

Procedural Abstraction and Reduction

Note Title

9/5/2007

- Reminders:
- BBQ this Thursday 11-1 in Lopata Courtyard
 - Meet with me to set up your CSE131X contract
 - My office Jolley Hall - Room 512

Quick review (related to practice problems for this Friday's quiz)

- Expression trees
- Overloaded operators in mixed type expressions

Abstraction

- Naming abstraction
- Procedural abstraction

131 web site:

<http://www.cse.wustl.edu/~kjc/cse131>

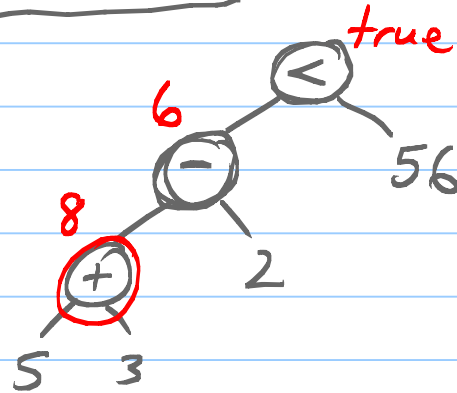
Reduction

- in top-down design
- for proving hardness results

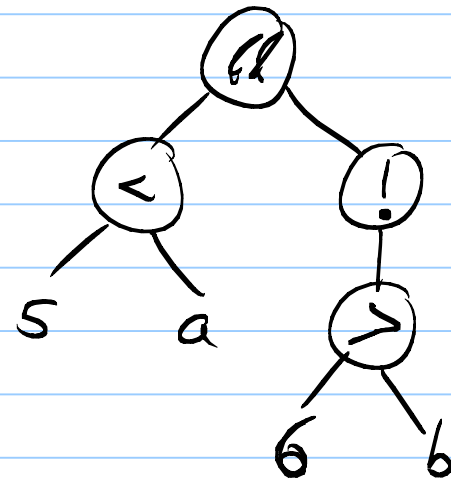
This Friday: ① Quiz over Module 1 practice problems ② Execution stack ③ Debugger

Expression trees:

→ $(5 + 3) - 2 < 56$



$(5 < a) \ \&\& \ !(6 > b)$



Mixed types & overloaded operators

/ (division) — floating pt. vs. integer

- (minus) — " " " or negation

$-(3+x)$ $-3-x$

+ (plus) — floating pt. vs. integer addition,
or string concatenation

$$(3 + 4) / 2 \Rightarrow 3$$

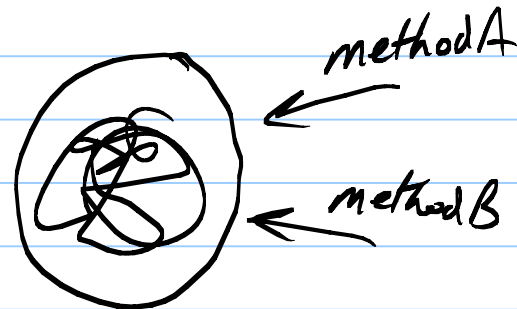
$$(3 + 4) / 2.0 \Rightarrow 3.5$$

promoted/converted to a string
↓

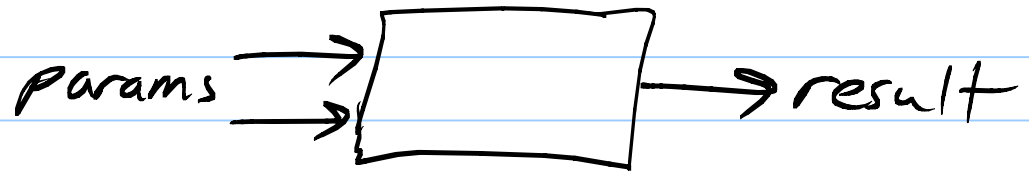
"Dean Sansalone has " + 5 + 5 + " toes."

"Dean Sansalone has 55 toes."

