

Midwestern State University  
Department of Computer Science  
Spring 2020

### **Course Information**

Course syllabus: Topics in Platform-Based Development: Parallel Distributed Computing- GPU Programming.

Course number: CMPS 4563

Class hours: 3:30 pm to 4:50 am, Monday, Wednesday and Fridays.

Class room: Bolin 127.

### **Instructor Information**

Instructor's Name: Doctor Eduardo Colmenares.

Instructor's office: Bolin Hall, office 126C.

Instructor's email: [eduardo.colmenares@msutexas.edu](mailto:eduardo.colmenares@msutexas.edu)

### **Course Description**

A practical introduction to the principles of parallel computing, parallel algorithm development and analysis, as well as, design, implementation, and evaluation of parallel programs by using and targeting and adequate balance between multicore CPU's and many-core Graphics Processing Units (GPU's).

### **Course Prerequisites**

Minimum grade of C in Data Structures and Computer Architecture.

### **Textbook**

Is the textbook required? The answer is yes.

Textbook name: Programming Massively Parallel Processors. A hands-on Approach

Textbook edition: Third edition.

Textbook Author: Kirk and Hwu.

### **Required Software**

Winscp

Putty

### **Student Resources:**

- CS-HPC Turing Cluster.
- Maverick, at Texas Advanced Computer Center (TACC)
  - Per Node:
  - Two 10-core Intel Xeon E5-2680 v2 "Ivy Bridge" CPUs (twenty total cores at 2.8GHz)
  - 256 GB RAM
  - NVIDIA Tesla K40 "Atlas" GPU with 12 GB G-RAM
  - Machine:
  - 132 nodes, 2560 total cores, 33.8 TB total RAM
  - Mellanox FDR InfiniBand interconnect

### **Evaluation Process Summary Table**

Category	Percentage
Attendance	5
Participation (Quizzes and In Class Activities (ICAs)	8
Homework (THH and ICH)	27
Project	20
Midterm	20
Final Exam	20

### **Grading Policy**

89 to 100 points is an A.

79 to 88.99 points is a B.

69 to 78.99 points is a C.

59 to 68.99 points is a D.

0 to 58.99 points is an F.

### **Attendance**

Attendance is a component of the course grade (five percent). Each student will have one unexcused absence. Each student will begin with 100 points for their attendance grade. For each additional unexcused absence, 25 points will be subtracted from the attendance grade. Please let your instructor know if you are going to miss a class for academically related extracurricular activities. If this is the case you must present the sponsoring university member's written justification before your absence occurs. At the beginning of class your professor will go over the class roster, if you are not in the classroom when your name is called you will receive an absence. The Attendance grade is 100% under your control.

### **Tests**

Tests are comprehensive in nature. No make-up exams will be given, except for the following cases:

1. Surgery, Medical Emergency, Death in the family, Presentation at a Conference, some others as determined by the instructor.
  - a. If you miss an exam, you will receive a permanent zero unless you notify the instructor and demonstrate with the proper official documentation that an emergency that you could not circumvent existed. This documentation must be presented not later than 24 hours after the test.
  - b. Students who miss an exam due to University business should notify the instructor in advance, and present the sponsoring university member's written justification.

If you do miss an exam and you fall in one of the categories above, this means that you have a properly documented case. Your instructor will proceed to assign a temporary grade of zero which will be substituted for your excused test grade (Final Exam). However, this substitution can only be performed once during the semester. Exams are uniquely composed for each term.

## Final Exam

There is no make-up final exam. The final exam will take place in our regular classroom. It is the student's responsibility to keep track of the designated date, time. A complete list of all MSU exams (by time) can be found at [Final Exam Schedule](#).

Final exam date is Monday May 11, 2020, from 5:45pm to 7:45pm, in our regular classroom.

## Policy on Testing Process

The Department of Computer Science has adopted the following policy related to testing.

- a) All bags, purses, electronics (turned off), books, etc. will be placed in the front of the room during exams, or in an area designated by the instructor.
- b) Unless otherwise announced by the instructor, nothing is allowed on the desk but pen/pencil/eraser and test papers.
- c) You are not allowed to leave the classroom. Please take this seriously and into consideration before any test and the final. Prepare yourself to be in the classroom during the entire exam.
- d) If you decide to leave the classroom during a test and/or the final exam, your exam will be collected, and you will not be allowed to continue.

