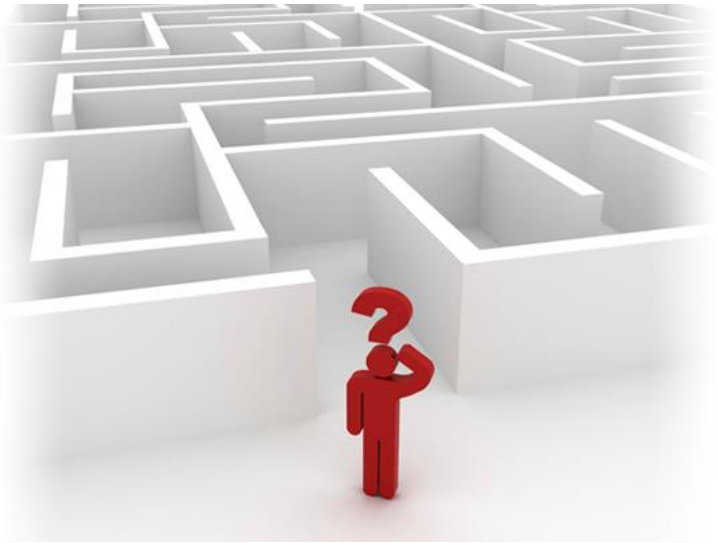


Design and Analysis of Algorithms I

Introduction

Guiding Principles

Guiding Principle #1

"worst-case analysis": our running time bound holds for every input of length n.

- particularly appropriate for "general-purpose" routines

As opposed to

- "average-case" analysis
- benchmarks

} requires domain knowledge

BONUS: worst case usually easier to analyze.

Guiding Principle #2

Won't pay much attention to constant factors, lower-order terms.

Justifications

1. way easier
2. constants depend on architecture / compiler / programmer anyways
3. lose very little predictive power (as we'll see)

Guiding Principle #3

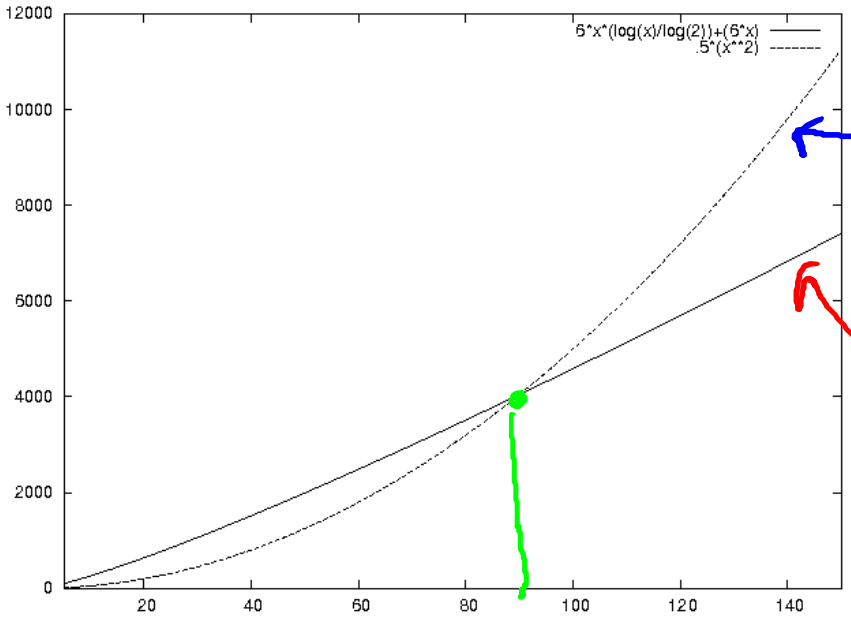
Asymptotic analysis: focus on running time for large input sizes n.

E.g.: $6n \log_2 n + 6n$ "better than" $\frac{1}{2}n^2$

Merge Sort

$\approx$ Insertion Sort

Justification: only big problems are interesting!

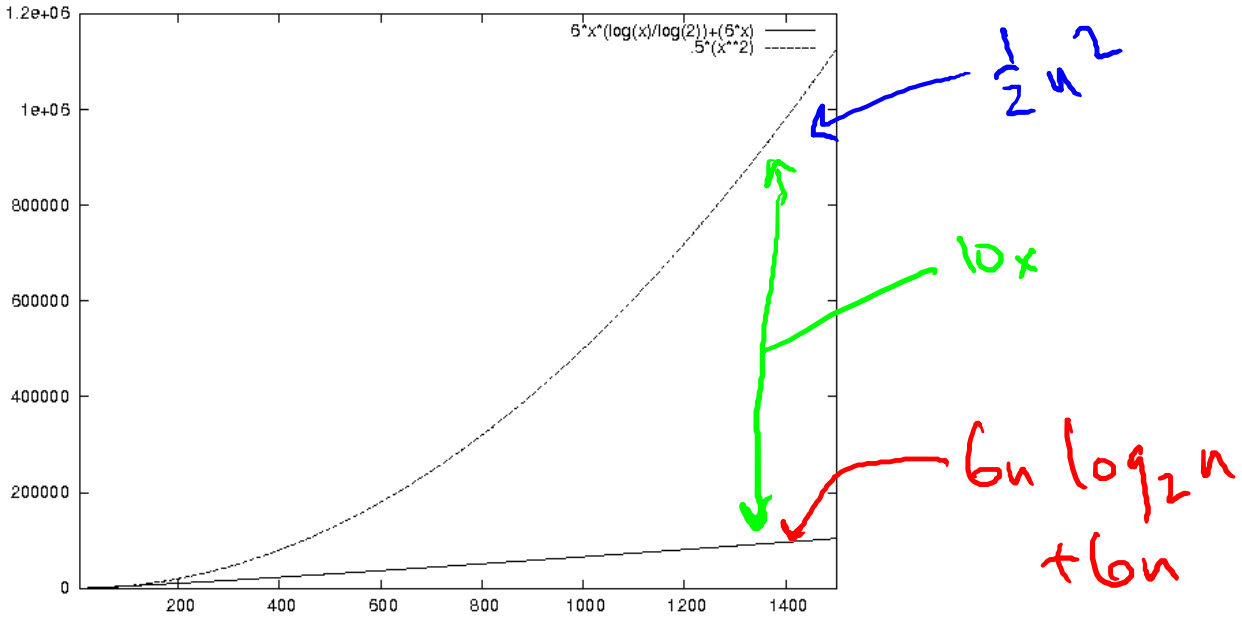


$\frac{1}{2}n^2$

$6n \log_2 n + 6n$

≈ 90

Small n


6*x^(log(x)/log(2))+(6*x)
.5*(x**2)
1.2e+06
1e+06
800000
600000
400000
200000
0
200
400
600
800
1000
1200
1400
$\frac{1}{2}n^2$
10x
$6n \log_2 n + 6n$

What Is a "Fast" Algorithm?

This course: adopt these three biases as guiding principles.

> fast algorithm $\approx$ worst-case running time grows slowly with input size

Usually: want as close to linear ($O(n)$) as possible.