

Phase 11 a : Function Types

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

$$\mid f : X \rightarrow Y, g : \mathbb{N} \rightarrow \mathbb{N}$$

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

$$\mid f : X \rightarrow Y$$

Injections (one-to-one mappings):

$$\mid f_{total} : X \rightarrow Y, f_{partial} : X \rightarrow Y$$

Surjections (onto mappings):

$$\mid f_{total} : X \rightarrow Y, f_{partial} : X \rightarrow Y$$

Bijections (one-to-one and onto):

$$\mid f : X \rightarrow Y$$

Complex function types (nested and higher-order):

$$\mid f : X \rightarrow Y, g : X \rightarrow (Y \rightarrow \mathbb{Z}), h : \mathbb{N} \rightarrow \mathbb{N} \rightarrow (\mathbb{N} \rightarrow \mathbb{N})$$

Mixed operators (relations and function types work together):

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