Spring 1999
EECE 432
M/W 4:00 - 5:15PM

EECE 432 / CS 442: Introduction to Parallel Processing

`http://www.eece.unm.edu/~dbader/eece432/`

Instructor: Dr. David A. Bader, EECE 230B, 277-6724, dbader@eece.unm.edu
Office Hours: Monday/Wednesday 8:30-9:30AM, and by appointment
Textbooks:

- K. Hwang and Z. Xu, *Scalable Parallel Computing: Technology, Architecture, and Programming*, McGraw-Hill, 1998.
- P.S. Pacheco, *Parallel Programming with MPI*, Morgan Kaufmann, 1997.

Course Description: Machine taxonomy and introduction to parallel programming. Performance issues, speed-up, and efficiency. Interconnection networks and embeddings. Parallel programming issues and models: control parallel, data parallel, and data flow. Programming assignments on massively parallel machines. **Prerequisites: CS 341 or EECE 344; CS 351L or EECE 331**. **Recommended: CS 481 or EECE 437**.

Goals: To introduce the principles and practice of parallel processing, so that the student may apply what is learned to the solution of engineering and science-related problems. This course will also prepare students for advanced graduate level work in parallel processing.

Grading:

(25 %) Midterm Exam
(25 %) Final Project
(25 %) Homework
(20 %) Independent Research Project
(5 %) Class participation

Topics:

- Taxonomy of Parallel Architectures: SIMD vs. MIMD, synchronous vs. coarse grain, shared memory vs. distributed memory, and hybrid architectures (SMP clusters).
- Performance issues including speedup, work, efficiency, bisection bandwidth, scalability, diameter.
- Ideal and realistic parallel algorithmic complexity models.
- Parallel programming with current methodologies such as MPI.
- SMP technology and POSIX threads.
- Parallel algorithms (for example, for data communication, sorting, and matrix operations) on current high performance machines.
- Store and Forward vs. Cut-Through Message Routing.
- New technologies for cluster computing, including SMP clusters.
- Current High-Performance Computing topics in architecture, benchmarks, national HPC programs, distributed computing, job scheduling, and scalable I/O.

CLASS POLICIES

1. **Homework**. There will be several homework assignments, including both problems and programming assignments.

2. **Exams**. The midterm exam will be a take-home exam, but **NO COLLABORATION IS ALLOWED**. Specifically, you may not communicate with any person about any aspect of an exam until after the hand-in deadline, even if you have already handed in your exam. You may use your notes from the course and any textbooks. Please reference all sources that you use. You will be given several days to work the exam, from March 3-8. There will be no final exam in the course.

3. Please let me know as soon as possible if you will need to re-schedule an exam, or have any special needs during the semester.

4. **Independent Research Project**. Research a current topic in parallel processing from list on the class web page, (or with instructor approval, you may choose any other relevant topic). On or before January 27, 1999, you must email your topic to me (`dbader@eece.unm.edu`). After April 12, each student will be required to give a short (10-15 min.) poster presentation to the class (explain the material on your topic from the poster – without use of an overhead projector or slides). Your name, topic, abstract, and short bibliography, must be included on the poster. Also, a one or two page handout on your project must be distributed to the class. These posters will be collected and displayed in the EECE Building Atrium.

5. **Computer Programming**. The programming components of this course will be taught on high-performance architectures, and it is expected that students will take **complete** responsibility for developing running programs. There will be several short programming assignments and one larger project (due May 10). Assignments are expected to be written using the Message Passing Interface (MPI) on architectures such as the IBM SP-2 located at the Albuquerque High Performance Computing Center (`www.arc.unm.edu`) and UNM AltaCluster (`www.arc.unm.edu/alta/`). You should immediately apply for an AHPCC login account and become familiar with these platforms and environments.