

Texas Tech University
Department of Computer Science

Course Name: Computer Systems Organization and Architecture
Number: CS 5375-001/-D01 Semester: Fall 2022

Instructor Name: Yong Chen, Office: EC-315/On Microsoft Teams, E-mail: yong.chen@ttu.edu
Instructor's Office Hour: 9:30 – 10:30 a.m. on Tue. and Thur.
TA Name: TBA, Office: TBA, E-mail: TBA
TA Office Hours: TBA

If you write me an email for this class, please start the email subject with [CS5375].

If Texas Tech University campus operations are required to change because of health concerns related to the COVID-19 pandemic, it is possible that this course will move to a fully online delivery format. Should that be necessary, students will need to have access to a webcam and microphone for remote delivery of the class and additional information will be communicated later.

Catalogue Listing: Introduction to the architecture, organization, and design of computer systems. Topics include processor, control and memory design, computer arithmetic, I/O, and a brief introduction to multiprocessors.

Texts: “Computer Architecture: A Quantitative Approach (The Morgan Kaufmann Series in Computer Architecture and Design) 6th Edition, by John L. Hennessy and David A. Patterson
ISBN-10 0128119055
ISBN-13 978-0128119051

Course objectives:

The objective of this course is to introduce computer systems organization and architecture and cover topics including trends in computer architecture, memory hierarchy, instruction-level, data-level, and thread-level parallelism, multiprocessors, and warehouse-scale computers.

Key Topics:

Trends in computer architecture
Performance models
Memory hierarchy
Instruction-level parallelism
Data-level parallelism
Vector, SIMD, and GPU architectures
Thread-level parallelism
Multiprocessor systems and warehouse-scale computers
Parallel programming

Expected Prior Knowledge and Skills In: _data structures, computer architectures, algorithms, C/C++ programming, Linux operating system

Grading Policy: All submissions are graded according to the assignment guidelines, course policies, verbal instructions/explanations and materials given in class lectures.

- Written assignments – 30% (six written assignments, weighing 5% each)
- Programming projects – 30% (two programming projects, weighing 15% each)
- Exams – 40% (two exams, weighing 20% each)

Course letter grade assignments: A=[85, 100] AND Top 40%, B=[75, 85), C=[65, 75), D=[55, 65), F=[0, 55)

Course Schedule

Topics and/or dates may be changed during the semester at the instructor's discretion because of scheduling issues, developments in the discipline, or other contingencies.

| Week | Topic |
|---|--|
| W1 | Syllabus highlights, introduction, classes of computers |
| W2 | Defining computer architecture, trends in technology Trends in architecture, dependability |
| W3 | Performance models, quantitative analysis Memory technology, optimizations |
| W4 | Cache and performance optimizations Virtual memory |
| W5 | Cross-cutting issues, introduction to HPCC systems, project #1 Instruction-level parallelism concepts |
| W6 | Compiler techniques, branch prediction Data hazards, dynamic scheduling |
| W7 | Multiple issue, static scheduling Data-level parallelism, vector architecture |
| W8 | GPU architecture GPU programming |
| W9 | Midterm exam Loop-level parallelism, cross-cutting issues |
| W10 | Midterm exam review, open discussion Thread-level parallelism, shared-memory architectures |
| W11 | Distributed shared-memory, directory-based coherence Synchronization, memory consistency |
| W12 | Multicore processors and performance Warehouse-scale computers, workloads |
| W13 | Programming models for warehouse-scale computers Computer architecture of warehouse-scale computers |
| W14 | Efficiency and cost |
| W15 | Cloud computing concepts Review and open discussion |
| Final exam: Tuesday, December 13 th , 8 a.m. to 10:00 a.m. | |

Computer Usage: On-campus HPCC systems (<https://www.depts.ttu.edu/hpcc/operations/equipment.php>) will be used for programming and hands-on experience. Personal computers or the on-campus computer

labs should be used for accessing the server systems remotely for programming projects. Detailed information regarding the access will be announced later.

Ethical Conduct: Students are expected to comply with the Texas Tech Code of Student Conduct in all aspects of this class. The Code of Student Conduct may be found from the Student Handbook and/or Office of Student Conduct.

In order to assure that all students have the opportunity to gain from time spent in class, unless otherwise approved by the instructor, students are prohibited from engaging in any other form of distraction, such as reading newspapers, working on other classes, taking cell phone calls, text messaging, and working on laptop computers. Inappropriate behavior in the classroom shall result, minimally, in a request to leave class.

Violations of conduct including academic dishonesty, foul language, and classroom citizenship are eligible to be reported to Student Conduct Office.

Student with Disabilities: The university is committed to the principle that in no aspect of its programs, shall there be differences in the treatment of persons because of race, creed, national origin, age, sex, or disability and that equal opportunity and access to facilities shall be available to all. If you require special accommodations in order to participate, please contact the instructor during office hours or by e-mail yong.chen@ttu.edu. Students should present appropriate verification from Student Disability Services. No requirement exists that accommodations be made prior to completion of this approved university process.

Vaccinations: Texas Tech University strongly recommends students adhere to CDC guidelines on COVID-19, including obtaining COVID-19 vaccinations. If you were unable to obtain a vaccination prior to your arrival on campus, the COVID-19 vaccine is available at Student Health Services by appointment.

Face Covering Policy: As of May 19, 2021, face coverings are optional in TTU facilities and classrooms but, based on CDC guidelines, are recommended and welcome, especially for those who have not been vaccinated for COVID-19 or who may have susceptibilities to the virus. Face coverings are required in public transportation (e.g., Citibus) and in the Student Health Clinic.

Personal Hygiene: We all should continue to practice frequent hand washing, use hand sanitizers after touching high-touch points (e.g., door handles, shared keyboards, etc.), and cover faces when coughing or sneezing.

Potential Changes: The University will continue to monitor CDC, State, and TTU System guidelines in continuing to manage the campus implications of COVID-19. Any changes affecting class policies or delivery modality will be in accordance with those guidelines and announced as soon as possible. If Texas Tech University campus operations are required to change because of health concerns related to the COVID-19 pandemic, it is possible that this course will move to a fully online delivery format. Should that be necessary, students will be advised of technical and equipment requirements, such as web cam, microphone, and remote proctoring software.