

15-213

“The course that gives CMU its Zip!”

Code Optimization I

Feb. 12, 2008

Topics

- Machine-Independent Optimizations
 - Basic optimizations
 - Optimization blockers

Harsh Reality

There's more to performance than asymptotic complexity

Constant factors matter too!

- Easily see 10:1 performance range depending on how code is written
- Must optimize at multiple levels:
 - algorithm, data representations, procedures, and loops

Must understand system to optimize performance

- How programs are compiled and executed
- How to measure program performance and identify bottlenecks
- How to improve performance without destroying code modularity and generality

Optimizing Compilers

Provide efficient mapping of program to machine

- register allocation
- code selection and ordering (scheduling)
- dead code elimination
- eliminating minor inefficiencies

Don't (usually) improve asymptotic efficiency

- up to programmer to select best overall algorithm
- big-O savings are (often) more important than constant factors
 - but constant factors also matter

Have difficulty overcoming “optimization blockers”

- potential memory aliasing
- potential procedure side-effects