Exercise 1: Formal languages and grammars

You can earn up to 10 points on this exercise.

Please email your solution to `langtech1saarlandws1617@gmail.com` *with the subject header* **Exercise 1** *by* **15:00, November 9, 2016**.

In the following grammars, strings within double quotes ("...") denote terminal symbols.
All others are non-terminals.

Task 1

Consider the following grammar:

S	→	N "fish"
N	→	"fish"

a. What kind(s) of formal language does the grammar admit? Explain your answer. (1 point)

b. Add one rule such that the above grammar represents a non-finite, non-regular, context-free language. Explain the relevant properties of your rule. (1 point)

Task 2

Now consider the following grammar:

S	→	NP VP
NP	→	Det N
PP	→	P NP
VP	→	V NP
Det	→	"the"
N	→	"fish"
P	→	"with"
V	→	"moved"

a. What kind(s) of formal language does the grammar admit? Explain your answer. (1 point)

b. Add one *sensible* rule to the grammar such that the grammar admits a non-finite, non-deterministic context-free language. Explain the relevant properties of your rules. (1 point)

c. Describe the general form of the sentences belonging to the part (b) language. (1 point)

Task 3

a. What is the general form of context-sensitive grammar rules and why are they necessary to describe cross serial dependencies in Swiss German? (1 point)

b. Consider questions in English. Provide one reason why transformations might be useful in describing the grammar of English questions, and one disadvantage of the transformation approach. (2 points)

Task 4

a. Write down a meaning for the English word "chair" in terms of between 5 and 10 binary features. (1 point)

b. Express the sentence "the teacher sat on the chair" in first-order predicate calculus. (1 point)