COMP 3030 – Automata Theory and Formal Languages

Calendar Description: An introduction to automata theory, grammars, formal languages and their applications. Topics: finite automata, regular expressions and their properties; context-free grammars, pushdown automata and properties of context-free languages; turing machines. Applications: lexical analysis, text editing, machine design, syntax analysis, parser generation.
Prerequisites: COMP 2080 and COMP 2140
This course is a prerequisite for: COMP 4310.

Outline

1) Review of Terminology (1/2 week)
    Strings, alphabets, and languages; Graphs and digraphs; Trees; Sets; Relations.
2) Finite Automata and Regular Expressions (3 weeks)
    Deterministic and non-deterministic finite automata and their equivalence.
    Epsilon-moves. Regular expressions.
3) Properties of Regular Sets (2 weeks)
    Pumping lemma, closure properties, and decision algorithms. The Myhill-Nerode theorem and minimization of finite automata.
4) Context-Free Grammars (2 weeks)
    Context-free grammars and derivation trees. Simplification of context-free grammars. Chomsky normal form and Greibach normal form.
5) Pushdown Automata (2 weeks)
    Pushdown automata and their relationship to context-free languages.
6) Properties of Context-free Languages (2 weeks)
    Pumping lemma, closure properties, and decision algorithms.
7) Turing Machines (1/2 weeks)
    Introduction to Turing machines.
8) Applications of Automata Theory and Formal Languages (2 weeks)
    Syntax analysis for compiler design (LR1 grammars) and cellular automata.

Text: John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, In*troduction to Automata Theory, Languages and Computation (third edition)*, Addison Wesley, 2007.