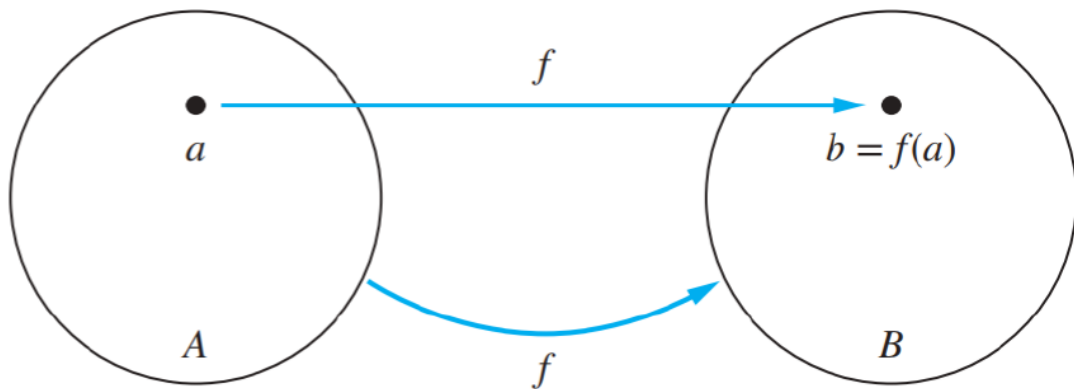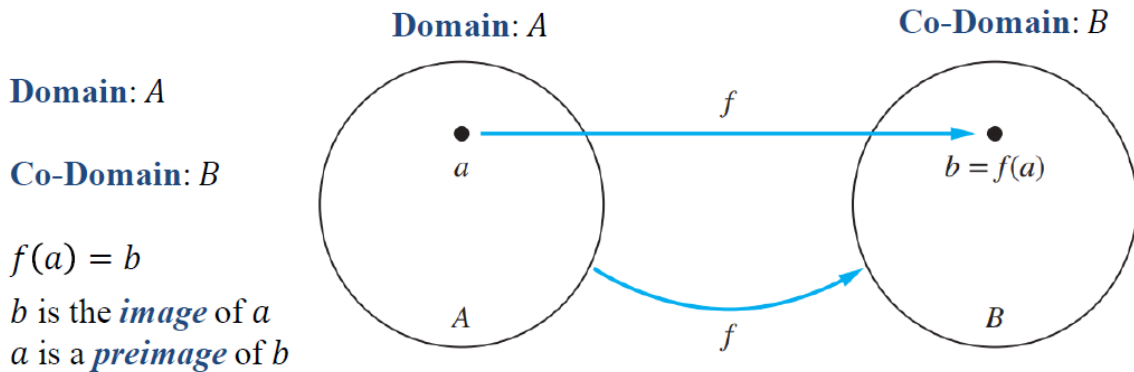# The Function $f: A \rightarrow B$

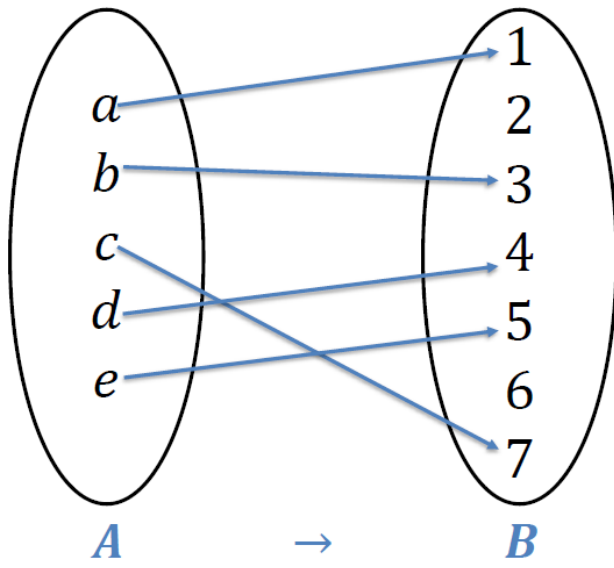

The function f maps A to B.

