DM552 Exercises 1

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1. What are the types of the following values?

   $[\texttt{'a'}, \texttt{'b'}, \texttt{'c'}]$
   $(\texttt{'a'}, \texttt{'b'}, \texttt{'c'})$
   $[(\mathit{False}, \texttt{'0'}), (\mathit{True}, \texttt{'1'})]$
   $([\mathit{False}, \texttt{'0'}], [\mathit{True}, \texttt{'1'}])$
   $[\mathit{tail}, \mathit{init}, \mathit{reverse}]$

2. Construct the above values by explicitly using the constructors

   $[\,] :: [a]$
   $(:) :: a \to [a] \to [a]$
   $(,) :: a \to b \to (a, b)$

3. What are the types of the following functions?

   $$\begin{aligned} \mathit{second}\ xs &= \mathit{head}\ (\mathit{tail}\ xs) \\ \mathit{swap}\ (x, y) &= (y, x) \\ \mathit{pair}\ x\ y &= (x, y) \\ \mathit{double}\ x &= x * 2 \\ \mathit{palindrome}\ xs &= \mathit{reverse}\ xs \equiv xs \\ \mathit{twice}\ f\ x &= f\ (f\ x) \end{aligned}$$

4. What are the types of the following expressions? What do they do?

   $(:)\ \texttt{'a'}$
   $(,)\ 5$
   $(+)\ 2$

5. Give the implementation of a function $orElse :: Maybe\ t \to t \to t$ such that

   $expression\ `orElse`\ fallback$

   equals *fallback* if *expression* is constructed using *Nothing*, and the value v if it is constructed using $Just\ v$.

6. Give examples of functions with the following types. (Your functions are allowed to be more general, but should work with the following types).

   $$f :: Num\ a \Rightarrow (a \to a) \to a$$
   $$g :: Num\ a \Rightarrow a \to (a \to a)$$
   $$h :: Num\ a \Rightarrow (a \to a) \to (a \to a)$$

7. Give a definition of a function $sign :: Num\ a \Rightarrow a \to a$ which returns 1 if its argument is positive, -1 if its argument is negative, and 0 otherwise.

8. Suggest possible types for the following functions

   $$one\ x = 1$$
   $$apply\ f\ x = f\ x$$
   $$compose\ f\ g\ x = f\ (g\ x)$$