CSCI-UA.0480-003 Parallel Computing
Spring 2018

Pre-requisite: Computer System Organization **(***CSCI-UA.0201)*
Meeting time and place: Mondays/Wednesdays 2:00-3:15pm WWH 109
Instructor: Mohamed Zahran (mzahran@cs.nyu.edu)
Web page: http://cs.nyu.edu/courses/spring18/CSCI-UA.0480-003/
Office hours: Tuesdays 2-4pm (WWH 320)

Description:

Most of us have learned to program a single microprocessor using a high-level programming language like C/C++, Java, ... This is called sequential programming. We feel very comfortable with this because we think in a sequential way and give the machine statements to be executed in sequence. However, this must change. A single microprocessor (or single core) no longer exists in almost all computers we are using today (including your tablets and smart phones). Most of our devices are now multicore processors. A multicore processor contains several cores (called CPUs or cores) on-chip.
Also many of these devices contain different type of cores: a graphics processing units (GPUs) for example.To make the best use of these chips we need to program them *in-parallel*. Sequential programming, for all platforms from smartphones to supercomputers, is falling out of fashion and taking back-seat to parallel programming.
How to think in parallel? How to write code in parallel to make the best use of the underlying hardware? How is that new hardware different from the traditional one? What will the future be for the software and hardware? This is the topic of this course.

Text:

We will use the following book:

Author: Peter S. Pacheo
Title: An Introduction to Parallel Programming
Publisher: Morgan Kaufmann
Year: 2011
ISBN 978-0-12-374260-5

The following ones are not required but are recommended:

Author: Gerassimos Barlas
Title: Multicore and GPU Programming: An Integrated Approach
Publisher: Morgan Kaufmann
Year: 2015
ISBN 978-0-12-417137-4

Programming Massively Parallel Processors: A Hands-on Approach
2nd Edition
(That books is mainly about GPUs)
Authors: David B. Kirk and Wen-mei W. Hwu
Publisher: Morgan Kaufmann
Year: 2013
ISBN: 9780124159921

Main Topics

- What is parallel computing? And why do we need it?
- Basics of parallel hardware
- Challenges in parallel programming
- How to think in parallel?
- OpenMP for shared memory
- MPI for distributed memory
- Performance analysis of parallel programs
- Pitfalls in parallel programming
- GPUs and how to program them with CUDA
- Supercomputers and how to program them

Grading

- Homework assignments 20%
- Labs 20%
- Midterm 20%
- Final exam 40%

Where to find Stuff:

- **Course web page**: for lecture slides, assignments (and their solutions), syllabus, and some interesting links.
- **NYU classes**: to submit assignments, check you assignment grades, and forums.

Good Luck and Have fun!