High Performance Software Development

Topics included

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- Modern programming styles vs. performance
- Relevant properties of modern CPUs
  - ILP, SIMD
- Performance-tuning software
- Compiler optimization
- Memory hierarchy
  - Cache-Aware and Cache-Oblivious algorithms

Topics not included

Topics NOT included

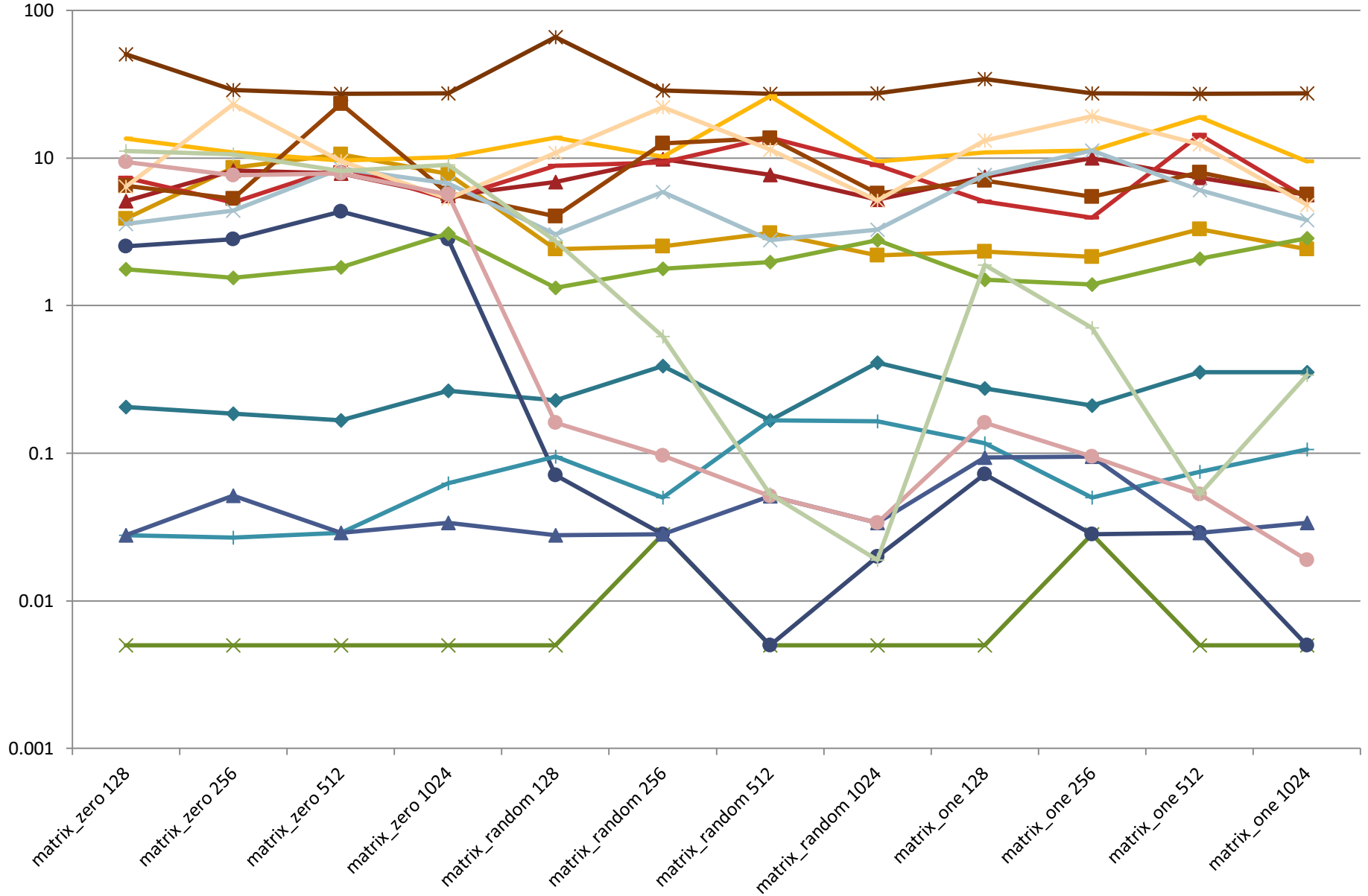
- Programming in assembly languages
  - Compilers usually do it better
  - However, we will use vector instructions within C/C++
- Parallel programming
  - See NPRG042 Programming in Parallel Environment
  - Observation: Careful single-threaded implementation produces speed-up similar to average parallel implementation
- Code optimization by compilers
  - See NSWI109 Compiler Construction
  - Here we will talk about what the compilers do, not how
- Programming environments for clusters, grids, clouds, ...
  - They require some experience in parallelism and robustness

