CENG577 - Parallel Computing - Spring 2019

**Hours:** Thursday 9:40-12:30 G102

**Instructor:** Murat Manguoglu

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Office Hours: Thursday 14:00-15:00

**Motivation:**

While the fastest computers are large parallel clusters today, programming them remains a challenge. The best algorithm and their implementation could be quite different than the sequential counterpart on a parallel platform. Programmer needs to consider multiple issues like how to load balance and how to effectively use multiple levels of caches and the communication network. Today parallel computing is everywhere, it is not only the fastest computers, but also from your laptop to cellphone, many devices contain parallel processors. *This course will focus on the design, analysis and implementation of parallel algorithms that one usually encounters in large scale Science and Engineering problems.*

**Outline:** (subject to change)

- Brief introduction and a review of the architectural features of parallel processors, memory hierarchy and programming models, task decomposition and design of parallel algorithms
- Basic communication operations and their implementation on various network topologies and performance analysis of parallel algorithms
- Overview of parallel computing software environments
- Dense parallel matrix computations and algorithms
- Sparse parallel matrix computations and algorithms
- Graphs and graph partitioning
- Case studies: various real world applications
Prerequisites:

Some experience in parallel programming. The course is open to graduate students from any department with some background in Scientific Computing and Parallel Programming provided there are available seats in the class. With the consent of the instructor, undergraduate students can also register for this course.

Programming Homeworks:

There will be 4 programming homework assignments. We will use our departmental hpc platform (https://ceng.metu.edu.tr/slurm). Homework reports should be written using \LaTeX.

Exams:

There will be a midterm and a final.

Attendance and Participation:

Attendance is required. Participation in the class, discussions and office hours are encouraged. I will randomly check attendance and I may use it in your favor when assigning letter grades.

Grading:

Homeworks (×4) 60%
Midterm 20%
Final 20%
Total 100%

Discussion and Communication:

We will use odtuclass.metu.edu.tr and news.ceng.metu.edu.tr
References:

Introduction to Parallel Computing, by Grama, Gupta, Kumar, and Karypis, Addison Wesley. 2003
Introduction to High Performance Computing for Scientists and Engineers, by Hager and Wellein, Chapman & Hall/CRC Computational Science. 2010
The Sourcebook of Parallel Computing, Dongarra, Foster, Fox, and Gropp, Kaufmann. 2002

Course Policy and academic honesty:

Discussion of ideas or concepts are allowed. However, when writing your code or solution you should not look at other people’s work. If you use a source (online or offline) you are expected to cite it and state how you used it. Violation of these general principles will be handled based on the university regulations and may result in disciplinary action. Late homework submissions will not be accepted. An exception is when there is an official medical or family emergency, in this case you should contact the instructor as soon as possible.