Tik-79.148 **Spring 2001**
Introduction to Theoretical Computer Science
Tutorial 3
Exercises

Ordinary exercises:

1. Simplify the following regular expressions:

   a) $(\emptyset^* \cup a)(a^*)^*(b \cup a)b^*$
   b) $(a \cup b)^* \cup \emptyset \cup (a \cup b)b^*a^*$
   c) $a(b^* \cup a^*)(a^*b^*)^*$

2. Write the regular expressions over the alphabet $\{0, 1\}$, which describe the following languages:

   a) $L = \{w \mid w$ has at most on pair of consequetive ones$\}$
   b) $L = \{w \mid w$ has an even number of zeros$\}$
   c) $L = \{w \mid w$ does not contain the substring $101\}$

3. Which of the following statements are true? Why?

   a) $aba \in (((c \cup b)^*a^*)^*(a^* \cup b^*)^*)^*$
   b) $(a \cup b)^* = a^* \cup b^*$
   c) $(a \cup b)^* \subseteq (a^*b^*)^*$

Demonstration exercises:

4. Give a proof or a counterexample to the following statements.

   a) $baa \in a^*b^*a^*b^*$
   b) $b^*a^* \cap a^*b^* = a^* \cup b^*$
   c) $a^*b^* \cap c^*d^* = \emptyset$
   d) $abcd \in (a(cd)^*b)^*$

5. Show that $a(b \cup c) = ab \cup ac$

6. **(Difficult)** Show that if a language L is regular, then also the language $L' = \{w \mid uw \in L$ for some string $u\}$ is regular.