Automi, Linguaggi e Traduttori. February 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:

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

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

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

Determine the time and space complexity of your program.

2. (4) Give a formal notion of 'power' and prove that nondeterministic pushdown automata are more powerful than the deterministic ones.

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

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

$A \to A\ S \mid b \mid \varepsilon$

4. (1) Construct a left linear grammar equivalent to the grammar of Exercise 1.

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

$S \to A$

$A \to B\ B$

$B \to b\ B \mid b$

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

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

8. (2) Show that not all context-sensitive languages are context-free languages.

9. (3) 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.