The Function $f: A \rightarrow B$

Domain: A

Co-Domain: B

$f(a) = b$

b is the *image* of a
a is a *preimage* of b

The **range**, or image, of f
is the *set of all images* of
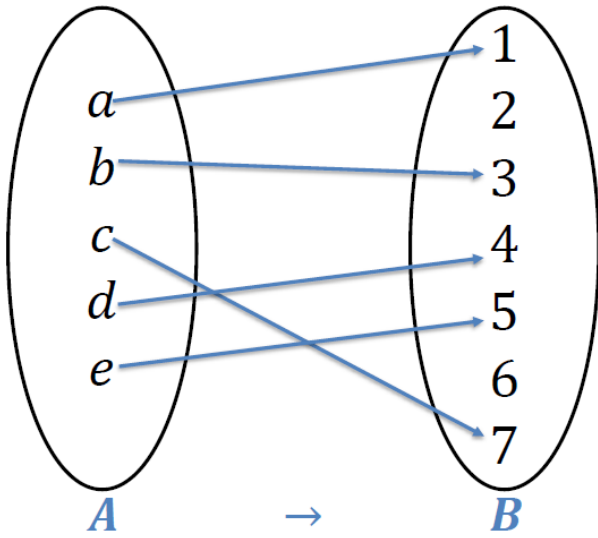elements of A.

The function f maps A to B.

Domain $= \{a, b, c, d, e\}$

Co-Domain $= \{1,2,3,4,5,6,7\}$

Range $= \{1,3,4,5,7\}$

One-to-One function (injective)

$$f(a) = 1$$

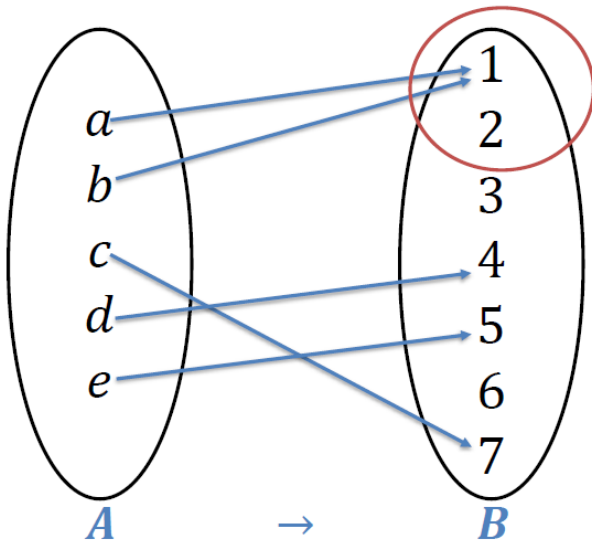$$f(b) = 3$$

$$f(c) = 7$$

$$f(d) = 4$$

$$f(e) = 5$$
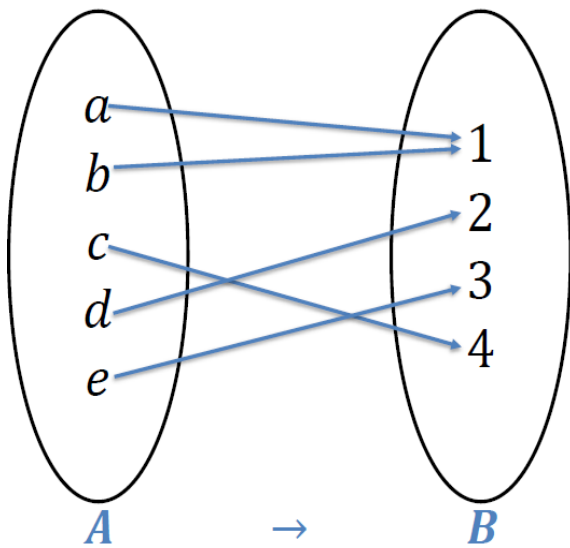
NOT One-to-One function (Not injective)