Related lectures

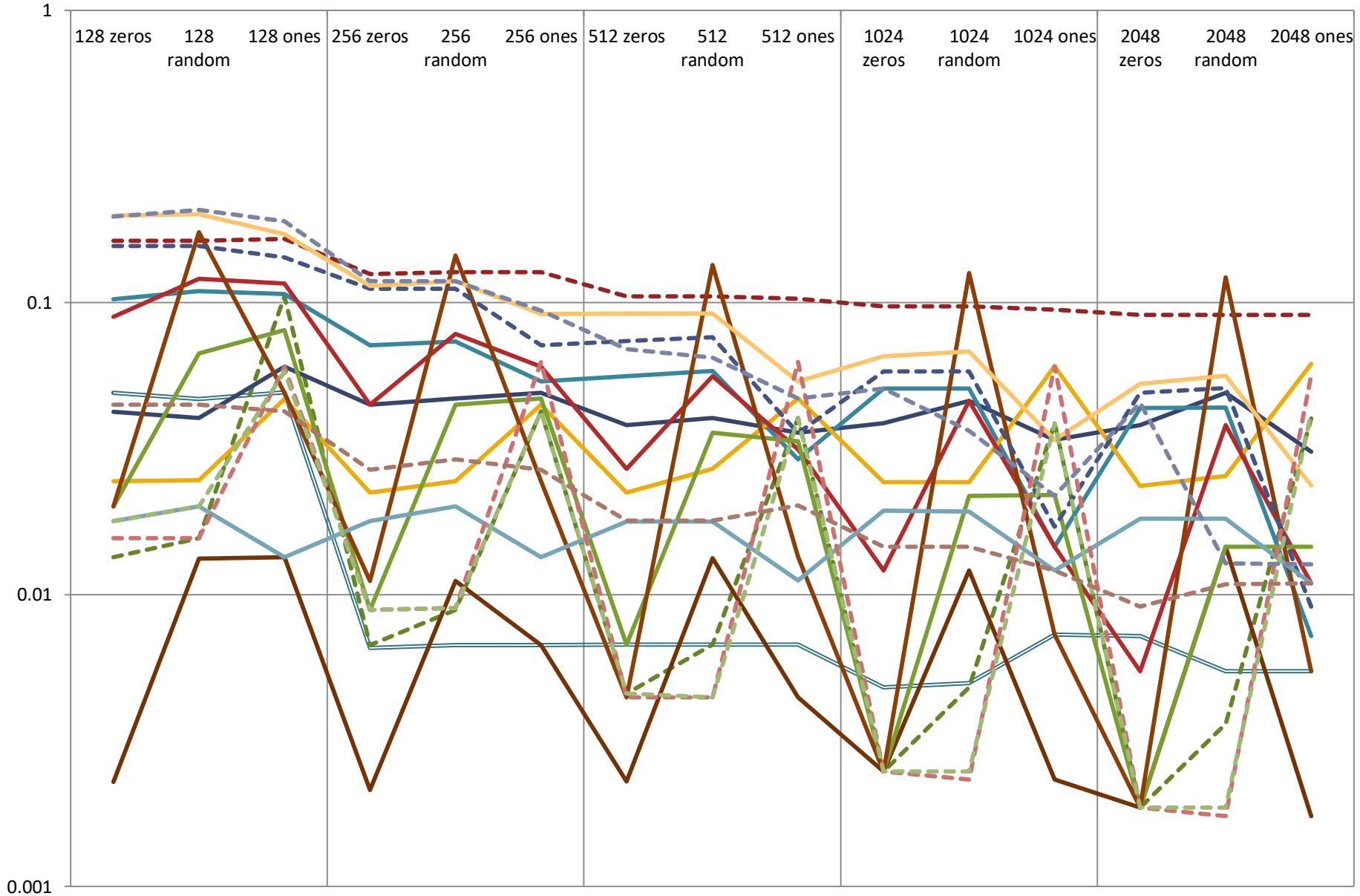
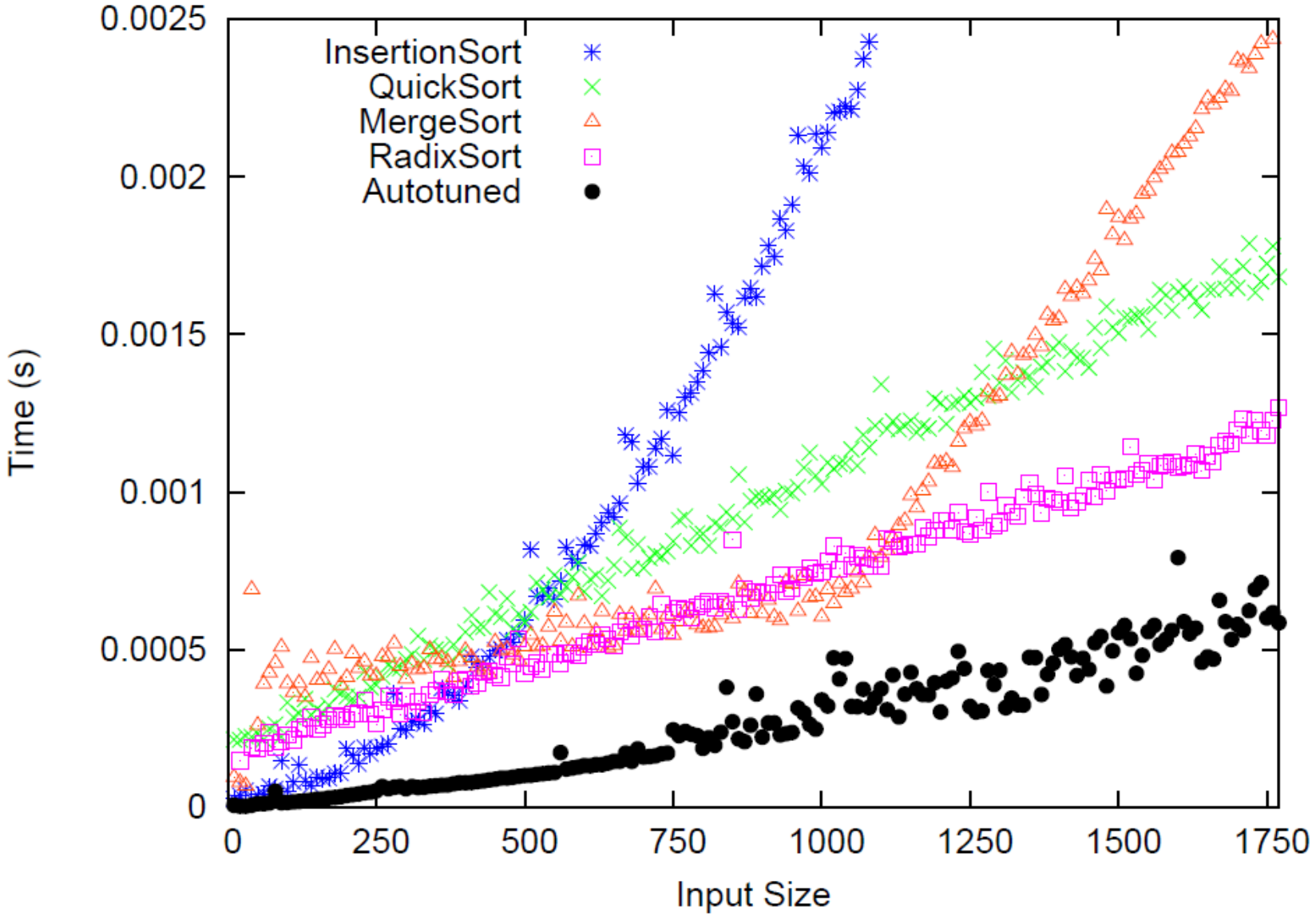
- Summer term
  - Compiler Design - NSWI109
    - Code optimization by compilers
  - Programming in Parallel Environment - NPRG042
  - Performance Evaluation of Computer Systems - NSWI131
    - Including the technology behind profilers, related statistics
  - Computer Architecture - NSWI143
    - Including more details on CPU internals and memory hierarchy
  - Advanced C++ Programming - NPRG051
    - Including template metaprogramming
  - Advanced Tools for Software Development and Monitoring - NSWI126
    - Selected tools, including profilers
- Winter term
  - Advanced Programming in Parallel Environment - NPRG058
  - Principles of Distributed Systems - NSWI035
    - The theory behind parallel and distributed systems

Motivation

A homework (2012/2013) – students not instructed to optimize speed



The same homework– students motivated to optimize speed



Real performance of sorting algorithms