Formal Languages and Automata Theory
Homework 5 (Regular expressions), Due date 21.11.2017

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Exercise 1 *(2 points) Find a regular expression for* $L = \{vwv : v, w \in \{a, b\}^*, |v| = 2\}$.

Exercise 2 *(3 points) Write regular expressions for the following languages* ($\Sigma = \{0, 1\}$)*:*

- *All strings ending in 10.*
- *All strings not ending in 10.*
- *All strings containing an odd number of 0's.*

Exercise 3 *(6 points) Find regular* ***grammars*** *for the following languages* ($\Sigma = \{a, b\}$)*:*

- $L = w : n_a(w)$ *is even,* $n_b(w) \geq 4$.
- $L = w : n_a(w)$ *and* $n_b(w)$ *are both even.*
- $L = w : n_a(w)$ - $n_b(w))$ *mod 3 = 1.*

Exercise 4 *(3 points) Obtain NFA for the following right linear grammar (start symbol S):*

- $S \rightarrow 0\ 1\ A \mid 1\ 0\ B$
- $A \rightarrow 0\ 1\ C \mid 0\ 1$
- $B \rightarrow 1\ 0\ D \mid 1\ 0$
- $C \rightarrow 0\ 1\ A$
- $S \rightarrow 1\ 0\ B$

Exercise 5 *(3 points) For a regular expression of length n, what would be the minimum number of states required in NFA to accept the same language? Justify the answer.*
Hint*: Use mathematical induction to prove your statement.*