**CSE 3315**
**Theoretical Concepts in Computer Science and Engineering**
**Spring 2018**

**Instructor:** Dr. Linda Barasch

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**Office Hours:** Tues 8:30-10:30 and Wed 1-3 or by appointment

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

**Time and Place of Class Meetings:**

| | | |
|---|---|---|
| CSE 3315-001: | TuTh 11-12:20 | NH 202 |
| CSE 3315-002: | TuTh 2-3:20 | 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 2nd 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 (Mar 30 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 Accomodations:** 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 or by calling 817-272-3364
**Counseling and Psychological Services (CAPS)** 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 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 or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or 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, 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.

**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

Jan 16
- Introduction and review

Jan 18
- Sets, Relations, and Languages

Jan 23

Sets, Relations, and Languages
Jan 25
Sets, Relations, and Languages
Jan 30
Finite Automata
Feb 1
Finite Automata
Feb 6
Finite Automata
Feb 8
Finite Automata
Feb 13
Finite Automata
Feb 15
Finite Automata
Feb 20
Context-free Languages
Feb 22
EXAM 1
Feb 27
Context-free Languages
Mar 1
Context-free Languages
Mar 6
Context-free Languages
Mar 8
Context-free Languages
Mar 20
Turing Machines
Mar 22
Turing Machines
Mar 27
Turing Machines
Mar 29
Turing Machines
Apr 3
Turing Machines
Apr 5
Undecidability
Ap0r 10
EXAM 2
Apr 12
Undecidability
Apr 17
Complexity
Apr 19
Complexity
Apr 24
Complexity
Apr 26
NP-completeness
May 1
NP-completeness
May 3
Review

FINAL EXAM – CSE 3315-001: Tues May 8 11-1:30
CSE 3315-002: Tues May 8 2-4:30

*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.