

Phase 11 a : Function Types

Total functions (every element in domain has a mapping):

$$| \quad f : X \rightarrow Y$$

Partial functions (some elements may not have a mapping):

$$| \quad f : X \nrightarrow Y$$

Injections (one-to-one mappings):

$$| \quad f_{total} : X \rightarrowtail Y$$

Surjections (onto mappings):

$$| \quad f_{total} : X \twoheadrightarrow Y$$

Bijections (one-to-one and onto):

$$| \quad f : X \rightleftarrows Y$$

Complex function types (nested and higher-order):

$$| \quad f : X \rightarrow Y \rightarrow \mathbb{Z}$$

$$\begin{array}{c} | \quad g : X \rightarrow (Y \rightarrow \mathbb{Z}) \\ | \quad h : \mathbb{N} \rightarrow \mathbb{N} \rightarrow (\mathbb{N} \rightarrow \mathbb{N}) \end{array}$$

Mixed operators (relations and function types work together):

$$\begin{array}{c} | \quad relation : X \leftrightarrow Y \\ | \quad function : X \rightarrow Y \\ \hline | \quad function \subseteq relation \end{array}$$