

Types of Function

**Ms. Rajanpreet Kaur Chahal
Assistant Professor, CSE**

Thapar Institute of Engineering & Technology, Patiala

Email: rajanpreet@thapar.edu

Types of Function

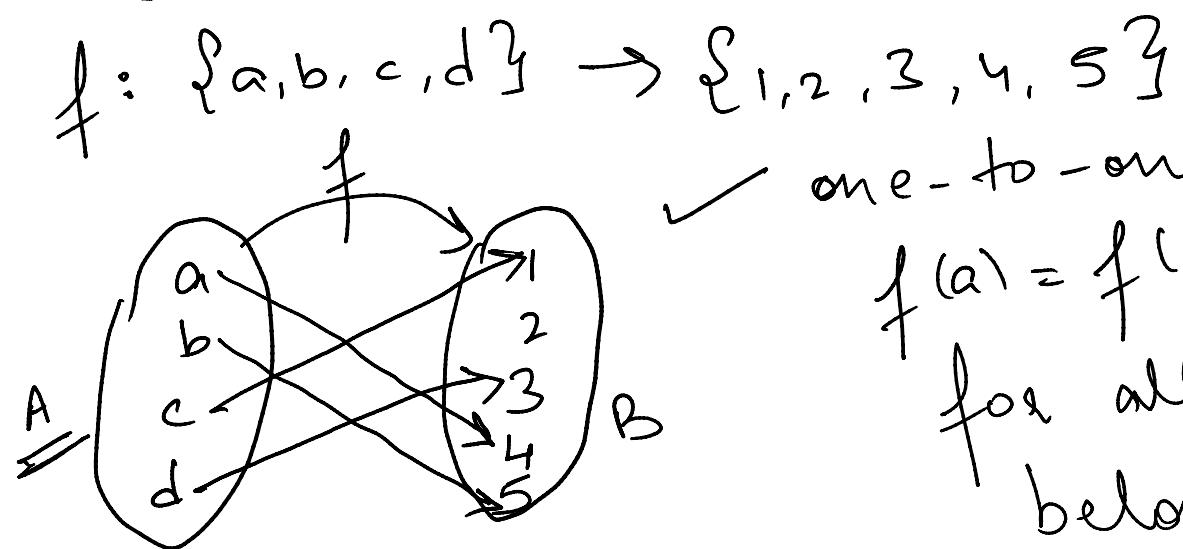
- ▶ A function can be of three types:
 - One-to-One function (Injective function)
 - Onto function (Surjective function)
 - One-to-One Correspondence (Bijective function)

One-to-One function

- ▶ A function f is said to be *one-to-one*, or an *injunction*, if and only if $f(a) = f(b)$ implies that $a = b$ for all a and b in the domain of f .
- ▶ A function is said to be *injective* if it is one-to-one.

Example 1

- Determine whether the function f from $\{a, b, c, d\}$ to $\{1, 2, 3, 4, 5\}$ with $f(a) = 4, f(b) = 5, f(c) = 1$, and $f(d) = 3$ is one-to-one.



✓ one-to-one.

$$f(a) = f(b) \Rightarrow a = b \quad \checkmark$$

for all elements a and b
belonging to domain of f .

Example 2

- Determine whether the function $f(x) = x^2$ from the set of integers to the set of integers is one-to-one.

$$\begin{aligned} f: \mathbb{Z} &\rightarrow \mathbb{Z} \\ f(n) &= n^2 \\ f(-1) &= (-1)^2 = 1 \\ f(1) &= 1^2 = 1 \end{aligned}$$