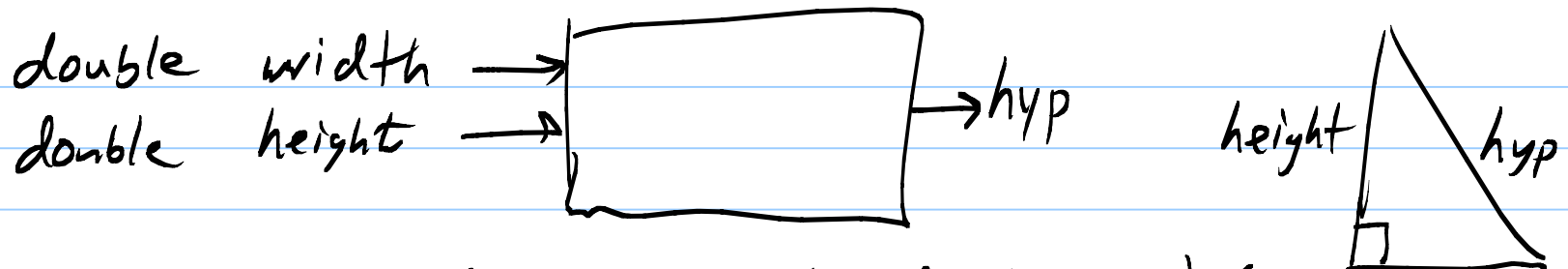
Abstraction - hiding detail



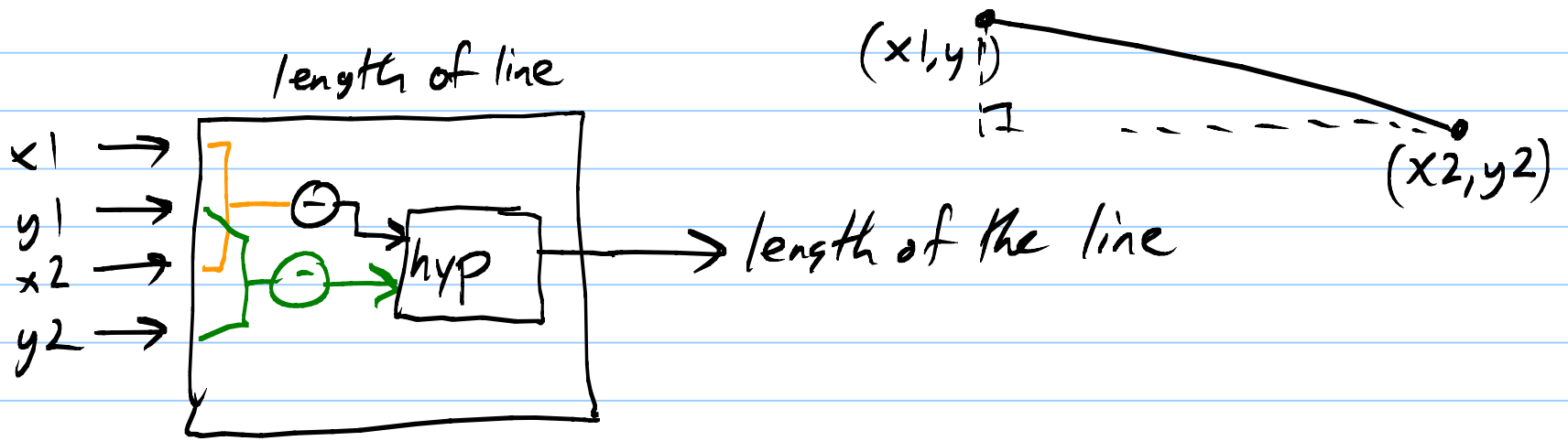
- Naming abstraction
- Procedural abstraction



- top-down design
 - reuse existing methods
 - hardness results — proof
- } construction

