Automi e Linguaggi. Corso frontale e Corso on-line. 2011-12.

Docente: Alberto Pettorossi.

Programmi Java o C++ da sviluppare e documentare:

1. Cocke-Younger-Kasami parser of type 2 languages generated by grammars with ε-productions.
2. Construction of tables for LR(1) parsing.

Programma dettagliato del corso e domande d'esame (Tra parentesi quadrate sono indicati i riferimenti bibliografici).

1. Mathematical Preliminaries [P: Chapter 1]. Chomsky Hierarchy and Kuroda Theorem. [ATFL: Chapter 1]

2. Regular languages, Regular Expressions, Finite Automata. Kleene's Theorem: NFA=FA. Left-linear and right-linear finite automata. Arden rule. Pumping Lemma for regular languages. Moore Theorem. Myhill-Nerode Theorem (facoltativo). Decidability results for regular languages. Closure properties of regular languages. [ATFL: Chapter 2]

3. Context-free languages, Chomsky normal form, and Greibach normal form. Pushdown automata. Deterministic context-free languages and deterministic pushdown automata. Decidability results for context-free languages and deterministic context-free languages. [ATFL: Chapter 3]

4. Avoiding useless symbols ('From Below' and 'From Above'), ε-productions, unit productions, and left-recursion. Pumping Lemma for context-free languages. Closure properties of context-free languages, ambiguity, and inherent ambiguity. Self-embedding property. [ATFL: Chapter 3]

5. Recursiveness of context-sensitive languages [ATFL: Chapter 4]. Turing Machines: basic notions. Decidability and semidecidability. Halting Problem and Post Correspondence Problem [ATFL: Chapter 5 and 6. No sections: 6.2, 6.3, 6.4].

6. Backtracking and parsing of regular languages [SPM: Sections 2.2, 2.3 and ATFL: Chapter 2].

7. Parsing for context free languages: Cocke-Younger-Kasami parser, Chop-Expand parser [ATFL: Chapter 3]. Earley parser (facoltativo) [ATFL: Chapter 3].

8. LL(1), LR(0), SRL(1) (facoltativo), LR(1), LALR(1) parsing. Use of parser generators: Bison (facoltativo). [SPM: Sections 4.1 and 4.2, Chapter 5, Section 6.2, Sections 7.3 and 7.5]. Operator precedence parsing (facoltativo) [SPM: Section 6.1]. Computing the transitive closure of binary relations [SPM: from Section 8.4 to Section 8.8].

9. String matching with finite automata and Knuth-Morris-Pratt algorithm [SPM: Chapter 9.1].

10. Basic notions of program correctness; Hoare triples. [P: Chapter 8. Section 3].

Riferimenti bibliografici.

[ATFL] A. Pettorossi: *Automata Theory and Formal Languages*, Third Edition, Aracne, 2011.

Per il backtracking, il parsing e il pattern matching:
[SPM] A. Pettorossi: *Techniques for Searching, Parsing, and Matching*, Third Edition, Aracne, 2011.

Per i preliminari matematici e le triple di Hoare:
[P] A. Pettorossi: *Quaderni di Informatica*. Parte I, Second Edition, Aracne, 2004.

Altri libri ove approfondire alcune tecniche di programmazione (quali il backtracking e il parsing) e gli argomenti di decidibilità, di computabilità e di complessità sono:

[DB] A.V. Aho, R. Sethi, J.D. Ullman: *Compilers: Principles, Techniques and Tools*, Addison-Wesley 1986. (Questo libro è noto anche come: The Dragon Book) Sections: 4.4, 4.5, 4.6, and 4.7.
[C] Pettorossi, A.: *Programming in C++*. Aracne, 2001.
[J] Pettorossi, A.: *Sequential and Concurrent Programming in Java*. Aracne, 2005.
[CDC] Pettorossi, A.: *Elements of Computability, Decidability and Complexity*. Third Edition, Aracne, 2009.
