

Rice University
Course Information for COMP/ELEC 526
High-Performance Computer Systems Architecture

Fall 2003

Instructor: Vijay S. Pai (DH 2023, vijaypai@rice.edu, x2887)

Office Hours: MW 2–3 PM, or by appointment.

Labbie: TBA.

Important electronic addresses: The course home page is at <http://www.owl.net.rice.edu/~elec526>. Most handouts, including lecture notes, homeworks, and solution sets, will be available here (see below). We will use a mailing list for important announcements. Please send an email to the instructor during your first week including your name and email address.

Meeting Place/Time: Herman Brown 227, MWF 1:00 PM – 1:50 PM

Prerequisites: COMP/ELEC 425 (or equivalent at another university), or permission of instructor. (Concurrent registration in COMP/ELEC 425 is **not acceptable**.)

Course Topics: This course will discuss the design of parallel architectures, including topics such as:

- Shared-memory multiple-instruction-multiple data (MIMD) architectures; e.g., Convex Exemplar, Cray T3E, SGI Power Challenge, SUN Ultra Enterprise Servers, Tera.
- Message passing MIMD architectures; e.g., IBM SP2, MIT J-machine, Thinking Machines CM-5.
- Single-instruction-multiple data (SIMD) architectures; e.g., Thinking Machines CM-1 and CM-2.
- Synchronization
- Techniques to reduce and tolerate communication latency; e.g., caches and cache coherence, memory consistency models, prefetching, and multithreading.
- Interconnection networks.
- Parallel algorithms and programming

Course Format: This class will consist of a lecture component and a student presentation component. Current plans are to have lectures on Monday and Wednesday, with student presentations on Friday to cover case studies and other topics related to the course material. The first few weeks will be entirely presented by the instructor, in the format of an overview of important topics in parallel computer architecture. The presentation schedule will be finalized in the next week as course enrollment stabilizes and topic schedules become clearer. All due dates listed in this document are tentative until finalized.

Course Text: The course material will primarily be covered from the book *Parallel Computer Architecture: A Hardware/Software Approach* by D. Culler, J. P. Singh, and A. Gupta, Morgan Kaufmann Publishers. The book will be supplemented with a few papers from the literature that will be made available in class.

Other useful textbooks for reference are:

- D. Lenoski and W-D. Weber, *Scalable Shared-Memory Multiprocessing*, Morgan Kaufmann Publishers, 1995.
- G. Almasi and A. Gottlieb, *Highly Parallel Computing*, Benjamin / Cummings Publishing Company, Inc., 2nd edition, 1994.
- J. L. Hennessy and D. Patterson, Chapter 8, *Computer Architecture: A Quantitative Approach*, Morgan Kaufmann Publishers, 2nd edition, 1995.
- M. K. Molloy, *Fundamentals of Performance Modeling*, Prentice Hall, 1989.

Lecture notes and handouts: Most handouts will be available from the course home page listed above. Most lecture notes will either be available from the course home page or as paper copies in a previous class. Please check the course web page on the morning before each class for any handouts or announcements. It is your responsibility to print out any handouts needed and bring them to class.

Homeworks: There will be one homework assignment with a substantial programming component. This will tentatively be due at the beginning of class on September 26, 2003. **Late homework will not be accepted in general.** For exceptional reasons, an agreement to submit late may be reached with the instructor. Except for unforeseen medical emergencies, the agreement must be made on the day the homework is handed out to the class.

Exams: There will be one take-home exam consisting of three hours in length, with open-book and open-notes. This exam will tentatively be handed out on October 15 and due at the beginning of class one week later.

Term project: There will be a substantial term project. You will work in groups of two or three to do a research project, typically involving an extension or re-validation of the results of a research paper from the literature. All projects must be approved by the instructor. Project groups must be formed by September 15. Groups should contact the instructor shortly thereafter with initial project ideas for approval, comments, and suggested references. There will be a 1-2 page written project proposal due on October 1, an oral progress report due on November 3rd, and a paper and presentation at the end of the semester. More details will be made available shortly.

Presentations: As noted on the course web page, most Fridays starting from September 12 until the end of the semester will feature a student presentation on a topic assigned or approved by the instructor. (The only exceptions are for various due dates.) The number of presentations per student will depend on the number of enrolled students, with a minimum of 1 per student and a maximum of 2 per student.

Class participation: Students are expected to contribute questions and insights to course meetings throughout the semester.

Grading: Homework: 15%, Exam: 20%, Project: 40% (split 5/5/10/20 between proposal, progress report, presentation, and final report), Presentations: 15%, Class participation: 10%.

Honor code policy: The exam and the written component of the homework must be done individually. The use of class notes, course text, and class handouts will be allowed for the exam and the homework. The project and the programming component of the homework are to be considered group work, with a maximum group size of 3. Software written by any of the group members in another course may be used toward programming assignments and projects if the instructor of the other course does not object. Homeworks, exams, and solution sets from previous offerings of this course, COMP/ELEC 525, COMP/ELEC 425, or any course offered by former Rice faculty must not be used for this course.

Students with Disabilities: Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities will need to also contact Disability Support Services in the Ley Student Center.