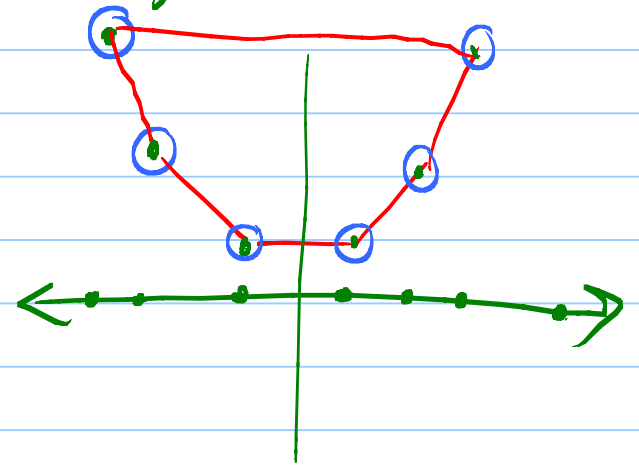
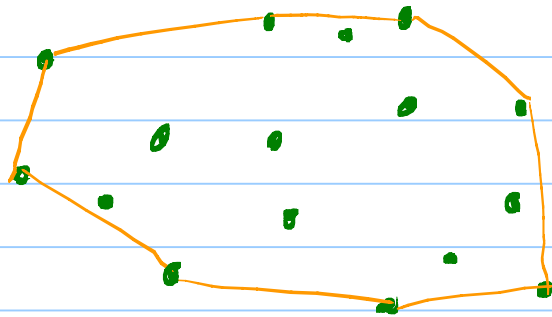


```
double hypotenuse (double width, double height) {
    return Math.sqrt (width * width + height * height);
}
```



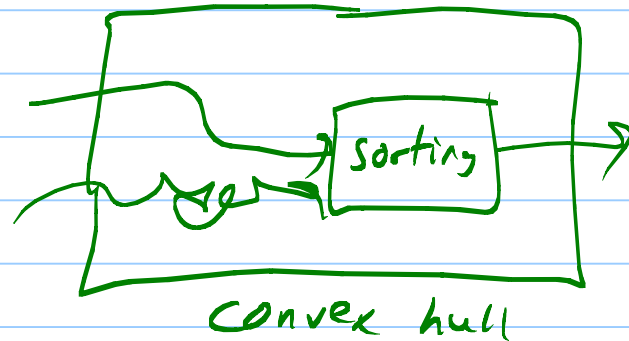
Using Reduction to show a hardness result

- Know that, in general, it takes $n \log_2 n$ time to sort
- Convex Hull Problem:



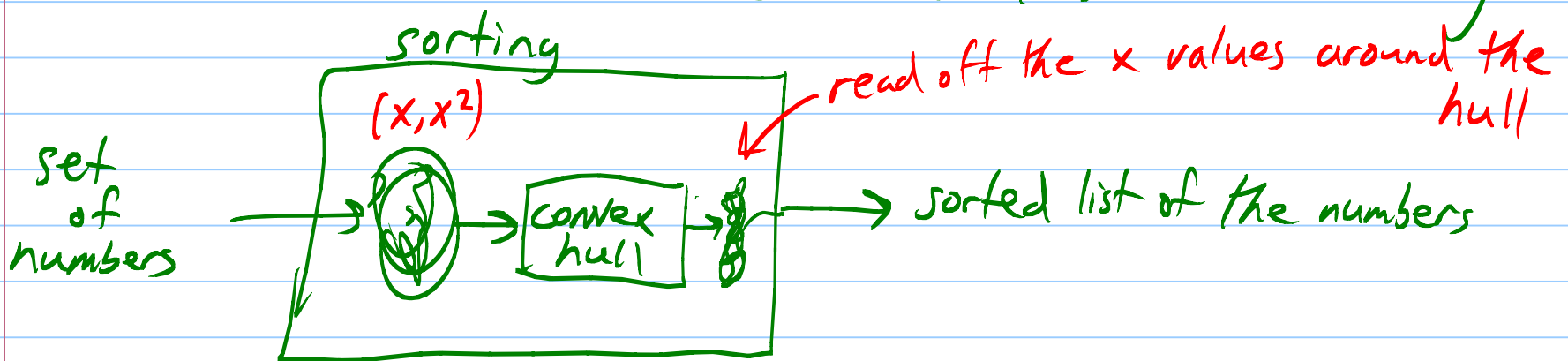
- Can we show that convex hull is at least as hard as sorting?

Direction in a reduction is key:



doesn't prove that convex hull is at least as hard as sorting

Might have been able to compute convex hull without sorting



Input: A set of values along the x axis.

Sort using convex hull
by using points (x, x^2)
that form a parabola.

Then read off the x
values from the
points around the hull
to get the sorted order.

