

## Phase 11 a : Function Types

$$[XDR, YDR, Z]$$

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

$$\left| \begin{array}{l} totalF1 : XDR \longrightarrow YDR \\ totalF2 : \mathbb{N} \longrightarrow \mathbb{N} \end{array} \right.$$

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

$$\left| \quad partialF : XDR \rightharpoonup YDR \right.$$

Injections (one-to-one mappings):

$$\left| \begin{array}{l} injTotal : XDR \hookrightarrow YDR \\ injPartial : XDR \hookrightarrow YDR \end{array} \right.$$

Surjections (onto mappings):

$$\left| \begin{array}{l} surjTotal : XDR \twoheadrightarrow YDR \\ surjPartial : XDR \twoheadrightarrow YDR \end{array} \right.$$

Bijections (one-to-one and onto):

$$\left| \quad bijection : XDR \xrightarrow{\sim} YDR \right.$$

Mixed operators (relations and function types work together):

$$\left| \begin{array}{l} relationDR : XDR \longleftrightarrow YDR \\ function : XDR \longrightarrow YDR \end{array} \right.$$