Series 5 (20.10.2011)

Submission: **15:00, October, 27, 2011**, into the boxes next to the room I-21. Write every solution on the separate paper (format A4)! Don't forget to sign your solutions.

It is not sufficient to answer a single number or yes/not. Answers always have to be justified.

Exercise 1.

a) Prove that language $\{0^{2^n} \mid n \in N\}$ is not regular.

b) Prove that every automaton which accepts language $\{w \mid |w|_a \mod k = 0\} \subseteq \{a,b\}^*$ has at least k states.

Exercise 2. Design finite deterministic automaton which decides for given binary number if it is divisible by number 3.

a) The first digit is the most significant. (Word 10010 is representing decimal number 18, thus is accepted). You can assume that most significant digit is allways 1.

b) The first digit is the least significant. (Word 01001 is representing decimal number 18). You can assume that most significant digit is allways 1.

Exercise 3. Let $z = a_1 \dots a_n$, where $a_i \in \Sigma$, for all $1 \leq i \leq n$. Reverse of the word z we denote by $z^R = a_n \dots a_1$ and $\lambda^R = \lambda$.

Let Σ is alphabet and L a regular language. Is the language $L^R = \{w^R \mid w \in L\}$ regular?