Assignment 12
Semantics, WS 2013/14

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www.ps.uni-saarland.de/courses/sem-ws13/

Read in the lecture notes: Chapter 5

Send your Coq solutions for exercises 12.9 and 12.10 to schaefer@ps.uni-saarland.de until Thursday 12:00pm. The solutions will not be graded.

Exercise 12.1 Define a datatype *list nat* in F. Realize the constructors *nil*, *cons*, and a fold function.

Exercise 12.2 Describe the set of canonical elements of the following STLC types.

a) $X \to X$

b) $X \to X \to X$

c) $X \to (X \to X \to X) \to X$

Exercise 12.3 Let $n \in \mathbb{N}$. Give a type in F that has exactly n canonical elements.

Exercise 12.4 Give functions describing conjunction, disjunction, and existential quantification in F_ω. Start by stating the types for these functions. Check your results with Coq. Prove in Coq that your definitions are equivalent to Coq's predefined versions of conjunction, disjunction, and existential quantification.

Exercise 12.5 Let A be a proposition. Give a proposition in CC stating that A has at most one proof.

Exercise 12.6 Give a function $\mathit{bintree} : P \to P$ in F_ω such that $\mathit{bintree}\ A$ represents binary trees labelled with A.

Exercise 12.7 Give a function $\mathit{tree} : P \to P$ in F_ω such that $\mathit{tree}\ A$ represents finitely branching trees labelled with A.

Exercise 12.8 Explain why the condition $\Gamma \vdash \forall x : A.\, B : u$ is needed in the single-sorted presentation of F.

$$\frac{\Gamma \vdash \forall x : A.\, B : u \qquad \Gamma, x : A \vdash s : B}{\Gamma \vdash \lambda x : A.\, s : \forall x : A.\, B}\ x \notin \Gamma$$

Exercise 12.9 (Coq) Define CC in Coq. You can find the definition of CC in the lecture notes, Chapter 5.6 – 5.7.

Exercise 12.10 (Coq) Define CC_ω in Coq. You can find the definition of CC_ω in the lecture notes, Chapter 5.8.