# Lecture 1

## First Meeting & Introduction to Parallel Computing

### Lecture Information

Ceng505 *Parallel Computing* at September 27, 2011

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Computer Engineering Department
Çankaya University



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# First Meeting

- CENG 505 Parallel Computing I Fall 2011
- TUESDAY 17:40 - 20:30 (T & L) INT-LAB1
- Instructor: Cem Özdoğan Materials Science and Engineering Department, New Campus MHB3 Z-21
- TA:
- WEB page: http://siber.cankaya.edu.tr/
- Announcements: Watch this space for the latest updates.

  ```
  September 27, 2011 13:23 In the first lecture, there
  will be first meeting and introductory studies. The
  lecture notes for the second week will be published
  soon, see Course Schedule section.
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- All the example c-files (for lecturing and hands-on sessions) will be accessible via the link.



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# Lecture Information I

- There is one group for lecturing.
- You will be expected to do significant programming assignments, as well as run programs we supply and analyse the output.
- Since we will program in C on a UNIX environment, some experience using C on UNIX will be important.
- In Hands-on sessions, we will concentrate upon the message-passing method of parallel computing and use the standard parallel computing environment called MPI (Message Passing Interface).
- Thread-based programming will also be outlined, and the distributed shared memory (DSM) approach (If we have enough time).



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# Lecture Information II

- Each student will complete a project based on parallel computing for the laboratory study.
- Also, each student will complete a project based on parallel computing, (distributed computing, cluster computing) for the midterm exam.
- Important announcements will be posted to the Announcements section of the web page, so please check this page frequently.
- You are responsible for all such announcements, as well as announcements made in lecture.



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# Overview

- This course provides an introduction to parallel and distributed computing and practical experiences in writing parallel programs on a cluster of computers.
- You will learn about the following topics:
  - Parallel Computers,
  - Message Passing Computing,
  - Embarrassingly Parallel Computations,
  - Partitioning and Divide-and-Conquer Strategies,
  - Pipelined Computations,
  - Synchronous Computations,
  - Load Balancing,
  - Programming with Shared Memory
- Topics might be classified into two main parts as;
  1. Parallel computers: architectural types, shared memory, message passing, interconnection networks, potential for increased speed.
  2. Basic techniques: embarrassingly parallel computations, partitioning and divide and conquer, pipelined computations, synchronous computations, load balancing, shared memory programming.



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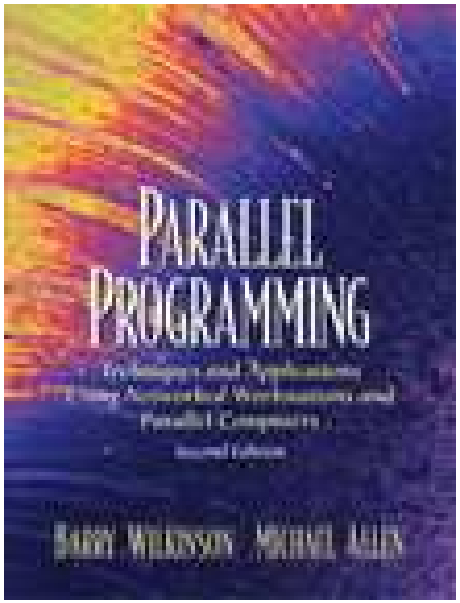
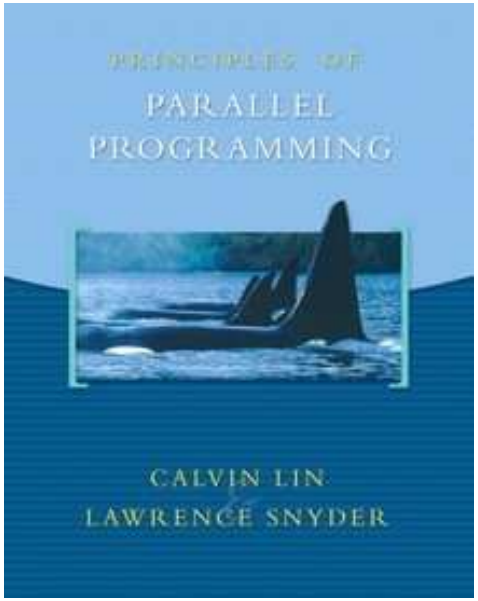
# Text Book I

- Required:
- Recommended: Principles of Parallel Programming, by C. Lin and L. Snyder, Addison-Wesley 2009, ISBN 0-32-148790-7.
- Recommended: Parallel Programming: Techniques and Application Using Networked Workstations and Parallel Computers, 2nd edition, by B. Wilkinson and M. Allen, Prentice Hall Inc., 2005, ISBN 0-13-140563-2.



