Faculty of Engineering | Electrical and Computer Engineering
Engineering Office Wing Room 448 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
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COURSE OUTLINE

ECE 553 Introduction to Parallel and Cluster Computing

Term – SPRING 2021 (202101)

Instructor	**Office Hours**	
Dr. Nikitas Dimopoulos	Days:	**M/R**
Phone: (250) 721-8902	Time:	**16:00-16:30/11:30-12:00**
E-mail: nikitas@ece.uvic.ca		Zoom Link:

https://uvic.zoom.us/j/87378763324?pwd=TExpeXpva0R2ZXVKS3k3bitsTlhqZz09

I can be reached via email (please use "ECE553 question" as your subject)

If you need to see me in person at a different time, please make an appointment (via email).

Course Objectives

The focus of the course is to explore the programming practices for clusters (and High Performance Computers). This will be accomplished through the use of the two prevailing standard environments i.e. MPI (Message Passing Interface) and OpenMP. We will study fundamental algorithms and their parallel implementations.
You will be gaining hands-on experience on a cluster environment (4-node/32-core Intel Xeon X5520 system)

Learning Outcomes

The student will be able to
- Describe the domain of High Performance Computers (HPC) including shared memory, distributed memory, pipelining, clusters, many-core and non-homogeneous systems.
- Explain the interplay of communications and computation in an HPC environment.
- Evaluate the latency and throughput of a communications link.
- Evaluate the performance of an application running on a parallel system and choose the appropriate scaling.
- Design parallel algorithms using domain or functional decomposition.
- Use MPI or OpenMP to implement a parallel algorithm.
- Describe the architecture and use of GPUs.
- Demonstrate the parallel implementation of a number of important algorithms including N-body problem, Matrix-Vector multiplication, Monte-Carlo methods etc.

Syllabus
- Preliminaries. The space of high performance computers
- Clusters. Commodity nodes and interconnection network strategies. Why performance depends on interconnections
- Programming. MPI and OpenMP. Develop programming skills through a number of applications.
- Partition, data decomposition, communication, granularity.
- The Sieve of Eratosthenes (finding prime numbers)
- The shortest-path problem
- Linear algebra (matrix-vector, matrix-matrix multiplication, linear systems)
- Monte Carlo Methods
- Finite Difference Methods

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A-Section(s): A01 / CRN 23987
Days: MR
Time: 14:30-15:50
Zoom link: https://uvic.zoom.us/j/85321044710?pwd=a1dHK0ZPZ3JocFplOUVRcnlLRTZYZz09

Required Text	**Optional Text**
Title: Parallel Programming in C and OpenMP	Title:
Author: M. J. Quinn	Author:
Publisher: McGraw Hill	Publisher:
Year: 2004	Year:

Course web site: https://www.ece.uvic.ca/~ece457
Login: Please use your UVic credentials to login

Online Course Delivery:

As this course will be conducted online during this term, students will need to complete assignments/labs online. The students will require access to a computer which has the following software installed:

- Zoom (https://zoom.us/download).

References:

Assessment:

Assignments:	5%	
Project	10%	
Midterm	30%	**Thursday, March 4, 2021**
Final	55%	

Important: All deadlines and schedules for this course will reference Pacific Standard Time until March 14, 2021 and then Pacific Daylight Time.

Note:
- Failure to pass the final exam will result in a failing grade for the course.
- Failure to complete the project, will result in a grade of N being awarded for the course.
- Homework will be assigned and collected, but it will not be corrected.
- Solutions will be posted after the due dates.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Graduate Calendar.

https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/B13jeiMdE?bc=true&bcCurrent=07%20-%20Grading&bcItemType=policies

Note to Students:
Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Course Withdrawal Deadlines:
- January 19, 2021: Withdrawal with 100% reduction of tuition fees (under review)
- February 9, 2021: Withdrawal with 50% reduction of tuition fees (under review)
- February 28, 2021: Last day for withdrawal (no fees returned) (under review)

Accommodation of Religious Observance:
https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/SkmigiMOV?bc=true&bcCurrent=17%20-%20Accommodation%20of%20Religious%20Observance&bcItemType=policies

Policy on Inclusivity and Diversity:
Engineering: https://www.uvic.ca/engineering/about/equity/index.php
Academic Calendar:
https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/HkQ0pzdAN?bc=true&bcCurrent=%20General%20University%20Policies&bcGroup=General%20University%20Policies&bcItemType=policies

Standards of Professional Behaviour:
You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities.
http://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Academic Integrity:

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Graduate Calendar for the UVic policy on academic integrity.

https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/BJujesM_E?bc=true&bcCurrent=02%20-%20Policy%20on%20Academic%20Integrity&bcItemType=policies

Equality:
This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Centre for Accessible Learning located in the Campus Services Building: https://www.uvic.ca/services/cal/. The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

Course Lecture Notes:
Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Sexualized Violence Prevention and Response at Uvic:

UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting www.uvic.ca/svp. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support, please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out:

    Where: Sexualized violence resource office in EQHR; Sedgewick C119
    Phone: 250.721.8021
    Email: svpcoordinator@uvic.ca
    Web: www.uvic.ca/svp

Office of the Ombudsperson:
The Office of the Ombudsperson is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations. Phone: 250-721-8357; Email: ombuddy@uvic.ca, Website: https://uvicombudsperson.ca/