CS 4379 Parallel and Concurrent Programming
Spring 2013, Course Syllabus and Policy Statement

Faculty Information
Instructor: Yu Zhuang, Office: 306E Engineering Center
Email: yu.zhuang@ttu.edu, Phone: 742-3527
Office Hours: 4:05-4:35 pm Wednesday, 3:20-4:35 Thursday, noon-12:50 pm Friday

Basic Course Information
Class: 11:00 -12:20 T Th, 205 Engineering Center
TA: Yin Lu, yin.lu@ttu.edu
Prerequisites: C, algorithm (CS 3364), architecture (CS 3375), some knowledge of system.
● NVIDIA CUDA C Programming Guide
Equipment required in class: a laptop that allows remote login to HPCC machines

Course Objectives: The goal of the course is to provide a basic training of programming for modern parallel computing systems for capturing the performance delivered by the multiplicity of computing units. This is a programming intensive course in which students learn major parallel programming theories, algorithms, and techniques that influence parallel computing performances through with a sequence of programming assignments. Application programming interfaces for shared/distributed memory systems will be used for instruction.

Learning Outcomes
• Possess basic skills of parallel programming with programming paradigms that has implementation on major forms of parallel architectures, addressing BS learning outcomes 1, 2, and 3 (a,b,f).
• Understand and master major considerations in parallelization and parallel algorithm design, addressing BS learning outcomes 1, 2, and 3 (a,b,f).
• Understand the basics of parallel algorithm performance metrics for better parallel algorithm design skills, addressing BS learning outcomes 1, 2, and 3 (a,b,f).

Outline of Topics
• A general architecture-independent programming paradigm and its programming API
  – The programming paradigm and API basics.
  – Point(processor)-to-point (processor) data transfer, blocking and nonblocking data transfer; send and receive operations, message envelope, data types.
  – Collective Communications: one-to-all broadcast, one-to-all scatter, all-to-one reduction, all-to-one gather, all-to-all gather-scatter/reduce-scatter.
  – Group and Communicator Management: accessors, constructors, destructors.
• Parallelization and Performance Analysis of Parallel Algorithms for Message-passing paradigm
  – Parallel computing overhead, granularity, speedup, efficiency, scalability,
  – models for communication cost estimation and evaluations
  – Examples of parallel algorithms

• Shared-memory parallel programming, GPU programming
  – Shared-address space parallel programming, fine-granularity creation
  – GPU programming
  – Examples of parallel algorithms

Outline of Course flow (tentative)

Jan 17  course overview, assignment 1 (2 %)
Jan 22  intro to  programming paradigms for distributed/shared memory machines, intro to
  message-passing paradigm, MPI, assignment 2 (programming, 3 %)
Jan 24  point-to-point communications, assignment 3 (programming, 10 %)
Jan 29  point-to-point communications,
Jan 31  collective communication, project 1 (15%)
Feb  5  collective communications, discussion of assignment 3
Feb  7  group and communicator management, discussion/grading of project 1
Feb 12  group and communicator management, discussion/grading of project 1
Feb 14 parallelization of algorithms , project 2 (15%)
Feb 19 parallelization of algorithms
Feb 21 Performance Analysis, discussion of project 2
Feb 26 Performance Analysis,
Feb 28 discussion/grading of project 2
Mar  5 discussion/grading of project 2
Mar  7 performance considerations in parallelization, project 3 (15%)
Mar 19 performance considerations in parallelization
Mar 21 discussion of project 3
Mar 26 discussion/grading of project 3
Mar 28 discussion/grading of project 3
Apr  2  load-balance, project 4 (15%)
Apr  4  discussion of project 4, Assignment 4 (5%)
Apr  9  discussion/grading of project 4
Apr 11 discussion/grading of project 4
Apr 16 Project 5 (20%), discussion of project 5
Apr 18 Intro to GPU/CUDA programming
Apr 23 Intro to GPU/CUDA programming
Apr 25 Intro to GPU/CUDA programming
Apr 30 CUDA programming, discussion of project 5
May  2  discussion/grading of project 5
May  7  discussion/grading of project 5
Methods of Assessment of Learning Outcomes and Grade Criteria

- 3 assignments (addressing all L.O.'s) --------------------------------------------- 20 %
- 5 programming projects (addressing all L.O. s) -------------------------------- 80 %

A: 90 – 100;  B: 80 – 89;  C: 70 – 79;  D: 60 – 69;  F: below 60.

Academic Conduct: Policy of the Department and the University will be followed. All work done in this course should conform to the Statement of Academic Conduct for Engineering Students, College of Engineering, Texas Tech University.

Attendance Policy:
- You are expected to be present for each class session.
- If you are absent, it is your responsibility to obtain class notes and handouts (if any) from your classmates; I will not necessarily keep extra copies of materials after they are initially distributed;
- There are no makeup exams or tests for unexcused absences.
- Absence due to religious observance - The Texas Tech University Catalog states that a student who is absent from classes for the observance of a religious holy day will be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. Notification must be made in writing and delivered in person no later than the 15th class day of the semester.
- Whether an absence is excused or unexcused is determined solely by the instructor with the exception of absences due to religious observance and officially approved trips. The Center for Campus Life will notify faculty, at the student’s request, when a student is absent for four consecutive days with appropriate verification of a health related emergency. This notification does not excuse the student from class, it is provided as a courtesy. The service is explained as follows and can be found on the Center for Campus Life web site at: http://www.campuslife.ttu.edu/crisis/

Illness and Death Notification: The Center for Campus Life is responsible for 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 (4) consecutive days with appropriate verification. It is always the student’s responsibility for missed class assignments and/or course work during their absence. The student is encouraged to contact the faculty member immediately regarding the absences and to provide verification afterwards. The notification from the Center for Campus Life does not excuse a student from class, assignments, and/or any other course requirements. The notification is provided as a courtesy.

