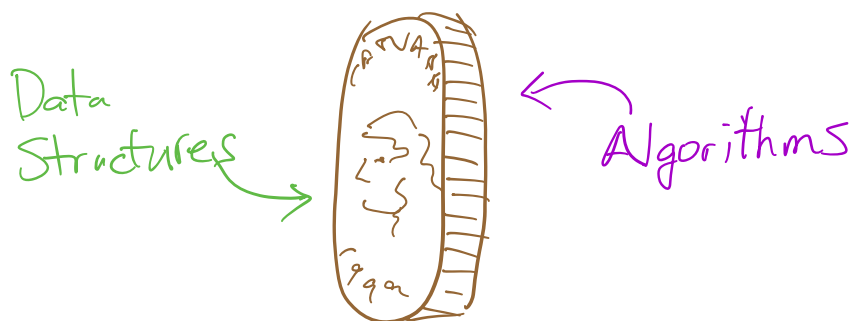
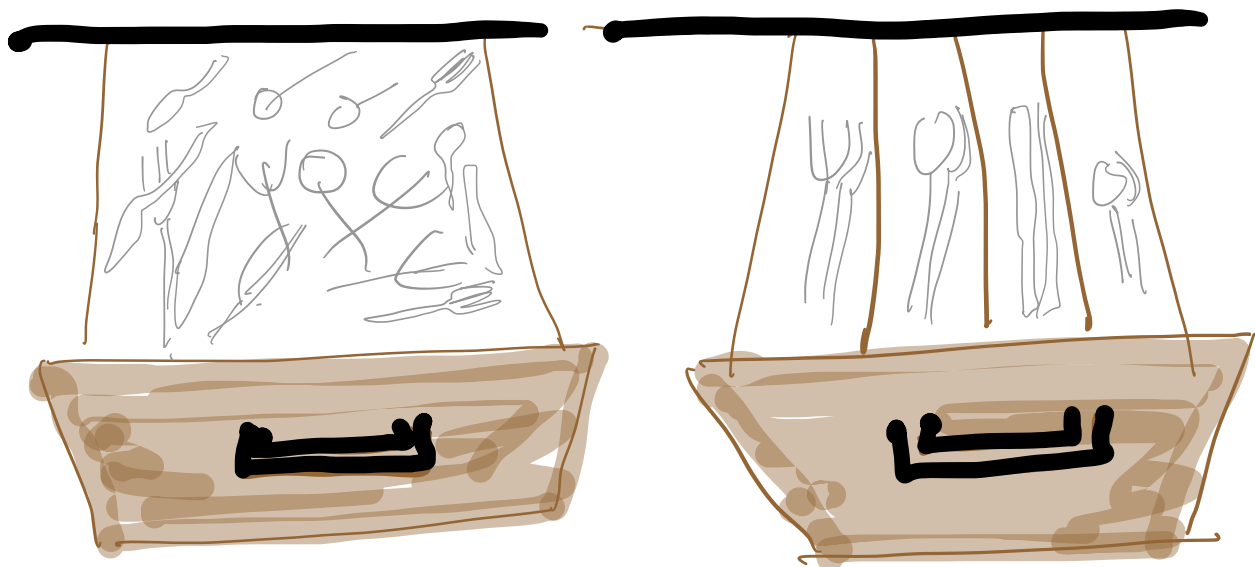


CSCI 260 - Data Structures and Algorithms

Administrivia - See course web pages at
csci.viu.ca/~vgpruesse/teaching/260



Eg. Cutlery drawer



Sort going in ... or sort coming out
which is better?

Either way, **what** is done/needs doing is the same:

init()

insert(x)

get fork()

get knife()

get spoon()

What makes one "way of doing" **it** the best way?
└──┬──┘
DS + Algs ADT

- running time
- memory
- power consumption.

Abstract Data Types (ADT)

- defines what is done by the alg/DS
- \exists many ways of "getting the job done"
 - **implementation** is the code that does it
 - **algorithm** is a mathematical object
 - ... a step-by-step procedure that "gets the job done" (meets reqs of ADT)
 - ... is language independent.

1. We need to select an algorithm before we can implement.

2. DS + Algorithm go hand-in-hand

- your **getSpoon()** depends on the DS: messy drawer or sorted?

ADT

- captures the behavior (job it does)

but not:

- running time

- space

Alg + DS

- need to be correct ...

- have related running times (and space).

