CS 4384.002 Automata Theory – Spring 2010

MW 2:30-3:45pm, ECS 2.305

Instructor: Gopal Gupta

Office: ECS 4.908 (CS Office Suite)

Office Hours: Monday & Wednesday 4:00-5:00pm
(For an appointment please send email to: gupta@utdallas.edu)

Teaching Assistant: TBA

Course Prerequisites: CS 3305 (Discrete Math II) or equivalent

Course Description: A study of formal languages and their power. Topics include finite automata, regular languages, pushdown automata, context-free languages, Turing machines.

Contents Description:

1. Brief review of mathematical background. (Chapter 0 in text)
   (Binary relations, digraphs, strings, languages, inductive definitions and types of proof ...)

2. Finite Automata and Regular Expressions. (Chapter 1 in text)
   (Deterministic and nondeterministic finite automata, regular expressions and regular sets, Kleene's Theorem.)

3. Properties of Regular Sets (Chapter 1, in particular Section 1.4)
   (Pumping Lemma, closure properties, decision algorithms)

4. Context-Free Grammars and Languages. (Chapter 2 in text)
   (Context-free grammars, regular grammars)

5. Simplified Forms and Normal Forms. (Chapter 2 in text)
   (Useful symbols, productions, unit productions, Chomsky normal form)

6. Pushdown Automata. (Section 2.2 in text)
   (Pushdown automaton, equivalence between pushdown automata and context-free languages)

7. Properties of Context-Free Languages. (Section 2.3 in text)
   (Pumping Lemma, closure properties, the CYK algorithm)

8. Turing Machines. (Chapters 3 and 4 in text)
   (Turing machines, their variants and the undecidibility of the halting problem)

Course Objective: The goal of this course is to introduce students to formal languages and the theory of computation. We will discuss several basic computational models including the finite automata (FA), pushdown automata (PDA) and Turing machines (TM) as well as the corresponding classes of regular languages, context-free languages and recursively enumerable languages. The classes of regular grammars and context-free grammars (CFG) will be introduced. We will show the equivalence between regular grammars and finite automata, and between context-free grammars and pushdown automata. We will also discuss various properties of regular languages and context-free languages, including the Pumping Lemma, several closure properties as well as some decision algorithms. We will discuss the Turing machine model, the notion of decidability/undecidability, the halting problem for TMs and the proof of its undecidability.

The Learning Objectives include: (1) Ability to design finite automata and regular expressions, (2) Ability to convert among DFAs, NFAs, and regular expressions, (3) Ability to show that certain languages are not regular, (4) Ability to design PDAs and CFGs, (5) Ability to convert PDAs to CFGs and vice versa, (6) Ability to show that certain languages are not context-free.

Required Textbooks and Materials:

Sipser, M.: "Introduction to the Theory of Computation", Thomas Course Technology, (2nd edition) 2006.
(Main Text)

Suggested Course Materials:

Lecture notes (to be found on UTD library electronic reserves under Dr. Huynh's CS 4384.001 section).

Martin, J.C.: "Introduction to Languages and the Theory of Computation", McGraw-Hill, 2003.

Sudkamp, Th.: "Languages and Machines", Addison Wesley, 1997.

Lewis, H. & Papadimitriou, C.: "Elements of the theory of Computation", Prentice Hall, 1998.

Kozen, D.: "Automata and Computability", Springer Verlag, 1997

Assignments and Academic Calendar/Grade Scale:

- 5 Homework assignments 10%
  (Solutions of HW problems will be provided.)
  (HW assignments are due in class on the date given. Late HWs will not be accepted. If you are not able to attend a class, you're responsible for any announcements/handouts. HW assignments will be distributed in class. A few copies are placed outside my office in the CS Office Suite.)
- 4 Quizzes 15%
  (Each quiz is worth 5%, and the one with lowest score will be dropped)
  The quizzes will be on Jan. 27, Feb. 15, March 29, and April 14. Each lasts about 25 minutes.
- Midterm Exam (75 minutes) 30% Monday, March 1, 2:30 pm
- Final Exam (120 minutes) 40% Monday, May 10, 2:00 pm
- Class attendance is mandatory (5%)

Course and Instructor Policies:

- A copy of the lecture notes (Chapters 1-9) can be found on UTD library electronic reserve.
- Final exam will be comprehensive.
- Students are required to have two photo ID's during an exam.
- Students are encouraged to discuss HW problems. However, your submission must be your own work. Anyone caught cheating on HWs will receive zero credit.
- If you decide to stop attending class, be sure to drop the course since you will not be dropped automatically.
- Any student wishing to contest a grade on a HW should contact the TA.
- Midterm exam will be returned 2 weeks after the grades are announced. During these 2 weeks you can go over your exam with the TA. Your request to re-grade your exam paper can be submitted in writing through the TA. Once the exam is returned to students, no request for regarding can be considered.
- Final Exam will be kept by the instructor for one semester. Anyone wishing to look at his/her exam solutions can make an appointment with the instructor or see him during his OHs. Final grades will be posted by the Records Office.
- All exams and quizzes will be graded by the instructor. HWs will be graded by the TA.

Field Trip Policies

N/A

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, A to Z Guide, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3, and in Title V, Rules on Student Services and Activities of the university's Handbook of Operating Procedures. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

Academic Integrity

The faculty expects from its student a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts, or omissions related to applications for enrollment or the award of a degree, and /or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and /or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially form the web from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's Handbook of Operating Procedures.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the deal will appoint and convene and Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

Disability Services

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday and Thursday, 8:30a.m. to 6:30p.m.; Tuesday and Wednesday, 8:30a.m. to 7:30p.m. ; and Friday, 8:30a.m. to 5:30p.m.

The contact information for the Office of Disability Services is:
The University of Texas at Dallas, SU 22
PO box 830688
Richardson, Texas 750803-0688
(972) 833-2098(voice or TTY)

Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.

It is the student's responsibility to notify his or her professors of the need for such and accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam of assignment.

Off-Campus Instruction and Course Activities

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at the website address given below. Additional information is available from the office of the school dean.
(http://www.utdallas.edu/BusinessAffairs/Travel-Risk-Activities.htm)

These descriptions and timelines are subject to change at the discretion of the Professor.