Academic Integrity
“It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension.”
“Scholastic dishonesty” includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment for two courses without the prior permission of the instructor) or the attempt to commit such an act.

“Cheating” includes, but is not limited to, the following:
1. Copying from another student’s test paper.
2. Using materials during a test that have not been authorized by the person giving the test.
3. Failing to comply with instructions given by the person administering the test.
4. Possessing materials during a test that are not authorized by the person giving the test, such as class notes or specifically designed “crib notes.” The presence of textbooks constitutes a violation only if they have been specifically prohibited by the person administering the test.
5. Using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program.
6. Collaborating with or seeking aid or receiving assistance from another student or individual during a test or in conjunction with an assignment without authority.
7. Discussing the contents of an examination with another student who will take the examination.
8. Divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructor has designated that the examination is not to be removed from the examination room or not to be returned to or kept by the student.
9. Substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course related assignment.
10. Paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program, or information about an un-administered test, test key, homework solution, or computer program.
11. Falsifying research data, laboratory reports, and/or other academic work offered for credit.
12. Taking, keeping, misplacing, or damaging the property of the university, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct.

“Plagiarism” includes, but is not limited to, the appropriation of, buying, receiving as a gift, or obtaining by any means material that is attributable in whole or in part to another source, including words, ideas, illustrations, structure, computer code, other expression and media, and presenting that material as one’s own academic work being offered for credit. Any student who fails to give credit for quotations or for an essentially identical expression of material taken from books, encyclopedias, magazines, Internet documents, reference works or from the themes, reports, or other writings of a fellow student is guilty of plagiarism.

“Collusion” includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

**Civility in the Classroom**

Students are expected to assist in maintaining a classroom environment that is conducive to learning. To ensure that all students have the opportunity to gain from time spent in class,
faculty members are encouraged to include a statement in their course syllabi relating to behavioral expectations in the classroom.

**Students with Disabilities**

**ADA Statement:**
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 Student Disability Services during the instructor’s office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.

**Ombudsman for Students**
The Ombudsman for Students is available to assist students with any conflict or problem that has to do with being a student at Texas Tech University. You may visit the Ombudsman in 237 Student Union Building or call 742-4791.

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**Statement of Academic Conduct for Engineering Students**
**College of Engineering, Texas Tech University**

**Preamble**
The College's primary goal is to educate students to fill leadership roles as professionals aware of technology and its economic and political role in the world. Therefore, we strive to produce technically competent graduates who solve problems, are able to communicate and work well with others; are sensitive to the needs of society; are well-educated in the humanities as well as in the engineering disciplines, and maintain a high-level of ethical and professional conduct.

**Policy**
The College of Engineering fully subscribes to the Code of Student Conduct as published in the Texas Tech University's "Student Affairs Handbook." The Handbook states the following: "The University is strongly committed to upholding standards of academic integrity. These standards require that students never present the work of others as their own. Any student found to have committed the following academic misconduct is subject to the disciplinary sanctions outlined in Part IX, Section D "Disciplinary Sanctions":

1. **Cheating**
   This violation includes, but is not limited to: (1) use of any unauthorized assistance or assisting others in taking quizzes, tests, or examinations; (2) dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignment(s); (3) the acquisition, without permission, of tests or other academic material belonging to a member of the University faculty or staff; (4) alteration of grade records; (5) bribing or attempting to bribe a faculty member to alter a grade.

2. **Plagiarism**
   This violation includes, but is not limited to, the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgment. It also
included the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

3. Instructor Responsibilities
The instructor in a course is responsible for initiating action in cases where there is an admitted act or convincing evidence of academic misconduct. Before taking such action, the instructor should attempt to discuss the matter with the student(s). If the suspected misconduct involved a final exam, the instructor should submit a grade of X until a reasonable attempt can be made to contact the student(s), after the end of the semester.

4. Instructor Sanctions
If academic misconduct is determined by the instructor, a failing grade shall be assigned to either the assignment in question or to the course grade. When a student is given a failing grade in a course as a result of academic misconduct, the instructor shall report in writing to the instructor's department chairperson the facts of the case and the action to be taken against the student. The chairperson shall provide a copy to the student, to his or her Academic Dean and to the Dean of Students Office.

5. Grade Appeal Procedure
The Grade Appeal Procedure (Part V, Section A) may be used to appeal a failing course grade, but not a failing grade given for a class assignment. The disciplinary penalty or grade of F shall not be implemented until the disciplinary procedures or grade appeal process has been exhausted. A student may continue the academic class and course work until a final decision is made.

6. Repeated Academic Dishonesty
In cases of repeated violations, either the instructor (through his or her department chairperson and/or Academic Dean's Office) or the Academic Dean may refer the case to the Dean of Students Office for further disciplinary action.