- We need to analyze algs

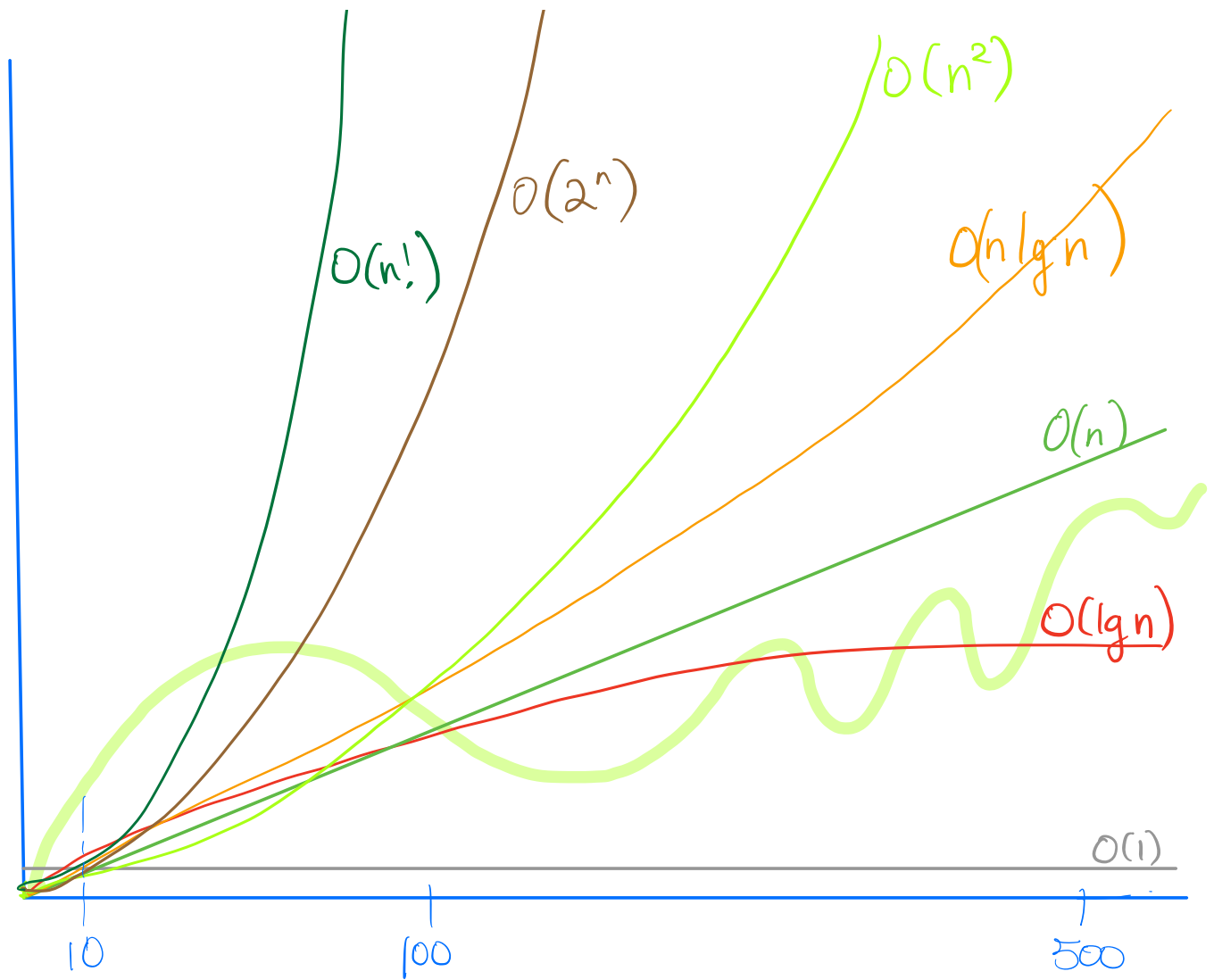
- We need measures of how much time an algorithm takes that is "independent of machine"

- on machine X, MULT could be
100x as many clock ticks as on
machine Y

$$- 16n^2 + 190n - 500$$

$$n^2 + 20n + 1000$$

$$, 5000n$$



What happens when you add two functions?

What happens when you multiply by a constant?

A Puzzle

Array ADT

init()

set(i, x) - i an integer index into Array ADT
 x a ~~double~~ float (like 7.23)

float
~~double~~ get(i)

Suppose you know

- need up to 1 billion entries
- OS can allocate space for 1 billion entries in constant time BUT it is full of garbage

Can you make all operations work in $O(1)$?

