CSCE 4160/5160: Parallel Programming, Processing, and Algorithms

General Information

Instructor: Tong Shu
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Office: Discovery Park NTDP F277
Office hours: 2:30 PM - 4:30 PM on Mondays
Final exam: 10:00 AM - 12:00 PM on Monday, May 4th, 2026

Course Description

Introduction to processing in parallel and distributed computing environments. General concepts of parallel machine models, processes, threads, mutual exclusion, synchronization and message passing. Design and analysis of parallel algorithms for engineering and scientific applications. Parallel programming using message passing and shared memory paradigms.
Taxonomy of parallel computers; shared-memory vs. message-passing architectures; theoretical models; parallel algorithm design strategies; parallel data structures; automatic parallelization of sequential programs; communication; synchronization and granularity.

ABET Course Outcomes (CSCE 4160)

The CSCE 4160 course will be evaluated regarding ABET. Here are the ABET outcomes:

1) Understand parallel machine models, processes, threads, mutual exclusion, and synchronization.
2) Design and analyze parallel algorithms.
3) Understand parallel programming using the message passing paradigm.
4) Understand parallel programming using the shared memory paradigm.

Prerequisite

Students planning to enroll in this course should have taken all the courses CSCE 2100 - "Foundations of Computing" with C (or better), CSCE 2110 - "Foundations of Data Structures" with a C (or better), and CSCE 3600 - "Principles of Systems Programming" with a C (or better) for CSCE 4160, or the course "CSCE 5150 - Analysis of Computer Algorithms" for CSCE 5160. Meanwhile, C/C++ programming will be helpful for this course.

Recommended Supplemental Books

1) Wen-mei W. Hwu, David B. Kirk, and Izzat El Hajj. Programming Massively Parallel Processors: A Hands-on Approach (4th Edition), Morgan Kaufmann, 2022, ISBN: 978-0323912310
2) Michael A. Nielsen and Isaac L. Chuang. Quantum Computation and Quantum Information (10th Anniversary Edition). Cambridge University Press, 2011, ISBN: 978-1107002173

Course Syllabus

- Fundamental quantum concepts and quantum computation

- Fundamental heterogeneous parallel computing and programming concepts: processes, threads, and synchronization
- CUDA programming on tensor cores in a GPU
- Message passing: NCCL programming across GPUs
- Shared memory: NVSHMEM programming across GPU nodes
- GPU profiling: NVIDIA Nsight Systems and Nsight Compute

This syllabus is subject to change based on the needs of the class.

Evaluation

Grading components:

Quizzes (individual)	10%
In-class activities and questionnaires (individual)	5%
Homework (individual)	20%
Project (teamwork)	30%
Final exam (individual)	35%

Grading scale for undergraduate students (based on 100 points):

Grade	Score
A	90 – 100
B	80 – 89
C	70 – 79
D	60 – 69
F	59 and below

In-class activities:

Students are expected and encouraged to attend classes. Students will be responsible for any missing class activities (such as quizzes, in-class assignments, etc.) or announcements. The absence reason could be anything including university-sponsored events. Also, the student's absence does not change the due date of any assignment.

Late Policy:

Students are expected to complete work on schedule. Late work within 24 hours can only have 80% credit for delay penalty. Late work beyond 24 hours is not accepted with any excuse. For multiple submissions with partial delay, 80% credit is only applied to the delayed portion.

Academic Integrity and Student Conduct

Please refer to https://engineering.unt.edu/cse/students/resources/academic-integrity.html

Unless explicitly noted, all work is to be done on an individual basis. Any violation of the university's guidelines for academic integrity will result in no credit for the course and further disciplinary action. More can be found about UNT policy in https://policy.unt.edu/sites/policy.unt.edu/files/06.003%20Student%20Academic%20Integrity.pdf

Plagiarism or cheating behavior in any form is unethical and detrimental to proper education and will not be tolerated. All work submitted by a student (projects, programming assignments, lab assignments, quizzes, tests, etc.) is expected to be a student's own work. The plagiarism is incurred when any part of anybody else's work is passed as your own (no proper credit is listed to the sources in your own work) so the reader is led to believe it is therefore your own effort. Students are allowed and encouraged to discuss with each other and look up resources in the literature (including the internet) on their assignments, but appropriate references must be included for the materials consulted, and appropriate citations made when the material is taken verbatim.

This course follows the Department of Computer Science and Engineering Cheating Policy. If plagiarism or cheating occurs, the student will receive a failing grade on the assignment and (at the instructor's discretion) a failing grade in the course. Specifically, students caught cheating or plagiarizing will receive a "0" for that particular assignment or exam for the first offense. Additionally, the incident may be reported to the Dean of Students, who may impose a further penalty. The second instance of cheating in this class will result in a grade of F in the class, and referral to the Department Chairperson and Dean of Engineering, whereby a dismissal hearing may be initiated by the Dean of Engineering.

Individual assignments, including laboratory exercises and programming assignments, in this course, must be the sole work of the individual student. You should not work with other students on shared program solutions or use solutions found on the Internet. Specifically, you should never copy someone else's solution or code, and never let a classmate examine your code. If you are having trouble with an assignment, please consult with your instructor or TA/IA assigned to this course. Failure to adhere to these strict standards may be cause for disciplinary action even leading to expulsion from the University.

Students are responsible for being familiar with the university standard for academic integrity. In the case that the above description or any in-class discussion of appropriate and inappropriate collaboration does not answer all of your questions, please meet with your instructor and look at the university Student Rights and Responsibilities web page.

Use of AI for the assignments

Based on the Student Academic Integrity Policy (UNT Policy 6.003) and AI, Plagiarism, and Academic Integrity at UNT Policy (https://guides.library.unt.edu/plagiarism/at-unt), any form of "unauthorized assistance" constitutes cheating. If the use of AI is not explicitly requested/

authorized in a question, the violation is “cheating”. Therefore, the use of AI in assignments are NOT welcomed unless it is asked in the question. Such a cheating can result in the failure of the class (F) as follows: i) The assignments will be evaluated using AI detection tools, e.g., Turnitin. ii) If a submission exceeds the soft threshold (i.e., 10% similarity), a deduction of two times the similarity will be applied (e.g., if you have a similarity of 11%, 2 x 11% = 22% deduction for that assignment will occur). iii) If a submission exceeds the hard threshold (i.e., 25% similarity), the assignment will be graded as 0 (zero). iv) For the second time exceeding the hard threshold, the student will automatically get an F (fail) from the class and may be reported to the university. v) Similarities in exams and the project will not be tolerated. For the project, if the similarity exceeds the hard threshold, the entire group will receive a zero (even if it is the first time).

Student Perceptions of Teaching (SPOT)

Student feedback is an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The SPOT survey will be made available at the end of the semester to provide you with an opportunity to evaluate how this course is taught. For the 2026 spring semester you will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Please look for the email in your UNT email inbox. Simply click on the link and complete your survey. Once you complete the survey you will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website at www.vpaa.unt.edu/spot or email spot@unt.edu .

ADA Accommodation

The University of North Texas makes reasonable accommodation for students with disabilities. Students needing a reasonable academic accommodations must first register with the Office of Disability Access (ODA) to verify their eligibility. If a disability is verified, the student will request their letter of accommodation. ODA will provide faculty with a reasonable accommodation letter via email to begin a private discussion regarding a student’s specific needs in a course. Students may request reasonable accommodations at any time, however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to meet with faculty regarding their accommodations during office hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information, refer to the Office of Disability Access website.