

ITCS 4145 Parallel Computing

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This course is an introductory course in Parallel Computing for undergraduate Computer Science and Engineering students. Parallel computing uses multiple cores, processors, or computers to solve problems at a greater computational speed. Computer systems with multiple execution cores are now commonplace, and in the future we are likely to see systems with a large number of processor cores. Programming such systems or a collection of such systems is now an imperative skill to learn for Computer Science and Engineering students. Parallel and Distributed computing is now a required knowledge area in the IEEE/ACM 2013 CS curriculum.

This course begins with programming shared memory and multicore computers using a thread model, with programming in OpenMP. Then programming interconnected computers using a message passing model is covered with programming in MPI. A new pattern programming approach to parallel programming will be introduced including parallel programming software tools developed at UNC-Charlotte and UNC-Wilmington. Pattern programming uses parallel design patterns that are well tested and known arrangements to solve common problems and provide scalable design structures. Programming with higher-level pattern programming tools is much easier and less likely to be flawed. Examples of the parallel design patterns include workpool, pipeline, divide and conquer, iterative stencil, iterative all-to-all, and data-parallel patterns. We continue in the course with various parallel algorithms. Hybrid programming is introduced, which uses combinations of shared memory and message systems. Finally we cover programming GPUs for high performance computing using CUDA.

Students will be provided with a pre-configured VirtualBox virtual machine (Ubuntu OS) with all the required software to do most of the programming on their own computer although instructions are also provided so that students can install the software natively on a Linux OS. Each student will also be provided an account on a department parallel programming cluster to test their programs in this environment.

Prerequisites:

ITCS 2214 and ITCS 3181 or ITCS 3182. *However ITCS 3181/2 can be waived. Contact the instructor.*

Typically junior/senior undergraduate standing Computer Science and Engineering students.

This course uses C as the underlying language mainly. There is a little Java.

For more information, contact the instructor by email (abw@uncc.edu).