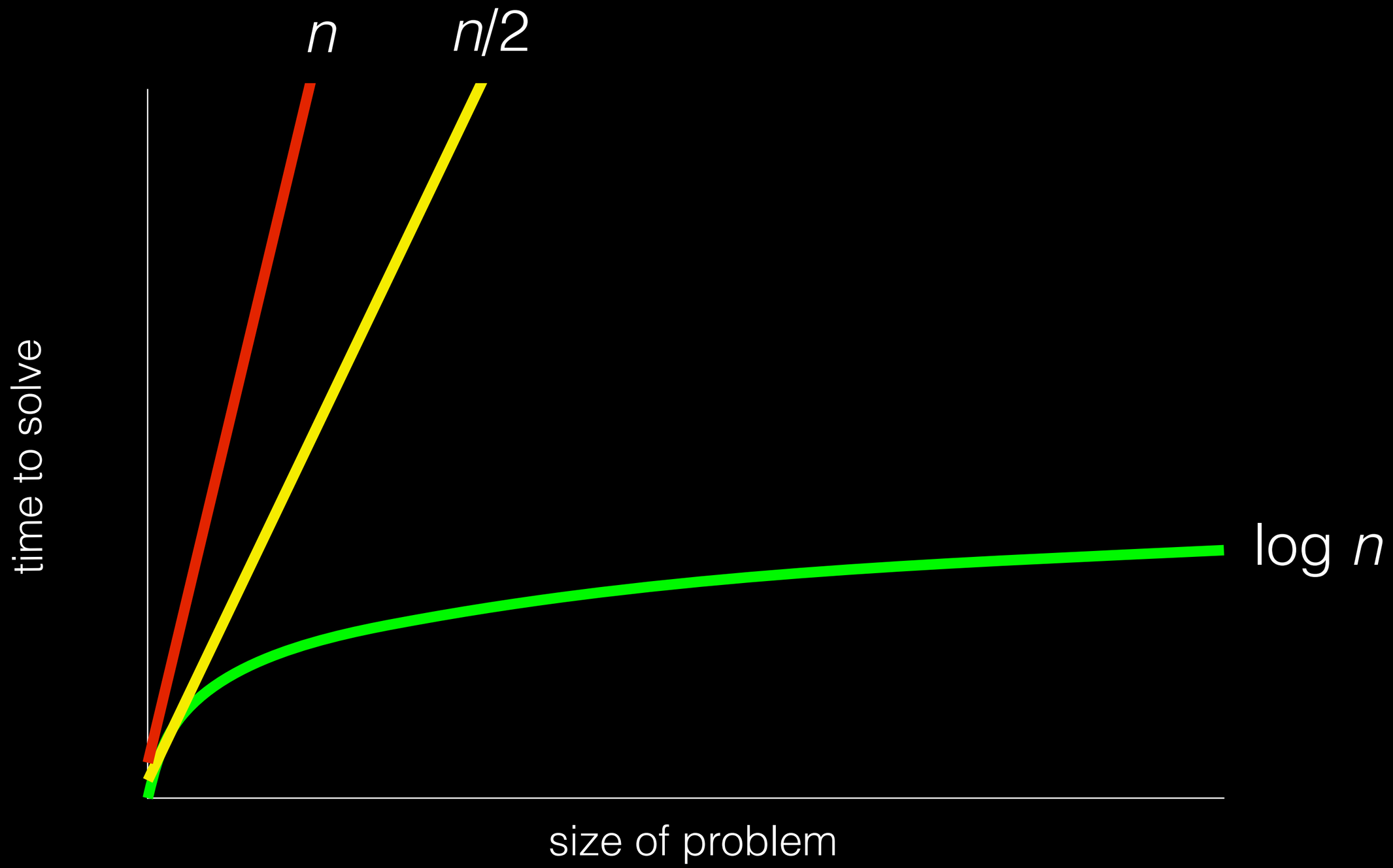
This Time

Algorithms, Data Structures

- searching, sorting
- correctness, efficiency
- arrays, linked lists, trees, hash tables
- dictionaries, lists, queues, sets, stacks


n
time to solve
size of problem


n
n/2
time to solve
size of problem


n
n/2
time to solve
log n
size of problem

o

$O(n^2)$

$O(n \log n)$

$O(n)$

$O(\log n)$

$O(1)$

...

Ω

$\Omega(n^2)$

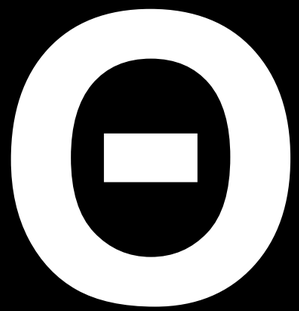
$\Omega(n \log n)$

$\Omega(n)$

$\Omega(\log n)$

$\Omega(1)$

…



4 2 7 5 6 8 3 1

selection sort

```
for i from 0 to n-1
    find smallest element between i'th and n-1'th
    swap smallest with i'th element
```

bubble sort

```
repeat until no swaps
    for i from 0 to n-2
        if i'th and i+1'th elements out of order
            swap them
```

$(n - 1)$

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

$$(n-1)+(n-2)+\ldots+1$$

$$(n-1) + (n-2) + \ldots + 1$$

$$n(n-1)/2$$

$$(n - 1) + (n - 2) + \ldots + 1$$

$$n(n - 1)/2$$

$$(n^2 - n)/2$$

$$(n - 1) + (n - 2) + \ldots + 1$$

$$n(n - 1)/2$$

$$(n^2 - n)/2$$

$$n^2/2 - n/2$$

1,000,000

$$n^2/2 - n/2$$

$$n^2/2 - n/2$$

$$1{,}000{,}000^2/2 - 1{,}000{,}000/2$$

$$n^2/2 - n/2$$

$$1{,}000{,}000^2/2 - 1{,}000{,}000/2$$

$$500{,}000{,}000{,}000 - 500{,}000$$

$$n^2/2 - n/2$$

$$1{,}000{,}000^2/2 - 1{,}000{,}000/2$$

$$500{,}000{,}000{,}000 - 500{,}000$$

$$499{,}999{,}500{,}000$$

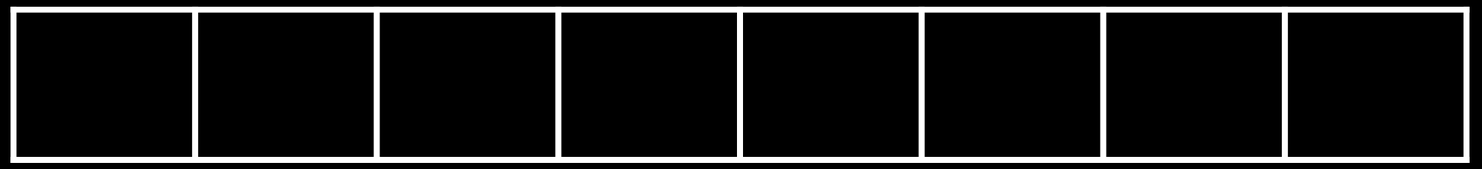
$n^2/2 - n/2$

$O(n^2)$

https://www.cs.usfca.edu/~galles/visualization/ComparisonSort.html

https://www.toptal.com/developers/sorting-algorithms

https://youtu.be/t8g-iYGHpEA



Assignment 2

Next Time

Internet Technologies

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Algorithms, Data Structures