$$f(-1) = f(1) \text{ but } -1 \neq 1$$

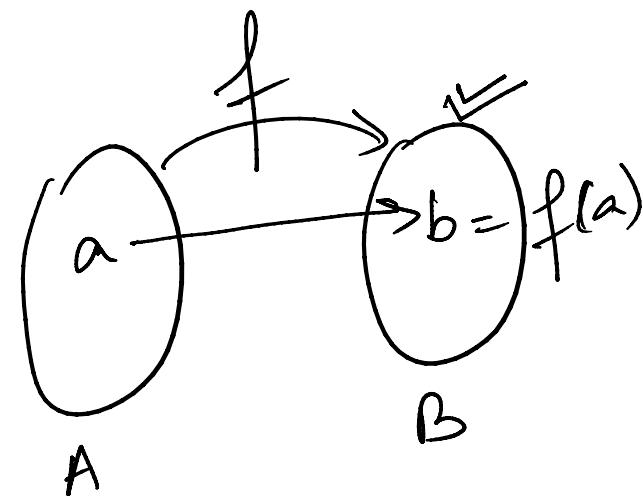
$$(f(a) = f(b) \Rightarrow a = b)$$

∴ not one-to-one

Onto function

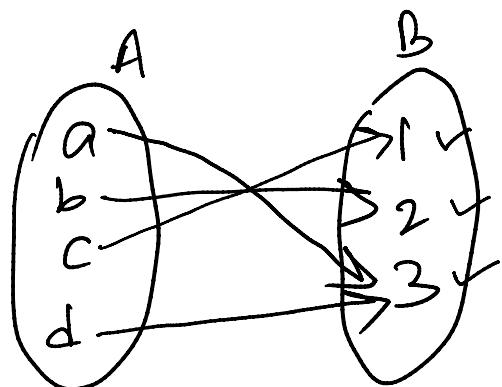
- ▶ A function f from A to B is called *onto*, or a surjection, if and only if for every element $\underline{b \in B}$ there is an element $\underline{a \in A}$ with $\underline{f(a) = b}$.
- ▶ A function f is called surjective if it is onto.

$$\overline{f : A \rightarrow B}$$



Example 1

- Let f be the function from $\{a, b, c, d\}$ to $\{1, 2, 3\}$ defined by $f(a) = \underline{3}, f(b) = \underline{2}, f(c) = \underline{1}$, and $f(d) = \underline{3}$. Is f an onto function?



Onto ✓
every element $b \in B$ has an element
 $a \in A$ such that $f(a) = b$.

Example 2

- ▶ Is the function $f(x) = \check{x^2}$ from the set of integers to the set of integers onto?

$$f: \mathbb{Z} \rightarrow \mathbb{Z}$$

$$f(x) = \check{x^2}$$

3 is not the square of any integer.

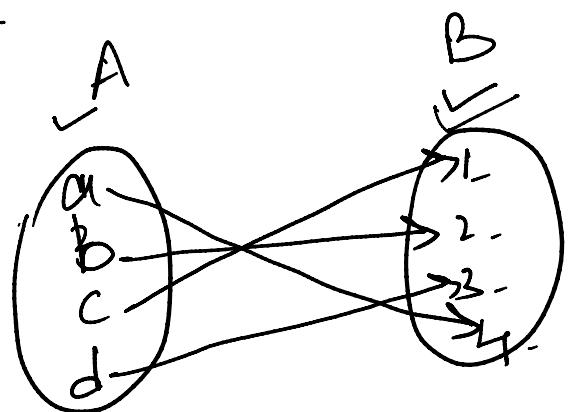
Not onto.

One-to-One correspondence

- ▶ The function f is a *one-to-one correspondence*, or a *bijection*, if it is both one-to-one and onto.
- ▶ A function f is called *bijection* if it is one to one and onto.

Example 1

- Let f be the function from $\{a, b, c, d\}$ to $\{1, 2, 3, 4\}$ with $f(a) = 4, f(b) = 2, f(c) = 1$, and $f(d) = 3$. Is f a bijection?



One-to-one:

$$a \neq b,$$

onto:

such that

onto.

$f(a) = f(b)$ implies that
 \therefore this fn. is one-to-one.

For every $b \in B, \exists a \in A$

$f(a) = b. \therefore$ this fn. is

$\therefore f$ is a bijection - ✓

Example 2

- ▶ Is the function $f(x) = x^2$ from the set of integers to the set of integers bijective?

