Fall 2024

COSC 365

High Performance Computing

WOFFORD

👩🏻‍🏫 INSTRUCTOR

Dr. Beau M. Christ
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Department of Computer Science

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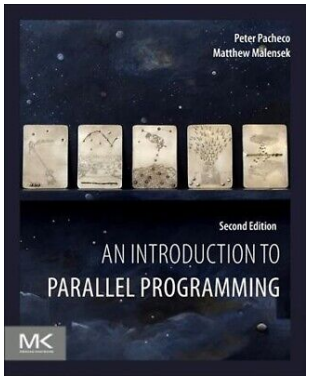
⏰ Office hours will be held **Mondays (1:00-2:30PM), Tuesdays (12:30PM-2:00PM), Wednesdays (2:30PM-4:30PM), and Thursdays (9:00AM-11:00AM)**. We can also individually schedule other times, if needed. I am always happy to chat!

🗺️ MEETING TIME & LOCATION

We will meet every Tuesday and Thursday from 2:30PM - 3:50PM in **OLIN 218**, unless otherwise specified.

📖 TEXTBOOK

You will need to obtain a copy of An Introduction to Parallel Programming (2nd edition) by Peter Pacheco and Matthew Malensek.



📋 COURSE OVERVIEW

Welcome to **COSC 365: High Performance Computing**!

Many programmers write software without considering the fact that most computers now have multiple processing cores, and therefore miss out on squeezing as much performance as possible from the programs they write. While software can get by just fine without the need for multiple cores, there is an increasingly large amount of scientific software being developed (coming from biology, physics, artificial intelligence, mathematics, and many other domains) where being able to compute things in parallel could literally open the doors to new scientific discoveries. Some of these computer programs can be so computationally expensive that it could take days, weeks, or even longer to finish running! Parallelizing the code can reduce the running time to days, hours, or even minutes, in some cases.

This course will give you experience writing computer programs that take advantage of the various tools, hardware, algorithms, and languages for writing parallel programs. Some of the topics we will explore include *multi-core processors*, *parallel programming using MPI, Pthreads, and OpenMP*, *distributed computing*, *general-purpose computing on graphics processing units (GPGPU)*, and *supercomputers*. This is an elective course in computer science that can greatly benefit other scientific disciplines as well! This course is a nice compliment to *COSC/MATH 201: Modeling and Simulation*, as well as *COSC 360: Operating Systems*.

Prerequisites: COSC 273 (*Computer Organization & Architecture*) with a minimum grade of C and COSC 350 (*Data Structures & Algorithms*) with a minimum grade of C.

Catalog Description: An introduction to the concepts, tools, languages, and algorithms for solving complex problems on massively parallel and distributed computers. Topics include advanced computer architecture, performance and optimization, and the design, analysis, and implementation of applications using parallel programming languages and tools.

✅ COURSE OBJECTIVES

By taking this course, my goal is for you to:

- **Understand parallel system architectures** and obtain hands-on experience using them
- **Write parallel programs** using the C programming language to maximize program performance
- **Become familiar with common UNIX commands and programs** in order to interact remotely with supercomputers
- **Gain hands-on experience with parallel programming libraries** such as MPI, Pthreads, and OpenMP
- **Run your programs** on a real supercomputer
- **Be exposed to GPGPU programming** such as CUDA for pushing performance even further

You will fulfill these objectives by:

- Reading your textbook
- Completing multiple hands-on projects
- Taking two midterm exams and a final exam
- Being engaged during in-class discussions and activities

📝 GRADING

All grades will be recorded in Moodle as the semester progresses, including your final grade. Your final grade will be weighted as follows:

Projects (40%)

You will complete multiple projects to help solidify your understanding of the material, each submitted via Moodle. They will be equally weighted, and each given a grade out of 10 points.

Midterm Exams (40%)

There will be two midterm exams given during the semester, where you will be tested on your knowledge of the material up to that point.

Final Exam (20%)

You will take one final exam at the scheduled time during finals week that will review everything covered during the semester.

GRADING SCALE

We will utilize the following grading scale (grades will be rounded, so a 92.49% will map to an A-, and a 92.5% will map to an A):

0% - 59%	F		80% - 82%	B-
60% - 69%	D		83% - 86%	B
70% - 72%	C-		87% - 89%	B+
73% - 76%	C		90% - 92%	A-
77% - 79%	C+		93% - 100%	A

📜 POLICIES

ATTENDANCE

You are expected to attend class. I do understand that absences are sometimes unavoidable, so I appreciate an email letting me know in advance that you will be absent. You are responsible for catching up on missed classes. Finally, in accordance with Wofford policy, you must be present for the final exam.

CLASSROOM

You are allowed to bring your computer to work along with the examples in class. I highly advise you, however, to not become distracted by your devices (notebook, phone, tablet, etc.) for things other than course-related use. Not only are you missing out and inhibiting your learning, but it is often a distraction to others as well. I strongly encourage you to use features such as **do not disturb** or **focus mode**. It is also worth mentioning that research has shown that taking notes by hand instead of typing results in a better learning experience.

LATENESS

You are expected to keep up with all coursework and due dates during the semester. Submitting coursework past the due date/time (even by a single minute!) will result in a 1 point penalty (out of 10) for that particular project. After that, you have 24 hours to submit the late work until a second penalty is given (another point). After 48 hours past the due date, the project will not be accepted under any circumstances and will receive a 0. There are a few reasons that are acceptable (medical, family emergencies, etc.), but I will usually only grant extensions for those cases when receiving an email or phone call before the due date. I will decide on a case-by-case basis, but having official documentation will help make your case.

COMMUNICATION

I will use email as my main means of communication. Feel free to contact me using "christbm@wofford.edu". The top of this syllabus shows other ways to contact me as well. You are also welcome to stop by office hours to chat about any questions or concerns you have.

ACADEMIC INTEGRITY

Please do your own work!

I have caught students cheating in the past, and take these matters very seriously. Any student I determine is guilty of academic dishonesty will have their case referred to the department and the college to be pursued further (trust me, you do not want that to happen). You may discuss ideas with other students, but **all work must be your own**. You can discuss approaches and ideas with others, but there should be no sharing of code.

To make sure you understand what constitutes academic dishonesty, please read the Wofford Honor Code. By enrolling in this course, you are pledging that you agree to the Wofford Honor Code and that all submitted work is your own. Please talk to me if you are unsure what constitutes academic dishonesty.

REASONABLE ACCOMMODATIONS

If you need accommodations with anything at all, please contact both the Wofford Accessibility Services and myself at the beginning of the semester. We will do our best to assist you as best we can.

USE OF GENERATIVE AI

Any AI-generated submissions are not permitted and will be treated as plagiarism. Any use of generative AI for any stage of your work in this course is considered a violation of the honor code. The one exception is the use of generative AI for syntax-related questions (e.g. "How do you write a for loop in Java?" or "How do I import a library in R?").