General

Lecture: 308 WH, 5:30pm – 6:50pm, Tue. and Thu.
Instructor: Dr. Jeff Lei, ylei@cse.uta.edu, 324 NH, x2341
Office Hours: 3:30pm – 4:30pm, Tue. and Thu.

Prerequisite

Basic understanding of operating systems concepts is necessary to follow the course material. A moderate proficiency in Java or C++ programming is assumed.

Objective

The purpose of this course is two fold. First, it aims to provide students with useful skills that are essential to develop concurrent software systems. Second, it intends to offer insights to the forefront of research efforts in the area of concurrent software systems. It is the instructor’s hope that as part of the outcome, some students will be stimulated to make further pursuit in the subject field.

The following specific attributes will be addressed in this course:

1. The students will gain a profound understanding about the nature of concurrent executions, such as nondeterminism, concurrency, synchronization, and communication.
2. The students will be able to apply fundamental principles and techniques in problem solving related to concurrency.
3. The students will develop technical proficiency in designing, implementing, debugging, and testing of concurrent software systems.
4. The students will be able to formally specify the behavior and properties of concurrent software systems.
5. The students will be able to use software tools to perform verification of concurrent software systems.

Synopsis

Concurrent software systems have seen widespread deployment in recent years. Allowing multiple threads to execute simultaneously increases resource utilization and leads to improved computing efficiency. However, concurrent software systems are inherently nondeterministic. Such nondeterminacy makes it extremely difficult to build these systems and to 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 specification, verification, and validation of concurrent software systems.

A tentative list of itemized topics is provided below:

1. Interleaving Model of Concurrency
2. Semaphores, Locks and Monitors
3. Deadlock, Livelock and Starvation
4. Classic Concurrent Problems (Mutual Exclusion, Bounded Buffer, Readers and Writers, and Dining Philosophers)
5. Analysis of Race Conditions
6. Tracing and Replay
7. Kripke Structure
8. Temporal Logic (CTL and LTL)
9. Model Checking

Textbook (Required)

Coursepack: *Multithreading in Java and C++/Win32* by Richard H. Carver and Kuo-Chung Tai

References (Optional)


Grading

There will be several (about five) homework assignments, including both written and programming assignments. There will be no exams. Each student is expected to read and present one or more research papers. The instructor will compile a collection of papers from which students can choose those of their interests.

The final grade will be determined according to the following percentages:

Assignments – 75%
Presentation – 25%

Assignment Policy
You are encouraged to discuss assignments with your classmates but are not allowed to copy solutions from or share with others. Late assignments are acceptable before solutions are posted or explained in class, with 10% deduction for every 24 hours. Less than 24 will be rounded to 24.

Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the University. Since dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

**Student Equality**

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of these accommodations, students must register with Office for Students with Disabilities, Box 19355, Lower Level, University Center, 817.272.3364. More information on University policy on student equality can be found at http://www.uta.edu/disability/.