Function Application Examples

$[Item, Dog, PersonRes, XRes]$

This file demonstrates function application in Z notation definitions.

Example 1 : Basic function definitions

$$
\begin{array}{|l}
squareRes : \mathbb{N} \longrightarrow \mathbb{N} \\
double : \mathbb{N} \longrightarrow \mathbb{N} \\
\hline
\forall\, n : \mathbb{N} \bullet squareRes(n) = n * n \\
\forall\, n : \mathbb{N} \bullet double(n) = 2 * n
\end{array}
$$

Example 2 : Functions with multiple arguments

$$
\begin{array}{|l}
add : \mathbb{N} \times \mathbb{N} \longrightarrow \mathbb{N} \\
maximum : \mathbb{N} \times \mathbb{N} \longrightarrow \mathbb{N} \\
\hline
\forall\, a, b : \mathbb{N} \bullet add(a, b) = a + b \\
\forall\, a, b : \mathbb{N} \bullet (maximum(a, b) = a \lor maximum(a, b) = b) \land maximum(a, b) \geq a \land maximum(a, b) \geq b
\end{array}
$$

Example 3 : Generic functions

$$
\begin{array}{|l}
[XRes] \\
\hline
collection : \mathrm{seq}\ XRes \\
\hline
\end{array}
$$

Example 4 : Function application elem quantifiers

$$
\begin{array}{|l}
posFunc : \mathbb{N} \longrightarrow \mathbb{N} \\
\hline
\forall\, x : \mathbb{N} \bullet posFunc(x) > 0 \Rightarrow posFunc(x) > 0
\end{array}
$$

Example 5 : Schema with function type

$$
\begin{array}{|l}
Heights \\
\hline
height : PersonRes \longrightarrow \mathbb{N} \\
\hline
\forall\, p : PersonRes \bullet height(p) > 0 \land height(p) < 300 \\
\hline
\end{array}
$$

Example 6 : Nested function application

$$
\begin{array}{|l}
func1 : \mathbb{N} \longrightarrow \mathbb{N} \\
func2 : \mathbb{N} \longrightarrow \mathbb{N} \\
func3 : \mathbb{N} \longrightarrow \mathbb{N} \\
\hline
\forall\, x : \mathbb{N} \bullet func1(func2(func3(x))) \geq 0
\end{array}
$$