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Theory I, Sheet 9

- The solutions should be submitted in English.
- JUST FOR FUN exercises are not mandatory.
- Your solutions should be delivered to the lockbox in building 051 floor 00, or right before the start of the tutorial (July 2, 4:00 p.m.).
- You are allowed to discuss your solutions with each other. Nevertheless, you are required to write down the answers in your own words.

Exercise 9.1 - Σ-Algebras

1. Explain why $\widehat{\mathcal{J}}$ is required to be a total funtion.
2. Define the ADT bool for the boolean algebra with the function symbols true, false, not, and, or, including the usual identities.
3. Give an implementation for the ADT bool.

Exercise 9.2 - Stack ADT

Specify an ADT Stack(A) for stacks. The operations available for this ADT should be as follows:

- new: Constructs a new empty stack.
- push: Adds an element to the top of the given stack.
- pop: Removes the top element of the given stack.
- top: Returns the top element of the given stack.
- isEmpty: Checks whether a given stack is empty.

Specify the signatures for these operations and define sensible identities for them. What are the constructors of the stack ADT?

Exercise 9.3 - Term induction

JUST FOR FUN. Let s, t be terms and p, q be strings over the natural numbers. Prove the following propositions:

1. If $pq \in \mathcal{P}os(s)$, then $p \in \mathcal{P}os(s)$.
2. If $pq \in \mathcal{P}os(s)$, then $s|_{pq} = (s|_p)|_q$.
3. If $p \in \mathcal{P}os(s)$ and $q \in \mathcal{P}os(t)$, then $(s[t]_p)|_{pq} = t|_q$.