CSC 6500 Theory of Languages, Automata and Computation Fall 2017

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Lectures: Mondays and Wednesdays, 11:30 AM -12:45 PM, State 306

Recommended (but not required) Text Book: Introduction to the Theory of Computation, any edition, by Michael Sipser, Thompson Course Technology. Appropriate notes will also be provided

Course Content and Goal: This course will focus on theoretical and mathematical models of Computation. We hope to cover the following topics:

1. An overview of various Finite Automata and theory of languages.
2. Turing machine as a model of computation to understand, explain and model an algorithm. What is computation and what is computable and what is not? (Undecidable and intractable problems)
3. Recursive and recursively enumerable languages
4. Time order and space complexity of an algorithm
5. Distinction between polynomial time and exponential time orders
7. Some biological models of computation (DNA computing): tradeoff between time complexity vs. space complexity
8. Quantum computing and its revolutionary impact on time and space complexity.

The subject matter involves some serious mathematical proofs of theorems about computation (rigorous proofs vs. wishful thinking). To make the subject interesting some time will be made to show the application of the concepts in implementing a variety of practical problems such as text search on the Web, HTML and XML languages, digital circuit design, and practical problems involving various kinds of complexity, including coding/decoding, data processing, and some problems from mathematics and graph theory.

Course Learning Outcomes:

1. The student will be able to understand and work with formal grammars such as context-free and regular grammars and their associated languages and understand recursive and recursively enumerable languages.
2. The student will be able to evaluate and explain the differences between different computational models (Turing Machines, Push-down Automata, Finite Automata, etc.)
3. The student will be able to understand and intelligently discuss the relationships between grammars & languages and different computational models.
4. The student will be able to design computational solutions for problems using different computational models.
5. The student will be able to write computer programs in a high level language to implement different computational models and understand how these programs are used in compilers and for computations.
6. The student will be able to perform problem reduction in order to reduce unknown problems to known ones in order to prove/examine questions on decidability and complexity.
7. The student will be able to use JFLAP for designing different machines and the use these machines for solving complex problems.
8. The course will emphasize Turing machine as a general computational model and its importance in deciding what is computable and what is not (through the use of halting problem) and if computable, its complexity through P-NP problems.
9. The student will know the Concepts of P, NP, NL, NP-completeness, NL-completeness, and PSPACE completeness.
10. The student will know various techniques to solve NP problems. These techniques will include probabilistic, heuristic, approximate, genetic algorithm, simulation annealing, branch and bound method, backtracking, semi-automatic methods like model checking, etc.
11. The student will learn about advances in computing like quantum computing, parallel computing, natural computing, superconducting computers, nano-technology: reconfigurable computers.
12. The course will give students a broad overview of the theoretical foundations of Computer Science and prepare them for study of topics and applications that depend upon understanding of formal languages and automata, including what are appropriate computer languages.

Attendance: Attending all lectures is essential (you are allowed to miss no more than two lectures); the assignments,
exams, quizzes, etc. will be based primarily (though not exclusively) on the material presented in these lectures. Also, assignments due dates, explanation and clarification of assignments, and material outside text books will be presented during lectures. If you miss a lecture, it is your responsibility to obtain the information covered in the session from your fellow classmates.

**Homework and Examinations:** There will be 8-10 home work due at the beginning of the lecture period of the due date. No late assignment will be accepted. Since each assignment is an integral part of the course, the instructor reserves the right to give a failing grade to anyone who is turning in 50% or less of the homework. The homework and any projects given are very important tools for learning the material taught in the lecture. Therefore, it is very important that you do the homework on your own; copying will be severely dealt with as per WSU policies.

There will be held three examinations on or about October 9, November 6, and December 11, 2017 (dates are subject to change, but at least one week notice will be given). All the examinations will be held during the regular lecture hours. The examinations will be closed books, closed notes and closed neighbors. In order to pass the course, you must pass all exams. There will be no make-up examinations.

**Final grade:** For the final grade, home works and exams are weighted as follows:

- Homework: 25%
- Exam 1: 25%
- Exam 2: 25%
- Exam 3: 25%

The final letter grades will be determined approximately as follows:

- A 92-100%; A- 90-91%; B+ 88-89%; B 82-87%
- B- 80-82%; C+ 78-79%; C 72-77%; C- 70-71%; D+ 68-69%; D 62-67%; D- 60-61%; F 0-59%

A grade of Incomplete (I) will be not be given. Please familiarize yourself with the new university policy about withdrawal from the course.

**Students Responsibilities and Academic Honesty:** As a college student, who is committed to seek a higher education, we expect you be a very responsible person. At the least, please:

* Do your best to understand the material covered in the class; ask questions when you do not understand.
* Be aware of the homework assignments and deadlines.
* Obtain notes and handouts from your classmates if you miss a class for unavoidable circumstances.
* Turn in your assignments in neat, readable and easily accessible form.

Also we expect all of you to have the highest level of academic honesty. We expect each of you to do your work (assignments, and exams) yourself and strongly encourage you to discuss with the instructor(s) regarding any problems which you might have in the course work. However, in fairness to all, if we find two or more assignments, which appear to be copied from each other, we will split the points evenly among all those involved (no matter who copied from whom). Repeated incidents will be dealt with severe disciplinary actions. Please note that, according to the new policy (per memo from the provost dated April 17, 2017).

**Academic misbehavior...includes...unauthorized reuse of work product..., which means submission for academic credit, without the prior permission of the instructor, of substantial work product previously submitted for credit in another course.**

**Course Drops and Withdrawals:** In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: [http://reg.wayne.edu/pdf-policies/students.pdf](http://reg.wayne.edu/pdf-policies/students.pdf)

**Religious Holidays:**

Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.
**Students with disabilities:** If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TTD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours or at another agreed upon time to discuss your needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

**Student services:**

- The Academic Success Center (1600 Undergraduate Library) assists students with content in select courses and in strengthening study skills. Visit [www.success.wayne.edu](http://www.success.wayne.edu) for schedules and information on study skills workshops, tutoring and supplemental instruction (primarily in 1000 and 2000 level courses).
- The Writing Center is located on the 2nd floor of the Undergraduate Library and provides individual tutoring consultations free of charge. Visit [http://clasweb.clas.wayne.edu/](http://clasweb.clas.wayne.edu/) writing to obtain information on tutors, appointments, and the type of help they can provide.

**Class recordings:**

Students need prior written permission from the instructor before recording any portion of this class. If permission is granted, the audio and/or video recording is to be used only for the student’s personal instructional use. Such recordings are not intended for a wider public audience, such as postings to the internet or sharing with others. Students registered with Student Disabilities Services (SDS) who wish to record class materials must present their specific accommodation to the instructor, who will subsequently comply with the request unless there is some specific reason why s/he cannot, such as discussion of confidential or protected information.