CS622: Theory of Formal Languages

SPRING 2026

Professor Dan Simovici

Office hours: Monday and Wednesday 2:30 – 3:30

In this course we present the basic aspects of formal languages, a theoretical Computer Science discipline inspired by mathematical linguistics and by the study of syntactic aspects of programming languages.
The main reference in this course is our book Introduction to the *Theory of Formal Languages* (World Scientific, 2024) by Dan Simovici; however, the slides available at www.cs.umb.edu/~dsim should suffice,

Attendance is mandatory. If you miss more than 5 classes, you incur a high risk of failure,

We shall cover the following topics:

- ***Words and Languages***
- ***Regular Languages:*** deterministic and nondeterministic automata, transition systems, closure properties, pumping lemma, minimal automata, syntactic monoids
- ***Grammars:*** Chomsky's hierarchy, regular operations
- ***Context-Free Languages:*** derivations and derivation trees, fixed-points and context-free languages, the pumping lemma, closure properties, regular and context-free languages, ambiguity
- ***Pushdown Automata:*** deterministic and non-deterministic pushdown automata
- ***Applications of formal language theory:*** coding theory, applications in molecular biology

The grade in this course is determined essentially your by homework and by your class participation. I insist on both the substance and the presentation of your homework. Please write neatly and clearly. I recommend that you learn **LaTeX** and typeset your homework in this language. You should also learn the Greek alphabet.

Academic integrity will be strongly enforced. Your homework must be your own product. You may consult with your colleagues, but you must be the sole author of your solutions.

Homeworks will be posted on the site of this course (www.cs.umb.edu/~dsim/cs622). Please consult this site each time when a homework is announced in class. Homework must be submitted electronically, on the date that is due and before 4:00pm.