$$f(a) = 1$$

$$f(b) = 1$$

$$f(c) = 7$$

$$f(d) = 4$$

$$f(e) = 5$$

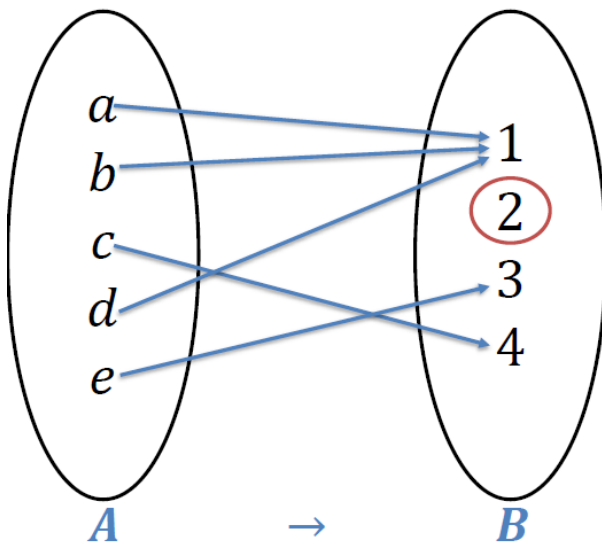## *onto* function (surjective)

$f(a) = 1$

$f(b) = 1$

$f(c) = 4$

$f(d) = 2$

Co-Domain = {1,2,3,4}

$f(e) = 3$

Range = {1,2,3,4}

NOT *onto* function (Not surjective)
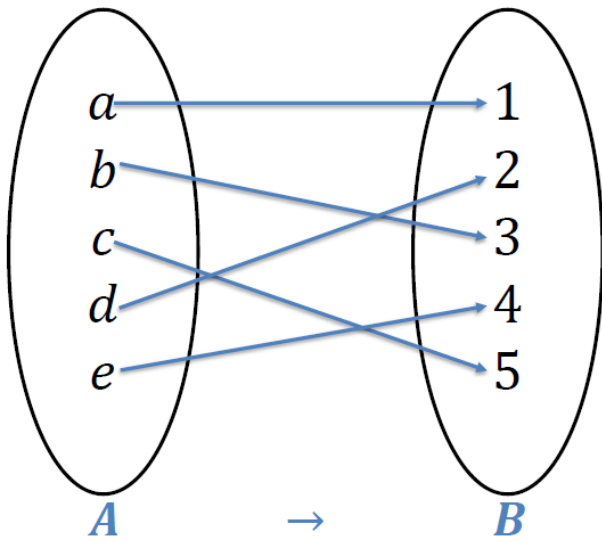

$f(a) = 1$

$f(b) = 1$

$f(c) = 4$

$f(d) = 1$

Co-Domain = {1,2,3,4}

$f(e) = 3$

Range = {1,3,4}

One-to-one correspondence (bijection)
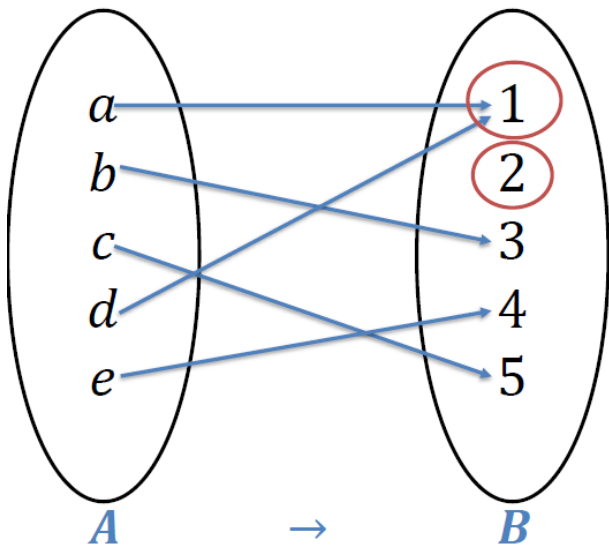
$|A| = |B|$