Algorithms + DS

- can compute an output for a given input
 - can be a DS with a lifetime operations can change it, or run algorithms on it.
-

Array ADT

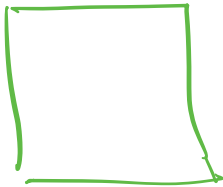
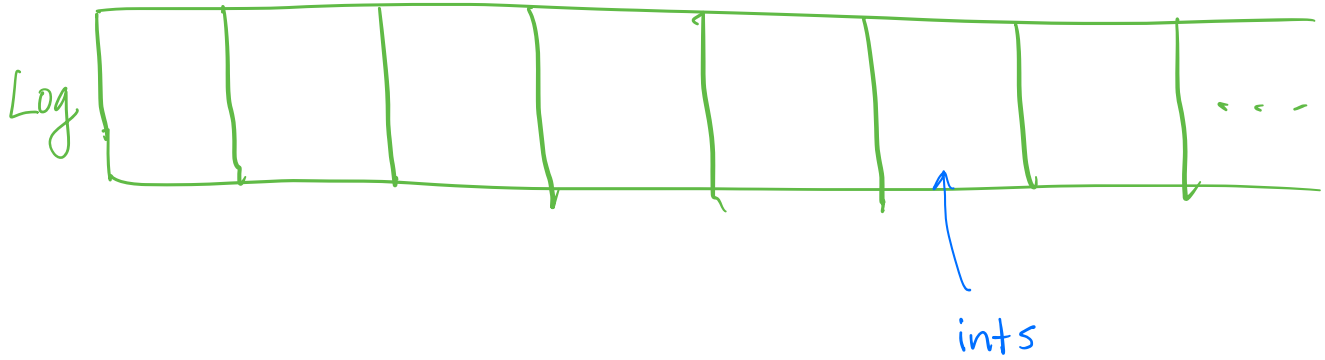
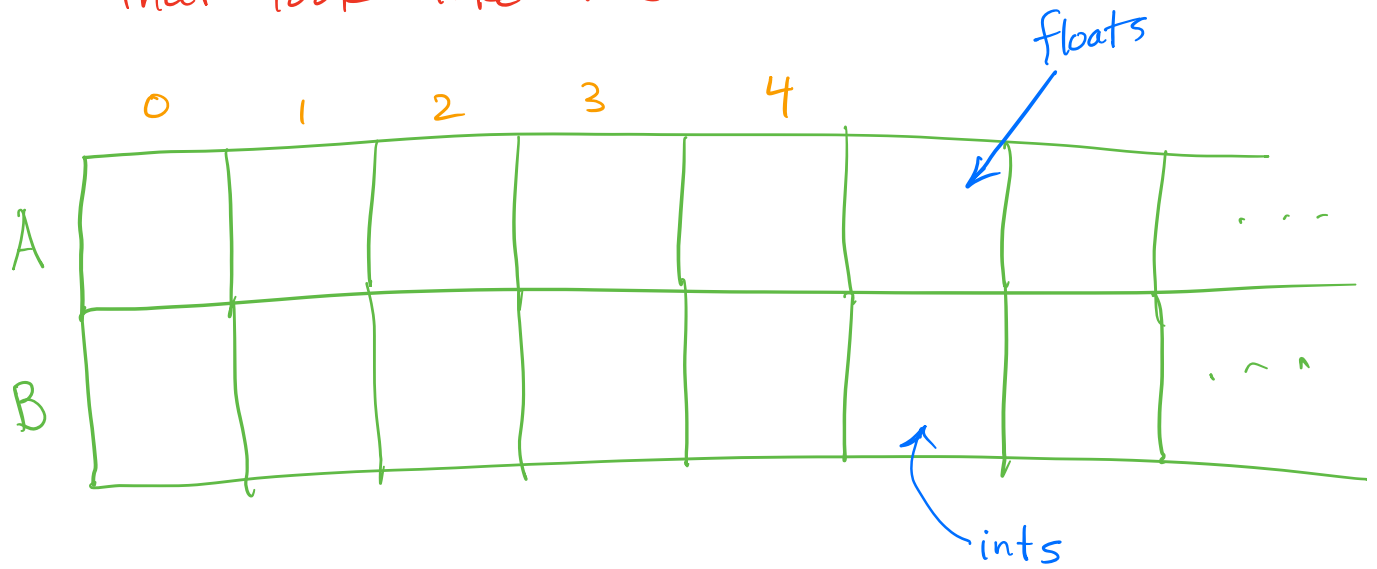
- obvious implementation (init is not $O(1)$)
 - use a sentinel.

- don't use a sentinel.

The Hint

(1 page down)

You can do it with Data Structures that look like this:



↑ an integer m which is an index into Log