Theoretical Computer Science II

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Exercise Sheet 7

Due: December 9, 2009

Exercise 7.1 (Regular expressions, 0.5 + 0.5 + 0.5 + 0.5 + 0.5 + 0.5 marks)

Consider the following regular expressions. Give two strings that are members of the the corresponding language and two strings which are not members – a total of four strings for each part. Assume the alphabet $\Sigma = \{a, b\}$ in all parts.

(a) $a(ba)^*b$

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

(c) $\Sigma^* a \Sigma^* b \Sigma^* a \Sigma^*$

(d) $aba \cup bab$

(e) $(\epsilon \cup a)b$

(f) $(a \cup ba \cup bb)\Sigma^*$

Exercise 7.2 (Regular Expressions, 0.5 + 0.5 + 1 + 1 marks)

Find regular expressions describing filenames, that

(a) end with *.tex* or *.dvi*,

(b) contain exactly one dot (.),

(c) have at least one letter before the last dot (.), and

(d) do not contain the substring *ox*.

Use the normal English alphabet as well as the symbols ., −, and _, i.e.
$\Sigma = \{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, ., -, \_\}$. You can use $\{a - z\}$ to denote the normal alphabet, or $\{a - b, d - z\}$ to denote the normal alphabet without the letter c (This is an example!), or use $\{a - z\} \setminus \{c\}$.

Exercise 7.3 (NFAs and Regular Expressions, 2.5 + 1.5 marks)

Consider the regular expression $(30 \cup 75 \cup 45)^* \circ 10$ (over the alphabet $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$).

(a) Give the NFA that recognizes $L((30 \cup 75 \cup 45)^* \circ 10)$ as it would be constructed according to the proof of Lemma 1.29 from the lecture.

(b) Give another NFA with at most 5 states that recognizes the same language (you do not have to justify your answer).