Syllabus: MSCS 6060 – Parallel and Distributed Systems
(Spring 2021)

Course Instructor	Dr. Satish Puri
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Office Hours	Tuesday 2 PM – 3 PM Thursday 11 AM – 12 Noon and by appointment through e-mail Virtual meeting only for office hours using Teams (Office Hours Spring 2021)
Course Details	Class meets: Mon & Wed 5 pm- 6:15pm in CU 417
Course Web Page	D2L
Course Text	Introduction to Parallel Computing, (Second Edition) Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar. Addison-Wesley, 2003. ISBN 0-201-64865-2. *Online book through MU library* http://0-proquest.safaribooksonline.com.libus.csd.mu.edu/book/-/0201648652 Peter Pacheco, Introduction to Parallel Programming. Programming Massively Parallel Processors (GPU book), 3rd Edition David Kirk and Wen-mei Hwu Learning Spark lightening fast data analysis, by Holden Karau et al, O'Reilly Additional course material and references will be provided in D2L
Prerequisites:	COSC 3100 – Data Structures and Algorithms 2 or equivalent course

Topics to be covered:
Parallel and distributed architectures, distributed and parallel algorithms, fundamental problems in parallel and distributed computing, and basic structures and services in parallel and distributed systems, Graphics Processing Unit (GPU).

Learning Outcomes: Upon completion of this course, the student will:

1. Understand parallel and distributed computing basics including the concepts, architecture, and algorithms.
2. Understand message passing and shared memory parallel programming paradigms and write parallel programs using these paradigms.
3. Understand parallel computing techniques to handle big data.
4. Study emerging architectures, new challenges, and hot research topics in parallel and distributed computing.

Grading Basis:
Midterm Exam: 20%; Programming/Written Assignments: 40%; Survey Paper/Research Project and Presentation: 20%; and Final Exam: 20%

The final grades will be based on:

95 – 100	A	89 - 94	A-		
84 – 88	B+	78 – 83	B	73 - 77	B-
67 - 72	C+	62 – 66	C	56 - 61	C-
51 - 55	D+	45 – 50	D	0 – 44	F

Computing Environments

Programs will be developed and executed in Linux environment. SSH will be used to remotely access the parallel computers and systems. Programs will be primarily written in C or C++. Students are strongly encouraged to review basic Linux commands, C or C++ programming language, and SSH (secure shell) at the very beginning of the semester to get prepared for programming assignments.

Servers to be used: **everest.mscsnet.mu.edu (36 multi-core CPUs and 3 NVidia GPU)**
pere.marquette.edu (1024 CPU cores)
Students are required to get accounts on Everest server.

Programming Assignments, Term Projects, and Exams

Students are allowed to submit homework and project/survey in a group of two. The term project consists of a proposal, implementation, an in-class presentation, and a final report. The term project can be a literature survey. In the case of a survey, code submission is not required. The project will be graded by submitted code/documents and project report.

Course Policies

1. Students are responsible for all material presented in lecture.

2. Exam coverage and topics will be notified well before the time of the exam. Exams must be taken on the hour they are scheduled, unless there are special scenarios.

3. Late Assignments: 25% penalty for up to 5 working days late. Points will not be given to submissions late by more than 5 working days. Late assignments shall not be accepted once the solutions are discussed or posted on course page.

4. In Class Exercises will be assigned from time to time during the class lecture. It is expected that students actively participate working on the problems.

5. All work submitted for grading must be the student's own work. Plagiarism will result in a score of zero on the exam or assignment, and/or dismissal from the course.

6. Attending lectures is vital to success in this class. If you cannot meet in-person due to COVID-19 restrictions, online engagement may be an appropriate alternative. Though I cannot guarantee that every requested adjustment will be possible, due to the challenges we face with the COVID-19 pandemic, I will adapt and adjust to your situation to the greatest extent possible.

7. Guidance for COVID-19 scenarios:
    - Confirmed COVID-19 diagnosis and in isolation: student must not attend class, but is expected to participate in all assignments to the extent possible based on severity of symptoms. Students are expected to inform instructor of quarantine or isolation dates and to communicate regularly about their ability to participate during that time. Medical documentation is NOT required for return to the classroom. Students are to contact Office of Disability Services in the event they are not able to

participate in coursework due to COVID-19 or symptoms of COVID-19 to explore if a reasonable accommodation can be afforded.
    - Symptomatic in isolation and needs testing or awaiting results: student must not attend class, but is expected to participate in all assignments to the extent possible based on severity of symptoms and seek out COVID-19 test through the Marquette University Medical Clinic [414-288-7184]. Same guidance as above for documentation and accommodation.
    - Confirmed COVID-19 exposure and in quarantine: Student must not attend class but is expected to participate in all assignments. Should symptoms develop students should seek out COVID-19 testing through the Marquette University Medical Clinic [414-288-7184]. Same guidance as above for documentation and accommodations.
    - For all isolation or quarantine: Student is expected to contact the instructor to indicate student's inability to participate in face-to-face experiences.
8. Any course related communication will be made to the student's official Marquette email address. It is the responsibility of the student to check his/her emails.

Topics to be covered

1) Grama et al., Introduction to Parallel Computing
   Book Chapters 1, 2, 3, 5, 4
2) Peter Pacheco, Introduction to Parallel Programming
   Book Chapters – Ch 1 Intro, Ch 2 Parallel Hardware, Ch 3 MPI, Ch 5 OpenMP
3) Holden Karau et al., Learning Spark (Book Chapters 1 to 4)
4) Shared-memory programming
   Java Threads, OpenMP and OpenACC compiler directives
   GPU book (Chapter 1 to 5)
5) Distributed-memory programming
   Message passing interface (MPI), MapReduce
6) Reading Research papers on Big data computing platforms like Hadoop, distributed filesystems and Spark.

Special Statement on COVID-19

Marquette University recognizes that this is a difficult time which may be filled with uncertainty as we move forward with the academic year. Your safety, health, and well-being, as well as that of our faculty and staff are our primary concern and we want to be able to support you in any way that we can. We have expectations that you act responsibly in order to mitigate risk to others.

Wearing Masks in Classrooms is mandated. Marquette requires all students, faculty, and staff to wear face masks or cloth face coverings in classrooms. We require the wearing of masks covering the nose and mouth in all physical classrooms to help mitigate the transmission of COVID-19. If you do not adhere to this practice you will be asked to leave the room. Facemasks are not a substitute for social distancing.

NOTE: This syllabus represents a general plan for the course and deviations from this plan may be necessary during the duration of the course.