Recommended



Recommended



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# Text Book II

- Beowulf Cluster Computing with Linux, 2nd edition, edited by William Gropp, Ewing Lusk, Thomas Sterling, MIT Press, 2003, ISBN 0-262-69292-9.
- Beowulf Cluster Computing with Windows, Thomas Sterling , MIT Press, 2001, ISBN 0-262-69275-9.
- Using MPI , Portable Parallel Programming with the Message Passing Interface, William Gropp, Ewing Lusk and Anthony Skjellum, The MIT Press, 1999, ISBN 0-262-57132-3.
- Using MPI-2, Advanced Features of the Message Passing Interface, William Gropp, Ewing Lusk, Rajeev Thakur, The MIT Press, 1999, ISBN 0-262-57133-1.
- MPI: The Complete Reference (Vol. 1) - The MPI Core, Marc Snir, Steve Otto, Steven Huss-Lederman, David Walker and Jack Dongarra, The MIT Press, 1998, ISBN 0-262-69215-5.



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# Text Book III

- MPI: The Complete Reference (Vol. 2) - The MPI-2 Extensions, William Gropp, Steven Huss-Lederman, Andrew Lumsdaine, Ewing Lusk, Bill Nitzberg, William Saphir and Marc Snir, The MIT Press, 1998, ISBN 0-262-57123-4.
- In Search of Clusters: The ongoing battle in lowly parallel computing, Second Edition, by Gregory F. Pfister, Prentice Hall Publishing Company, 1998, ISBN: 0-13-899709-8.
- How to Build a Beowulf - A Guide to the Implementation and Application of PC Clusters, by Thomas Sterling, John Salmon, Donald J. Becker and Daniel F. Savarese, MIT Press, 1999, ISBN 0-262-69218-X.
- PVM: Parallel Virtual Machine, A Users' Guide and Tutorial for Network Parallel Computing, Al Geist, Adam Beguelin, Jack Dongarra, Weicheng Jiang, Robert Manchek and Vaidyalingam S. Sunderam, MIT Press, 1994, ISBN 0-262-57108-0.



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# Grading Criteria & Policies

- There will be a final exam: 40%
- Term Project as Midterm exam: 25%
- Term Project as Lab. exam: 25%
- Attendance is REQUIRED and constitutes part of your course grade; 10%. You are responsible for everything said in class.
- I encourage you to ask questions in class. You are supposed to ask questions. Don't guess, ask a question!
- The code you submit must be written completely by you. You can use anything from the textbook/notes.



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# Field

- Data-intensive applications; transaction processing, information retrieval, data mining and analysis, multimedia services, computational physics/chemistry/biology and nanotechnology.
- High performance may come from
  - fast dense circuitry,
  - packaging technology,
  - parallelism.
- Parallel processors are computer systems consisting of multiple *processing units* connected via some *interconnection network* plus the software needed to make the processing units work together.



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# Field II

- *Uniprocessor* – Single processor supercomputers have achieved great speeds and have been pushing hardware technology to the physical limit of chip manufacturing.
  - Physical and architectural bounds (Lithography, $\mu$m size, destructive quantum effects.
  - Proposed solutions are maskless lithography process and nanoimprint lithography for the semiconductor).
  - Uniprocessor systems can achieve to a limited computational power and not capable of delivering solutions to some problems in reasonable time.



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