

Professor: Torgersen

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Office Hours: Monday, Wednesday, Friday 3:00 to 4:30. Also by appointment.

Text: Parallel Programming: For Multicore And Cluster Systems by Thomas Rauber and Gudula Rünger

Facilities: Dell PowerEdge C6146 (gottlieb), Sun 5120 (genesis), WFU Cluster (deac), LittleFE.

Goals:

1. Overview of Parallel Computing Paradigms
 - (a) Data dependency
 - (b) Speedup, Amdahl's Law and Gustafson's Law
 - (c) Fine grain vs coarse grain parallelism
 - (d) Data parallelism, functional parallelism, task parallelism
 - (e) Light weight threads
 - (f) Shared memory parallel programming directives (OpenMP)
 - (g) Message passing (MPI)
2. Overview of Parallel Architecture Designs
 - (a) Pipelining and super-scalar instructions
 - (b) Shared memory and memory issues, (e.g., contention, cache coherence)
 - (c) Synchronization and critical section algorithms
 - (d) Memory Coherency models
 - (e) Message passing and communication issues
 - (f) Traditional interconnect topologies
 - (g) Multi-core processors (e.g., SPARC T2, AMD Bulldozer)
3. Theory: Parallel time complexity and asymptotic metrics
 - (a) Speedup and Efficiency
 - (b) Parallel time complexity
 - (c) Iso-efficiency: relating problem size to number of processors
4. Hands-on
 - (a) Parallel programming projects.
 - (b) Develop skill in programming with concurrent threads and message passing.
 - (c) Parallel program profiling (depending on available tools)
5. Some widely-studied parallel problems,
 - (a) Parallel prefix
 - (b) Matrix algorithms, e.g., matrix multiply, QR factorization
 - (c) Sorting (e.g., bitonic sort) and Searching
 - (d) Graph algorithms – path finding, centrality measures, etc.
 - (e) Parallel FFT (if time allows)
6. Automatic detection of parallelism (if time allows)

Expectations:

1. Class participation.
2. Communicate if things get complicated.
3. Your best effort.

Grading:

Exams (65%), take home problem sets + programming projects (35%).

Excused Absences:

- Missing an exam is only excused for a limited number of reasons and circumstances must be verifiable. Acceptable circumstances include only:
 - Official excused absences, e.g., varsity sports, dance team, marching band, etc.
 - A medical reason.
 - Childbirth (by you or your spouse/partner).
 - Military duty.
 - The passing of a family member.
- The final exam date is Wednesday, May 9, 2018 at 2:00pm. Early exam times are not available to accommodate travel plans.

Graduate Students: Graduate students enrolled in CSC 646 will be required to include additional features into their programming projects. In addition, graduate student assignments may include analytical and technical challenges that are not required for undergraduate students.

Disability Notice:

If you have a disability that may require an accommodation for taking this course, then please contact the Learning Assistance Center (758-5929) within the first two weeks of the semester.

Pandemic Planning Notice:

The University has requested that faculty collect personal contact information as part of emergency planning and preparation. The information you provide is strictly confidential.