Theoretical Computer Science – Exercise 6

Technische
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Please prepare the following exercises at home prior to the tutorial:

Exercise 1

A palindrome is a string that reads the same forward (left to right) as backward (right to left). Palindromes in German are, e.g*.: otto, anna, reittier, lagerregal, rotor*; an English palindrome is, e.g., *racecar*.

Now consider only palindromes over the alphabet {a, b, c}, e.g., abccba, abba, cbbabbc. Specify a context-free grammar that produces palindromes of any length over this alphabet.

Exercise 2

Specify a grammar for the language L containing all non-negative integers that are divisible by 5 without remainder. What type is your grammar? (Leading zeros are permitted)

Exercise 3

Consider the following regular expression over the alphabet {a, b, c}:   a (b | c)$^+$ba | b$^+$ | bca*

a) What type in the Chomsky hierarchy is the language defined by this expression?
b) Draw the transition diagram of the equivalent automaton.
c) Specify a grammar that generates the same language. What type is your grammar?

We will do the following exercises together during the tutorial:

Exercise 4

Specify a grammar for the language L containing all non-negative integers that are divisible by 4 without remainder. What type is your grammar? (Leading zeros are permitted)
Hint: A number is divisible by 4 if and only if its last two digits are a number that is divisible by 4.