Automi, Linguaggi e Traduttori. March 2007.

Precision and clarity are important. Document your program of Exercise 1 and motivate your constructions and answers. Exercise 1 is compulsory.

1. (6) Write a C++ or Java program for testing whether or not a word in $\{0,1\}^*$ is generated by the grammar with the following productions and axiom S:

$S \to 0\,A \mid 0\,B \mid 0$
$A \to 1\,B$
$B \to 0\,A \mid 0 \mid 1\,S$

Determine the time and space complexity of your program.

2. (3) Prove that the set of all deterministic context-free languages is a proper subset of the set of all context-free languages.

3. (4) Construct the Greibach normal form of the grammar with the following productions and axiom S:

$S \to A\ S \mid a$
$A \to S \mid A\ S \mid a \mid \varepsilon$

4. (4) Describe the Chop-Expand algorithm for parsing context-free grammars. Determine its time and space complexity.

5. (5) Construct an LR(1) parser for the context-free grammar G with the following productions and axiom S':

$S' \to S$
$S \to C\ C$
$C \to a\ C \mid b$

6. (3) Give a program P which satisfies the triple $\{true\}P\{true\}$ and also the triple $\{false\}P\{false\}$. Determine the set of all programs which satisfy the triple $\{true\}P\{true\}$ and also the triple $\{false\}P\{false\}$.

7. (2) Show that there exists a type 0 language $L \subseteq \Sigma^*$ such that $\Sigma^* - L$ is not a type 0 language. Show that the class of type 0 languages is not a boolean algebra.

8. (3) Describe (not in all details) the Knuth-Morris-Pratt pattern matching algorithm. Determine its time and space complexity.

9. (3) Describe an algorithm for computing the reflexive and transitive closure of a boolean relation subset of $A \times A$.

10. (1) Show that not all context-free languages are regular languages.

11. (2) Define the concepts of decidable, semidecidable, and undecidable problem.

Nota. Tra parentesi sono indicati i punti per ogni esercizio. Le due prove in itinere valgono, di norma, 4+4 punti. Per la prova orale, si presenti: (i) il programma fatto da solo/a di cui all'Esercizio 1 con alcune prove di esecuzione, (ii) un elaborato con la soluzione degli altri esercizi fatti da solo/a e (iii) se possibile, si venga con un portatile ove siano istallati e pronti per l'esecuzione i programmi relativi alle due prove in itinere.