CS 1645/2045: Introduction to High Performance Computing (Spring 2021)
Department of Computer Science, University of Pittsburgh
Course Reference Number: 25932 (CS1645) & 25933 (CS2055)

When: Spring 2021

What & Where:
Lectures: Mon. & Wed., 6:30 pm – 7:45 pm @ Remote Synchronous (129 Victoria Building)

Instructor: Dr. Constantinos Costa
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Office Hours: Instructors and TA's office hours are listed on the class web site.

Course Description: This course is an introduction to the architecture of and software techniques for parallel and high performance computing systems. The content includes fundamental aspects of vector processing, shared-memory, and distributed-memory systems. Specific applications in parallel processing paradigms will be covered.

Prerequisites: A grade of C or better in CS 0447 and CS 0449 and CS 1501 is required. Working knowledge of C and familiarity with Unix are assumed.

Class Web Page: http://db.cs.pitt.edu/courses/cs1645/current.term
All handouts and class notes will be accessible from Canvas and published on the class web page. You are expected to check this page frequently (at least twice a week).

Textbook: *An Introduction to Parallel Programming* by Peter Pacheco (Morgan Kaufman, 2011, ISBN:978-0123742605)

Textbook (Optional): *Structured Parallel Programming: Patterns for Efficient Computation (1st ed.)* by Michael McCool, James Reinders, and Arch Robison (Morgan Kaufmann ISBN-13: 978-0124159938 & ISBN-10: 0124159931)

Platforms and Mode of Instruction: Both the lectures and recitations will be taught primarily via **remote synchronous instruction**. Zoom meetings will be our primary platforms of interaction. If you need help navigating Canvas, please consult this list of Student Resources for using Canvas. For maximum engagement during the lectures and recitations, we encourage everyone to keep their video on during Zoom sessions. Furthermore, for additional asynchronous engagement, both lectures and recitations will be recorded.

You must connect via a personal electronic device over a reliable and fast internet connection. The larger the screen on your device, the easier it will be for you to see and participate, so computers are generally preferable to phones, for example. If you are not equipped with a computer or do not have access to a stable internet connection, the university is offering services to provide you with support (Chromebook and internet hot spots). Please contact the Technology Help Desk for further information. Recommended browsers: Chrome / Firefox / Edge.

Operational Posture: The University of Pittsburgh will be operating with a system of Operational Postures. Use the link operational postures to see the current posture and details about what each posture means generally here. *For this course, all aspects of the course will operate the same way regardless of the university's operational posture.*

Note on Email & Communication: In order to achieve the highest level of communication outside the classroom, we will use the **Campuswire** system for all questions and clarifications on lectures, recitations and assignments. *You should use email only for confidential matters.* For a confidential email to the instructor and the TA, you should send the email to **costa.c@cs.pitt.edu**. Note that this email address works only within the pitt.edu domain. If you have a confidential matter for the *instructor only*, then please email the instructor directly, but make sure to include the prefix [CS1645] or [CS2045] in the subject line of your email message. We will make every effort to respond to all email requests within one business day at the latest. **Due to spam filtering, you should always try to use your pitt email address when sending email and include your full name.**

Course Grading:

Homework Assignments	20%	4-5 Assignments
Term Project	15%	group project of 2-3 member
Midterm Exam	30%	Mon, Mar. 10, 2021
Final Exam	30%	TBD
Class Attendance & Participation	5%	

Grading Policy: The grade scaling will be computed based on the performance of the undergraduate students only. Graduate students will then be graded on this undergraduate scale.

Attendance and participation in lecture and recitation may be used to decide borderline grades.

Unless explicitly noted otherwise, the work in this course is to be done *independently*. Discussions with other students on the assignments should be limited to understanding the statement of the problems. Cheating in any way, including giving your work to someone else will result in an F for the course and a report to the appropriate University authority.

Marks can be appealed up to two weeks after they have been posted, after that no appeals will be considered.

Class Attendance & Participation Because of the remote synchronous teaching, your attendance in our Zoom meetings and your class/recitation discussion participation is essential. It is therefore important that you do not miss class and recitation and participate actively while there. You must come to class willing to actively volunteer and participate. In addition to attendance and in-class participation points, additional points will be given for contributions and good answers to the discussions on Campuswire.

Submission & Late Policy: All written assignments must be submitted electronically and **there is no late submission**. An assignment which is late will be accepted *only* under special circumstances with the instructor's permission prior to its deadline. In such a case, the instructor will determine any penalty in a fair manner.

Make-up Policy: Students are expected to take both midterm and final exams. Make-up exams will only be given in the event of a medical situation or an emergency, and only if this is documented and the instructor is notified *immediately if in advance is not possible*. Missing an exam will result in a zero for the exam.

Students with Disabilities: If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 140 William Pitt Union, 412-648-7890 or 412-383-7355 (TTY) as early as possible in the term. More info at: www.drs.pitt.edu.

Religious Observance: In order to accommodate the observance of religious holidays, students should inform the instructor of any such days within the first two weeks of the term by email (**Jan 28**).

Copyrighted Material All material provided through this web site is subject to copyright. This applies to class/recitation notes, slides, assignments, solutions, project descriptions, etc.

Outline: Tentative Syllabus

1. High performance computing systems
2. Parallel programming patterns
3. Multiprocessor architectures
4. Cache coherence in symmetric multiprocessors
5. Shared memory programming with OpenMP
6. Accelerators programming with OpenMP extensions
7. Models of parallel processing
8. Performance metrics
9. Distributed memory programming with MPI
10. Parallel algorithms
11. Map Reduce