## Homework

- THH: Take Home Homeworks (Regular Homeworks)
- ICH: In Class Homeworks (These will be announced with plenty of time, so that the student can prepare for them. The instructor will announce what material can be used during the homework)
- Some assignments may be individual and some team assignments. It is OK (and encouraged) for you to work with each other ONLY to verbally discuss concepts associated with your assignments, such discussion must be at a very high level (superficial). However, any write up that you turn in, including any code, must be your own original production.
- Sharing partial or full code, working in pairs or groups, copying code from the web will be considered plagiarism and will lead to a grade of zero. For more information see (Ethical Conduct – Page 3).
- Submitted work is due when specified, as specified (format) by the instructor. It is in the student's best interest to keep track of all deadlines.
- The instructor is not required to remind students of ANY date and/or deadline associated with tests, homework, reports, project assignment, etc.
- Assignments submitted to the instructor's email will be considered invalid and deleted. Even if submitted before the deadline.
- Students must be prepared to talk/explain/defend their homework during class time

## Late Policy & Deadlines

- Submitted work is due when specified, as specified (format) by the instructor. It is in the student's best interest to keep track of all deadlines.
- The instructor is not required to remind students of ANY date and/or deadline associated with tests, homework, reports, project assignment, etc.
- Assignments submitted to the instructor's email will be considered invalid, even if submitted before the deadline. Assignments MUST be submitted to the corresponding dropbox via D2L
- Late assignments will NOT be accepted.
- Very Important: Before you submit any file, take your time and double OR triple check that
  - a. You are uploading the correct and ALL necessary files

- b. Your work is correct at the best of your abilities
- c. Failure to fulfill (a) and (b) ON TIME, WILL NOT excuse you from a bad grade.

### **What does it mean to be late?**

Imagine that your assignment is due today at 8:00 am. If you deliver your assignment by 8:00:01 am (1 sec late) then it will be marked as “late submission”.

### **VERY – VERY IMPORTANT**

Before you submit any file, take your time and double OR triple check the following:

- a) You are uploading the correct AND all files
- b) Your work is correct at the best of your abilities
- c) Failure to fulfill (1) and (2) ON TIME, DOES NOT excuse you from a bad grade.

The previous rule will be strongly enforced.

If you know you will be absent ahead of time, let the instructor know, and turn your assignment in early if possible. It is the student’s responsibility to keep track of the designated date, time.

### **Additional Grade Policy**

Once the grades, have been either returned to the students, or published via D2L, the student will have one week to examine them and check for inconsistencies, errors, etc. After the one week window of opportunity all grades will become PERMANENT and WILL NOT change. It is not only the student’s responsibility to check the accuracy of his/her grades, but also in his/her best interest to do it.

This rule DOES NOT apply to the final exam because the final is exam triple checked by the instructor before publishing the grade.

### **Important Information about our grading policy**

The instructor reserves the right to adjust the grade distributions for the whole class. What does it mean? It means that grade distributions will not be adjusted on an individual basis.

### **Policy on Testing Process**

The Department of Computer Science has adopted the following policy related to testing.

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2. Unless otherwise announced by the instructor, nothing is allowed on the desk but pen/pencil/eraser and test papers.
3. No student is allowed to leave the room during an exam and return. Be prepared to remain in the classroom for the entire duration of the test.

### **Laptop Policy**

For this class, you are not required to buy a laptop. However, if the instructor announces an ICH (In Class Homework) or ICA (In Class Activity), you are responsible for:

- a. Bringing a laptop with all necessary programs properly installed, configured and tested.
- b. Bringing the laptop’s charger: If you do not bring your charger and cannot complete the assignment(s) because your battery died, then your grade will not be a good one.

- c. Make sure that you have a fully working and in-classroom tested Wi-Fi capabilities. If you cannot submit your homework because your Wi-Fi does not work, then your grade will not be a good one.

### **Excusing Late Work**

Any document used to excuse the late delivery of an assignment **MUST** be presented no longer than one week from the corresponding missed deadline. Valid excuses (Surgery, Medical Emergency, Death in the family, and Presentation at a Conference). Failure to fulfill this requirement will make null the excuse, leading to a permanent grade of zero in the corresponding assignment.

### **Additional Grade Policy**

Once the grades, have been either returned to the students, or published via D2L, the student will have 48 hours to examine them, and check for inconsistencies, errors, etc. After the 48 hour window of opportunity all grades will become **PERMANENT** and **WILL NOT** change. It is not only the student's responsibility to check the accuracy of his/her grades, but also in his/her best interest to do it.