$f(a) = 1$

$f(b) = 3$

$f(c) = 5$

$f(d) = 2$

$f(e) = 4$

Co-Domain = {1,2,3,4,5}

Range = {1,2,3,4,5}

NOT *One-to-one correspondence* (Not bijection)

$f(a) = 1$

$f(b) = 3$ **NOT** one-to-one

$f(c) = 5$ **NOT** onto

$f(d) = 1$

$f(e) = 4$

Co-Domain = {1,2,3,4,5}

Range = {1,3,4,5}

NOT *One-to-one correspondence* (Not bijection)
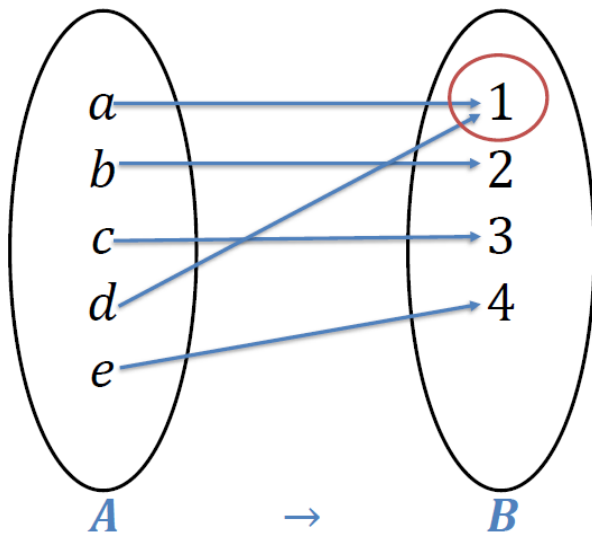
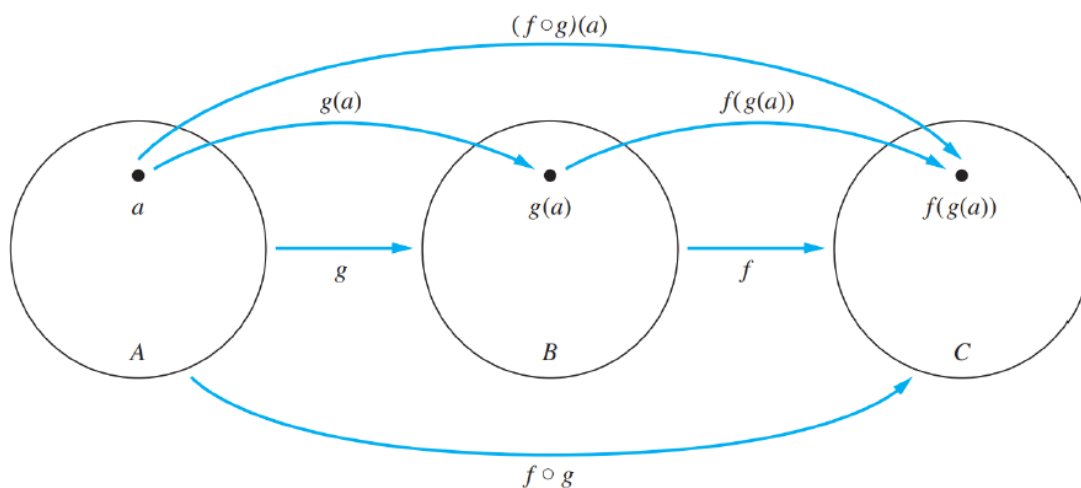

$f(a) = 1$

$f(b) = 2$ **Onto**

$f(c) = 3$ **NOT** one-to-one

$f(d) = 1$

$f(e) = 4$

Co-Domain = {1,2,3,4}

Range = {1,2,3,4}

Composition of the Functions f and g

$$(f \circ g)(a) = f(g(a)).$$

Example:
Let g be the function from the set $\{a,b,c\}$ to itself such that g(a) = b, g(b) = c, and g(c) = a.
Let f be the function from the set $\{a,b,c\}$ to the set $\{1,2,3\}$ such that f(a) = 3 , f(b) = 2 , and f(c) = 1. What is the composition of f and g?