

**CSE 3315**  
**Theoretical Concepts in Computer Science and Engineering**  
**Fall 2017**

**Instructor:** Dr. Linda Barasch

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**Office Hours:** Tues 11-1 and Wed 10-12 or by appointment

**Section Information:** CSE 3315-001 and CSE 3315-002

**Time and Place of Class Meetings:**

CSE 3315-001: TuTh 9:30-10:50	ARCH 401
CSE 3315-002: TuTh 2-3:20	COBA 147
CSE 3317-003 MoWe 1-2:20	NH 110

**Description of Course Content:** Selected theoretical concepts including regular and context free languages, finite state and pushdown automata, Turing machines, computability, and NP-completeness.

**Student Learning Outcomes:**

Students will have an understanding of the theoretical foundations in computer science and engineering, including the following:

Strings, languages, countability and proof techniques

Ability to create, describe, and use finite automata and regular languages

Determinism vs nondeterminism

Ability to create, describe, and use pushdown automata and context-free grammars

Ability to prove certain languages are/are not regular or context-free

Ability to create, describe, and use Turing Machines

The Church-Turing thesis and computability theory

Computational complexity and the classes P, NP and NP-complete

**Required Textbooks and Other Course Materials:**

Lewis and Papadimitriou Elements of the Theory of Computation 2<sup>nd</sup> edition 9780132824787

**Descriptions of major assignments and examinations:** There will be 2 exams and a final comprehensive exam. In addition, there will be six or more quizzes/homeworks/participation scores of which the five highest grades will be used. Homework will be picked up and quizzes administered at the beginning of class only.

**Attendance:** At The University of Texas at Arlington, 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. Students are expected to attend all classes. I do not factor attendance directly into the grade computation, However, attendance is required to score points on quizzes/homework/participation.

**Grading:**

Six quizzes/homework	20%
(lowest grade will be dropped, 4% each (of 5))	
Two exams	25% each
Comprehensive final	30%

90-100 A  
80-90 B  
70-80 C  
60-70 D  
<60 F

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels; see “Student Support Services,” below.

There will be NO make-up of exams unless the instructor has been notified in advance, and then only under extenuating circumstances as determined by the instructor, whose decision is final. Requests for permission to go home before the final exam date will never be granted except for medical reasons and with proof from a doctor.

**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 (Nov 1 by 4pm). 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/ses/fao>).

**Disability Accommodations:** 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 (OSD)**. 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](http://www.uta.edu/disability) or by calling 817-272-3364 **Counseling and Psychological Services (CAPS)** [www.uta.edu/caps/](http://www.uta.edu/caps/) or calling 817-272-3671.

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](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**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](http://www.uta.edu/titleIX) or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or [jmhood@uta.edu](mailto:jmhood@uta.edu).*

**Academic Integrity:** All students enrolled in this course 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.

**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](mailto:resources@uta.edu), or view the information at [www.uta.edu/resources](http://www.uta.edu/resources).

**The IDEAS Center** (2<sup>nd</sup> 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](mailto:IDEAS@uta.edu) or call (817) 272-6593.

**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 a 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.

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 Schedule/Topics**

### Chapter 1 Sets, Relations, and Languages

- 1.1 Sets
- 1.2 Relations and functions
- 1.3 Special types of binary relations
- 1.4 Finite and infinite sets
- 1.5 Three fundamental proof techniques
- 1.6 Closures and algorithms
- 1.7 Alphabets and languages
- 1.8 Finite representations of languages

### Chapter 2 Finite Automata

- 2.1 Deterministic finite automata
- 2.2 Nondeterministic finite automata
- 2.3 Finite automata and regular expressions
- 2.4 Languages that are and are not regular
- 2.5 State minimization
- 2.6 Algorithmic aspects of finite automata

### Chapter 3 Context-free Languages

- 3.1 Context-free grammars
- 3.2 Pushdown automata
- 3.4 Pushdown automata and context-free grammars
- 3.5 Languages that are and are not context-free
- 3.6 Algorithms for context-free grammars

### Chapter 4 Turing Machines

- 4.1 The definition of a Turing machine
- 4.2 Computing with Turing machines
- 4.3 Extensions of Turing machines
- 4.5 Nondeterministic Turing machines

### Chapter 5 Undecidability

- 5.1 The Church-Turing thesis
- 5.2 Universal Turing machines
- 5.3 The halting problem

### Chapter 6 Computational Complexity

- 6.1 The class P
- 6.2 Problems, problems...
- 6.3 Boolean satisfiability
- 6.4 The class NP

### Chapter 7 NP-completeness

- 7.1 Polynomial-time reductions
- 7.2 Cook's Theorem
- 7.3 More NP-complete problems

Thurs Aug 24

Introduction and review

Mon Aug 28

Tues Aug 29

Sets, Relations, and Languages

Wed Aug 30  
Thurs Aug 31  
    Sets, Relations, and Languages  
Tues Sept 5  
Wed Sept 6  
    Sets, Relations, and Languages  
Thurs Sept 7  
Mon Sept 11  
    Finite Automata  
Tues Sept 12  
Wed Sept 13  
    Finite Automata  
Thurs Sept 14  
Mon Sept 18  
    Finite Automata  
Tues Sept 19  
Wed Sept 20  
    Finite Automata  
Thurs Sept 21  
Mon Sept 25  
    Finite Automata  
Tues Sept 26  
Wed Sept 27  
    Finite Automata  
Thurs Sept 28  
Mon Oct 2  
    Context-free Languages  
Tues Oct 3  
Wed Oct 4  
    EXAM 1  
Thurs Oct 5  
Mon Oct 9  
    Context-free Languages  
Tues Oct 10  
Wed Oct 11  
    Context-free Languages  
Mon Oct 16  
Tues Oct 17  
    Context-free Languages  
Wed Oct 18  
Thurs Oct 19  
    Context-free Languages  
Mon Oct 23  
Tues Oct 24  
    Turing Machines  
Wed Oct 25  
Thurs Oct 26  
    Turing Machines  
Mon Oct 30  
Tues Oct 31  
    Turing Machines  
Wed Nov 1  
Thurs Nov 2  
    Turing Machines  
Mon Nov 6  
Tues Nov 7  
    Undecidability

Wed Nov 8  
Thurs Nov 9  
    EXAM 2  
Mon Nov 13  
Tues Nov 14  
    Undecidability  
Wed Nov 15  
Thurs Nov 16  
    Complexity  
Mon Nov 20  
Tues Nov 21  
    Complexity  
Mon Nov 27  
Tues Nov 28  
    Complexity  
Wed Nov 29  
Thurs Nov 30  
    NP-completeness  
Mon Dec 4  
Tues Dec 5  
    NP-completeness and review

FINAL EXAM – CSE 3315-001: Thursday, Dec 14 8-10:30  
                  CSE 3315-002: Tuesday, Dec 12 2-4:30  
                  CSE 3315-003: Monday, Dec 11 11-1:30

*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course, including dates of exams.*

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**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.