CSE5317/4305: Design and Construction of Compilers (Spring 2018)

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Office Hours: Tuesday and Thursday 3:30-5:00pm  
Section Information: CSE 5335-001 and CSE 4305-001

Description of Course Content:  
Review of programming language structures, translation, and storage allocation. Introduction to context-free grammars and their description. Design and construction of compilers including lexical analysis, parsing and code generation techniques. Error analysis and simple code optimizations will be introduced.

Objectives:  
The goal of this course is to give a working knowledge of the basic techniques used in the implementation of modern programming languages. The course is centered around a substantial programming project: implementing a complete compiler for a realistic language. Students successfully completing this course will be able to apply the theory and methods learned during the course to design and implement optimizing compilers for most programming languages.

Student Learning Outcomes:  
Upon successful completion of this course, students

- will gain an in-depth understanding of many theoretical and practical aspects of modern compiler technology, including scanning, parsing, type-checking, code generation and optimization, and storage allocation;
- will have the skills to design and implement practical optimizing compilers for programming languages.

Prerequisites:  
Prerequisites: CSE3302 (Programming Languages), which requires both CSE3315 (Theoretical Concepts) and CSE3322 (Computer Architecture I), or consent of instructor.  
Students must:

- have knowledge and programming experience with Java;
- be familiar with the functions of modern computer architectures and be able to program in an assembly language;
- be familiar with data structure concepts and algorithms (such as lists, trees, sorting, hashing, etc).

Students without adequate preparation are at substantial risk of failing this course.

Required Textbooks and Other Course Materials:  
- Lecture notes.
- Lecture slides, which are based on the lecture notes.

Other Texts: You may find the following texts useful for additional background and explanation:

- A. V. Aho, M. S. Lam, R. Sethi, and J. D. Ullman: Compilers: Principles, Techniques, and Tools, second edition, (this is the classic red "Dragon" book), Addison-Wesley, 2007. This is the best reference manual on compiler construction in existence, although it is sometimes considered hard to read.

Descriptions of major assignments and examinations:
There will be six programming assignments, one midterm exam, and one comprehensive final exam.

Attendance:
At UTA, taking attendance is not required. Rather, each faculty member is free to develop his or her own methods of evaluating students’ academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I allow students to attend class at their own discretion.

Grading:
The final grade will be based on
- 40% project
- 25% midterm exam
- 35% final exam (comprehensive)

The course work will be the same for graduates and undergraduates, except for the last project, which is optional (extra credit) for undergraduate students. Final grades will be assigned according to the following scale:

- A: score >= 90
- B: 80 <= score < 90
- C: 70 <= score < 80
- D: 60 <= score < 70
- F: score < 60

Sometimes, lower cutoff points are used, depending on the overall performance of the class. After the first grades are posted, students can check their grades online at the course web page.

Reading Assignments:
Completing reading assignments before the class period in which the material is discussed is essential to success in this class. Not all the assigned material will be covered in class, but you will be responsible for it on exams.

Exams:
Both exams are open textbook (only the class required textbook) and open notes (all notes must be securely bound in one notebook). The final exam will cover the material from the first lecture up to and including the last lecture. Once the exam grades are posted, you will have 10 business days to dispute your grade and get your exam re-evaluated. Before you request for re-evaluation, make sure to compare your answer with the solution. No re-evaluation will be entertained after the 10 day period. No makeup exams will be given unless there is a justifiable reason (such as illness, sickness or death in the family). If you miss an exam and you can prove that your reason is justifiable, you should arrange with the instructor to take the makeup exam within a week from the regular exam time. For any other case, you will get a zero grade for the missed exam.

Project:
The course project is to construct a compiler for a small programming language and will involve: lexical analysis, parsing, semantic analysis (type-checking), and code generation for a MIPS architecture. This project will be done in Scala, which has some similarities with Java. A short tutorial on Scala will be given in class. The project is to be completed in several stages spaced throughout the term and will be done individually. The last programming assignment (code generation) is optional for undergraduate students: if an undergraduate student does not complete the last programming assignment, he/she will get 100 points for this assignment, but if he/she complete this programming assignment successfully he/she will get up to 150 points for this assignment. Details will be given out in class the third week of the course. All submissions must be done electronically using the class web site. Late assignments will be marked 20 points off per day (out of 100 max). So, there is no point submitting a project report more than 4 days late! This penalty cannot be waived, unless there was a case of illness or other substantial impediment beyond your control, with proof in documents from the school.

How to do Well in this Course:
Students who get the most out of this course will be the ones who put in the most effort. If you
want to do well, attend all the lectures, read the assigned sections of the book, and start early on your project assignments. Working out the problems from book chapters will immensely help in doing well on exams. If you are having difficulty, the instructor and the GTA will be more than happy to help you. In addition to regular office hours, the best way of communication with the instructor or the GTA is through email. If you can't make it to the scheduled office hours but really need help, contact one of us for an appointment.

**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://wweb.uta.edu/aoa/faq/).

**Americans with Disabilities Act:**
The University of Texas at 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). 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 that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

**Title IX:**
The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit www.uta.edu/titleIX.

**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 as they see fit in their courses, including (but not limited to) 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.

**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.
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 next to the classroom. 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.

Course web page:
https://lambda.uta.edu/cse5317/
Please visit this web page often; it will contain class notes, solutions, etc.

Related web pages:
- cse5317 Spring 2017
- Compiler course at Cornell
- Compiler course at Purdue
- Compiler course at Portland State

Last modified: 01/15/2018 by Leonidas Fegaras