This rule **DOES NOT** apply to the final exam because the final exam is triple checked by the instructor before publishing the grade.

### **Departmental Cheating Policy and Ethical Conduct**

#### **Policy on Academic Honesty**

The Department of Computer Science had adopted the following policy related to cheating (academic misconduct). The policy will be applied to all instances of cheating on assignments and exams as determined by the instructor of the course.

- 1st instance of cheating in a course: The student will be assigned a non-replaceable grade of zero for the assignment, project or exam. In addition, the student will receive a one letter grade reduction in course.
- 2nd instance of cheating in a course: The student will receive a grade of F in course & immediately be removed from course.
- All instances of cheating will be reported to the Department Chair and, in the case of graduate students, to the Department Graduate Coordinator.

### **Departmental Cheating Policy (enforced) | Ethical Conduct Policy on Academic Honesty**

The Department of Computer Science had adopted the following policy related to cheating (academic misconduct). The policy will be applied to all instances of cheating on assignments and exams as determined by the instructor of the course.

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- All instances of cheating will be reported to the Department Chair and, in the case of graduate students, to the Department Graduate Coordinator.

### **RECORDING OF CLASS LECTURES**

Permission must be requested in writing & obtained from the instructor before recording of class lectures. If permission is granted, the recording may only be used by the student making the recording. Recordings may **NOT** be posted on any internet source without written

permission of the instructor. Failure to adhere to the policy may result in removal from the course with a grade of F or other appropriate punishment.

### **Classroom Civility**

All violations of classroom civility will be reported to the Dean of Students.

Students are expected to assist in maintaining a classroom environment that is conducive to learning. In order to ensure that all students gain from time spent in class, students are prohibited from engaging in any form of distraction, e.g. leaving the room for extended periods of time, reading newspapers (or other articles), working on other courses, and using cell-phones or laptops for calls or messages. If you indulge in any such inappropriate behavior (without explicit consent of the instructor), you will (at the very least) be asked to leave the classroom. [MSU Dean of Students Website](#).

### **Student with Disabilities**

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from disability support office during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Disability Support Office has been provided. For additional information you may contact the Disability Support Office in Clark Student Center 168 - Phone: (940) 397-4140.

[Disability Support Services](#).

### **Dean of Students**

The Dean of Students can assist in notifying the campus community of student illnesses, immediate family deaths and/or student death. Generally, in cases of student illness or immediate family deaths, the notification to the appropriate campus community members occur when a student is absent from class for four consecutive days with appropriate verification. It is the student's responsibility for missed class assignments and/or course work during their absence. [MSU Dean of Students Website](#).

### **University's Campus Carry**

Senate Bill 11 passed by the 84th Texas Legislature allows licensed handgun holders to carry concealed handguns on campus, effective August 1, 2016. Areas excluded from concealed carry are appropriately marked, in accordance with state law. For more information regarding campus carry, please refer to the University's webpage at [Campus Carry](#).

## **Tentative Agenda**

We will try to respect this agenda as much as possible, however it is possible that some topics will require more, or less time to cover them, which may lead to changes. Students will be informed about those changes in class. The instructor reserves the right to modify, add, remove, update the proposed agenda.

- a) Syllabus, TACC, Turing, accounts, Why Parallel Computing is important, Virtual Machine, General Ideas
- b) Chapter 1-2: - Introduction, GPU History
- c) C Reinforcement: - Basic C, Functions in C, Arrays, Pointers, Bitwise operations (in C)
- d) Data structures, Dynamic memory allocation, Linked Lists
- e) Project Documentation: Doxygen
- f) Project Management: Make files
- g) Parallel Concepts: Speedup, Efficiency, etc, + Performance Analysis. Fast Fourier Transform (FFT)
- h) Chapter 3: - Introduction To Data Parallelism and CUDA C
- i) Chapter 4: - Data Parallel Execution Model
- j) Chapter 5: - CUDA Memories
- k) Chapter 5: - CUDA Memories
- l) Chapter 6: - Performance Considerations
- m) Chapter 7: Floating Point Format
- n) Chapter 13: - Parallel Programming and Computational Thinking
- o) Chapter 8: - Parallel Patterns, Convolution
- p) Introduction to Distributed Memory Programming with MPI - Point to Point Comm. (Blocking and Non-Blocking)
- q) In Class Project Presentation (3 groups – 20 min each group)
- r) In Class Project Presentation (3 groups – 20 min each group)

NTASC Conference Presentation (TBD)