

CSE 6324: Advanced Topics in Software Engineering
Fall 2016

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Office Hours: 9:30 – 11:00am, Tue and Thu

Section Information: CSE 6324 Section 001

Time and Place of Class Meetings: 12:30pm – 1:50pm, Tue and Thu, ERB 130

Description of Course Content:

Recent years have seen a proliferation of concurrent software systems. Allowing multiple threads and/or processes to execute simultaneously increases resource utilization and improves computing efficiency. However, concurrent software systems are inherently nondeterministic. As a result, it is notoriously difficult to build these systems and ensure their correctness.

The focus of this course is on the construction of concurrent software systems with high assurance. The topics covered by this course can be divided into two parts. The first part highlights basic concepts, principles, and techniques that are underlying the design, development, debugging, and testing of concurrent software systems. The second part provides an introduction to formal methods in modeling, specification and verification of concurrent software systems.

Student Learning Outcomes:

- A solid understanding about the basic concepts, principles, and techniques of concurrent programming.
- A solid understanding about a set of classic synchronization problems as well as their solutions.
- Ability to analyze, design, implement, and test concurrent code for solving common synchronization problems.

Requirements:

Basic understanding about software engineering and operating systems. Moderate proficiency in Java programming.

Required Textbooks and Other Course Materials:

Textbook:

Richard H. Carver and Kuo-Chung Tai, Modern Multithreading, John Wiley & Sons, 2005, ISBN: 0-471-72504-8

References:

Maurice Herlihy, *The Art of Multiprocessor Programming*, Morgan Kaufmann, 2012, ISBN: 978-0123973375.

Robin Milner, *Communication and Concurrency*, Prentice Hall, 1989, ISBN: 0-13-115007-3

Descriptions of major assignments and examinations:

There will be several (about 5) homework assignments, a midterm exam, and a programming project. In the programming project, you will apply the techniques covered in this course to build a software application that demonstrates a significant degree of concurrency.

Attendance: There will be two types of class meetings, including regular lectures (i.e., lectures given by the instructor), and project presentations. Attendance for regular lectures is strongly encouraged. Attendance for project presentations is required and will be factored into your project grades. *The instructor reserves the right to change this policy as needed.*

Grading:

Tentatively, the final grade will be determined according to the following percentages:

Homework Assignments - 20%

Midterm Exam - 50%

Project - 30%

Make-up Exams: No make-up exams will be given.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington (“University”) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.*

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as “lecture,” “seminar,” or “laboratory” shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition,

no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located to the east or west of ERB. The detailed evacuation map can be found at https://www.uta.edu/campus-ops/ehs/fire/Evac_Maps_All/Evac_ERB/Evac_ERB_130A.pdf. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

The IDEAS Center (2nd Floor of Central Library) offers **free** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

The English Writing Center (411LIBR): The Writing Center Offers free tutoring in 20-, 40-, or 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Our hours are 9 am to 8 pm Mon.-Thurs., 9 am-3 pm Fri. and Noon-6 pm Sat. and Sun. Register and make appointments online at <http://uta.mywconline.com>. Classroom Visits, workshops, and specialized services for graduate students are also available. Please see www.uta.edu/owl for detailed information on all our programs and services.

The Library's 2nd floor Academic Plaza offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation. <http://library.uta.edu/academic-plaza>

Course Schedule

The following table shows the major topics that will be covered as well as the estimated number of lectures for each topic. These topics will be covered in the order as they appear in the table. The rest of the class meetings will be given to project presentations.

The instructor reserves the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.

| Topics | # of Lectures |
|---------------------------|---------------|
| Syllabus | 1 |
| Introduction | 2 |
| Java Threads | 1 |
| Critical Section | 1 ~ 2 |
| Replay Shared Variables | 1 |
| Semaphore and Lock | 2 ~ 3 |
| Replay Semaphore and Lock | 1 |
| Advanced Locking | 1 ~ 2 |
| Monitor | 3 |
| Replay Monitor | 1 |

| | |
|---------------------|-------|
| Message Passing | 1 ~ 2 |
| Race Analysis | 1 |
| Midterm Exam | 1 |
| Concurrency Testing | 1 ~ 2 |
| CCS | 2 ~ 3 |

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381.