CENG577 - Parallel Computing - Spring 2021

**Hours:** TBD

**Instructor:** Murat Manguoglu

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Office Hours: -

**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 architecture of the modern parallel computing platforms and the design, analysis and implementation of parallel algorithms for solving large scale science and engineering problems.*

**Outline:**

Introduction and a review of the architectural features of parallel processors, communication operations, memory hierarchy and programming models, task decomposition and design of parallel algorithms. Dense and sparse matrix computations. Graphs and graph algorithms.

**Prerequisites:**

Excellent programming skills. 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.
Lectures:

Based on the feedback provided last semester, approximately 2 hours of video lectures will be posted on youtube weekly and during the regular class hours we will have live discussion (approximately 1 hour long but could be longer if needed) of the current week’s topics using Zoom which will not be recorded.

Final:

Final will be an oral exams and they will be conducted via Zoom each will be no longer than 20 minutes long. They will be recorded.

Project:

The project can be done individually or with a team of at most 3 people. It will consist of 3-phases: pre-proposal, proposal and final report. The project topics should be chosen so that they require approximately 4-homework equivalent amount of work and they should not have been submitted anywhere else before (as a paper or as work on another course). In the pre-proposal phase, a challenging problem should be determined. If there is a team, it should be formed at this point. The pre-proposals will be due on April 11th. The proposal should give the existing methods for solving the problem and your brief plan on how to solve the problem. The proposals are due on April 25th. The final reports are due on June 26th.

Discussions and communication:

We will use odtuclass.

Attendance and Participation:

Attendance and participation to online discussions are encouraged. I may use it in your favor when assigning letter grades.

Grading:

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<tr>
<th>Grade</th>
<th>Percentage</th>
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<tr>
<td>Project</td>
<td>80% (including preproposal-15%, proposal-20% and the final report-45%)</td>
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<tr>
<td>Oral Final</td>
<td>20% (during the finals)</td>
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<td>Total</td>
<td>100%</td>
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**Course Policy and academic honesty:**

All phase-reports of the project should be your work. If you use a source you are expected to cite it.

**Makeup policy:**

In case of an official medical or family emergency that prevented you from attending the final, or submitting any of the project reports on time, you should contact the instructor as soon as possible and provide documentation.
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:

If you use a source (online or offline) you are expected to cite it and state how you used it. Late project 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.