INDIVIDUAL ASSIGNMENT 2

(due: Problem 1: Wednesday Jan. 24; Problem 2:1 Monday Jan. 29, both before class)

- This is not a programming assignment. For this individual assignment prepare a concise (and readable) answer sheet and hand it on the due date, just before class. Write your name and email address on the front page.

Problem 1 (Types, Function Signatures) Below the function signatures are in the style of Haskell type declarations.

a) Explain the type of each of the expressions f₁, f₂, and f₃:

\[
\begin{align*}
f₁ &: \text{String} \to \text{Integer} \\
f₂ &: \text{Integer} \to \text{String} \\
f₃ &: (\text{Integer}, \text{String}) \to \text{Bool}
\end{align*}
\]

Let's assume the domain of each fᵢ is finite. What other names (from the class) describe best the type of each fᵢ?

b) Explain the function signatures for

\[
\begin{align*}
f &: a \to (b \to c) \\
g &: (a \to b) \to c \to d
\end{align*}
\]

Hint: e.g., for f think of integer addition, i.e., let a = b = c = Integer. What are the values and types say for f 17 3 and f 17 if f denotes integer addition.

For g, think of the map function explained in class. What types make sense for c and d in case of the map function?

Problem 2 (Functions vs Relations) “(A \to B)” is the set of all functions from A to B. “(A \times B)” is the Cartesian product of A and B. Let A = \{1, 2, \ldots, n\} and B = \{1, 2, \ldots, m\}

\[
\begin{align*}
a) \text{How many elements has “}(A \times B)\text{”}?
\end{align*}
\]

\[
\begin{align*}
b) \text{How many elements has “}(A \to B)\text{”}?
\end{align*}
\]

\[
\begin{align*}
c) \text{Let } k \text{ be given. How can we model a relation over } A₁, \ldots, Aₖ \text{ as a function? (Hint: it is sufficient to give a Haskell signature)}
\end{align*}
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1But preferably you should turn in Problem 2 together with Problem 1, since there will be a programming assignment coming out on Wednesday!