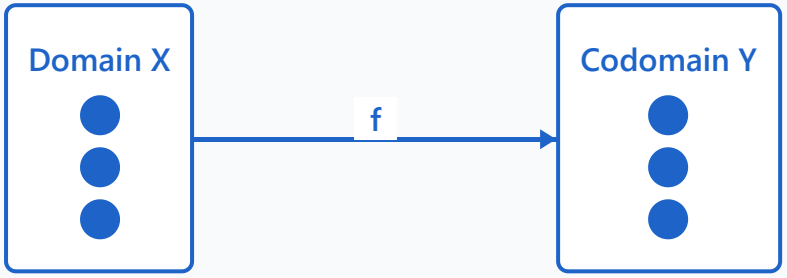
Functions and Mapping Concepts

Function: f: X → Y



Each input maps to **exactly one** output

Domain X: Set of all possible inputs

Codomain Y: Set of all possible outputs

Range: Actual outputs achieved by f

One-to-one (Injective)

Different inputs → Different outputs
No two inputs map to the same output

Onto (Surjective)

Every output is reached
Range = Codomain

Bijection

Both injective and surjective
Perfect one-to-one correspondence

ML Application

Regression models are functions
f(x) = y

Function Mapping Examples

Natural Number Division

f: ℕ × ℕ\{0} → ℚ

- f(6, 2) = 3
- f(7, 2) = 3.5

Square Function

f: ℝ → ℝ≥0

- f(-3) = 9
- f(0) = 0

Absolute Value

f: ℝ → ℝ≥0

- f(-5) = 5
- f(0) = 0

• f(10, 4) = 2.5

✓ Well-defined function
Each pair maps to unique rational

• f(4) = 16

✓ Surjective onto non-negative reals
✗ Not injective (±x → same output)

• f(3) = 3

✓ Surjective onto non-negative reals
✗ Not injective (±x → same output)