

Phase 11 a : Function Types

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

$$\mid f : X \rightarrow Y \quad g : N \rightarrow N$$

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

$$\mid f : X \rightharpoonup Y$$

Injections (one-to-one mappings):

$$\mid f_{total} : X \hookrightarrow Y \quad f_{partial} : X \hookrightarrow Y$$

Surjections (onto mappings):

$$\mid f_{total} : X \twoheadrightarrow Y \quad f_{partial} : X \twoheadrightarrow Y$$

Bijections (one-to-one and onto):

$$\mid f : X \xrightarrow{\sim} Y$$

Complex function types (nested and higher-order):

$$\mid f : X \rightarrow Y \rightarrow Z \quad g : X \rightarrow Y \rightarrow Z \quad h : N \rightarrow N \rightarrow N \rightarrow N$$

Mixed operators (relations and function types work together):

$$\mid \frac{relation : X \leftrightarrow Y \quad function : X \rightarrow Y}{function \subseteq relation}$$