CS 5313: Formal Language Theory Fall 2019
Course Information (Last Revised on August 28, 2019)

---

1. General Information

	Instructor: H. K. Dai	Teaching Assistant: K. Chen
Office Location:	Mathematics, Statistics, and Computer Science Building	
	Room 209	Room 313
Office Hours:	Monday/Wednesday 1:00 - 2:00 (or by appointment)	Tuesday 10:00 - 11:30, Thursday 2:00 - 3:30
Office Phone:	744-7207	
email Address:	dai@cs.okstate.edu	kuchen@okstate.edu
Universal Resource Locator:	http://www.cs.okstate.edu/~dai/	

2. Course Description in Current University Catalog

CS 5313: Formal Language Theory. Prerequisites: CS 3613 (Theoretical Foundations of Computing). Formal language theory applied to procedure oriented languages. Application of finite state algorithms to lexical analysis. Chomsky hierarchy of languages. Generation, recognition, and closure properties of languages.

3. Course Goals

The main goal of the course is to introduce abstract formal models of computational devices, and an appreciation for the powers and limitations of such formalisms. A secondary goal is to present a body of facts about and techniques for studying "classical" models, such as finite automata, context-free grammars, pushdown automata, and Turing machines, having important applications in a variety of other areas of computer science.

4. Course Materials and References

1. Text: [Sip12] M. Sipser. *Introduction to the Theory of Computation.* Cengage Learning, Recent Edition (3rd edition, 2012).
2. Reference: [Mar10] J. A. Martin. *Introduction to Languages and the Theory of Computation.* McGraw-Hill, Recent Edition (2010).
3. Lecture notes (sketchy): from course instructor.
4. Class pages (http://www.cs.okstate.edu/~dai/course/CS5313/2019fall/2019fall.html).

5. Homework and Examinations

There will be about 4-5 homework assignments (written and in-class/person presentations of their solutions), possibly a few unannounced quizzes, 1 test, and 1 final examination.

6. Course Grade

The course grade is based on the homework/presentations (30%), unannounced quizzes (10%) and test (25%), and final examination (35%). The passing letter-grade is determined by the following partition of the course grades:

D : [50, 60); C : [60, 70); B : [70, 85); and A : [85, 100]

7. Miscellaneous

1. **Lectures**: Lectures are not mandatory, but historically, students with active attendance have done significantly better on examinations than their less frequently attending classmates.
2. **Homework**: Problem sets form an important part of the learning in the course, and thus, you are required to do them in order to pass.
3. **Collaboration**: You are encouraged to collaborate in study groups on the solution of the homework. If you do collaborate you must write up solutions on your own and acknowledge your collaboration in the write-up for each problem. If you obtain a solution with help (e.g., through library work, another student, etc.), acknowledge your source, and write up the solution on your own.

8. Student Disability Services

Student Disability Services and other Student Services are committed to providing support services to students with physical and learning disabilities. Please advise the instructor of desired academic accommodations, and notify Student Disability Services.

9. Academic Dishonesty or Misconduct

Refer to the section in "University Academic Regulations" in current "University Catalog"
(http://registrar.okstate.edu/)

10. Adding/Dropping/Withdrawing, Important Dates, and Syllabus Attachment

1. **Test and Final Examination**: Tentative date for the test is October 3 (Thursday), 2019.

   Adopting "Fall 2019 Final Exam Schedule", the firm time/date for final examination is 6:00 – 7:50 pm, December 12 (Thursday), 2019 in regular class meeting place.

   Refer to the section in "Fall 2019 Final Exams":
   http://registrar.okstate.edu/Exams

2. **Adding/Dropping/Withdrawing and Important Dates**: Refer to the section in "Academic Calendar":
   http://registrar.okstate.edu/

3. **Syllabus Attachment**: Refer to:
   http://academicaffairs.okstate.edu/content/resources-students

CS 5313: Formal Language Theory Fall 2019
Course Outline (Tentative) (Last Revised on August 21, 2019)

---

1. Mathematical Preliminaries and Introductory Material
   1.1. Alphabets, strings, and operations on strings
   1.2. Languages and operations on languages
2. Finite Automata
   2.1. Deterministic finite automata (DFAs)
   2.2. Nondeterministic finite Automata (NFAs)
   2.3. The equivalences of DFAs and NFAs
3. Regular Expressions
   3.1. Regular expressions
   3.2. The equivalence of finite automata and regular expressions
4. Closure Properties of Regular Languages
   4.1. The pumping lemma for regular languages
   4.2. Closure properties of regular languages
5. Context-Free Grammars
   5.1. Context-free grammars (CFGs)
   5.2. Simplification of CFGs
   5.3. Normal forms of CFGs: Chomsky and Greibach normal forms
   5.4. Ambiguity
6. Pushdown Automata
   6.1. Pushdown automata (PDAs) and their form of acceptance
   6.2. The equivalence of CFGs and PDAs
7. Properties of Context-Free Languages (CFLs)
   7.1. The pumping lemma(s) for CFLs
   7.2. Closure properties of CFLs
8. Computability/Decidability
   8.1. Turing machine (TM) model, and its modifications
   8.2. Models of computation; Church's hypothesis
   8.3. Recursive enumerable languages, recursive languages; computability/decidability
   8.4. Properties of recursively enumerable and recursive languages
9. Undecidability
   9.1. Universal Turing machines
   9.2. Examples of: non-recursively-enumerable languages, non-recursive languages
   9.3. Rice's theorem
10. Miscellaneous topics