Example 2

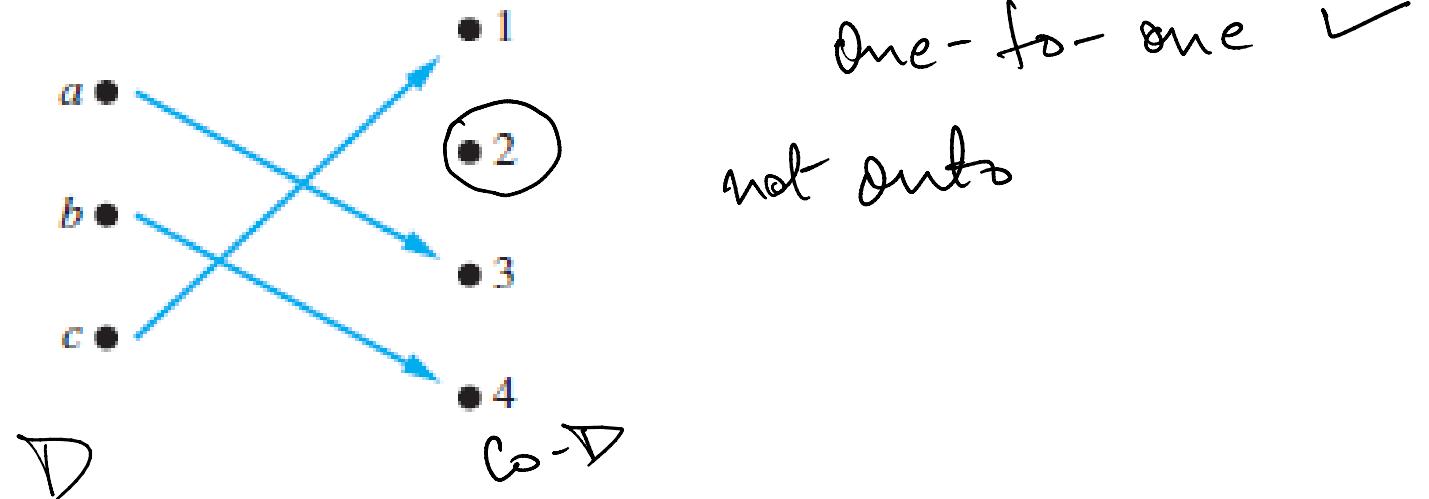
- Is the function $f(x) = x^2$ from the set of integers to the set of integers bijective?

$f(n) = n^2$ is not one-to-one &

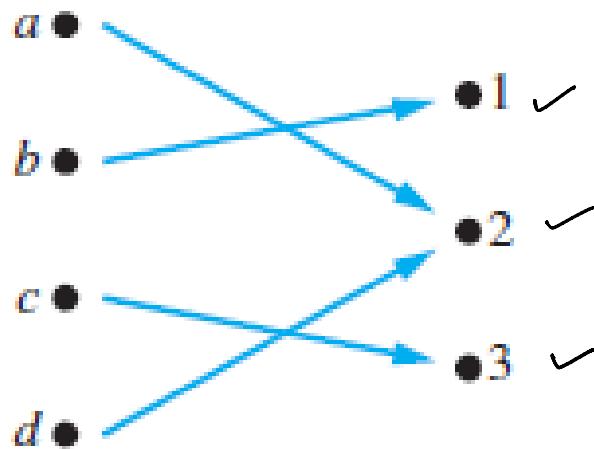
$f(n) = n^2$ is not onto.

∴ $f(n) = n^2$ from \mathbb{Z} to \mathbb{Z} is not bijective.

Examples of Different Types of Correspondences



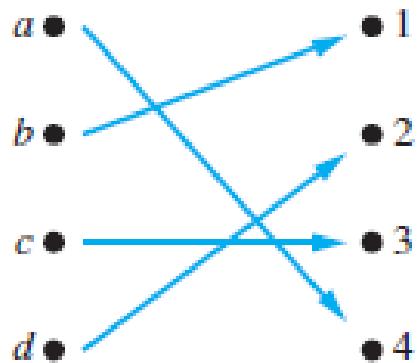
Examples of Different Types of Correspondences



One-to-one? $f(a) = f(d) = 2$
but $a \neq d$

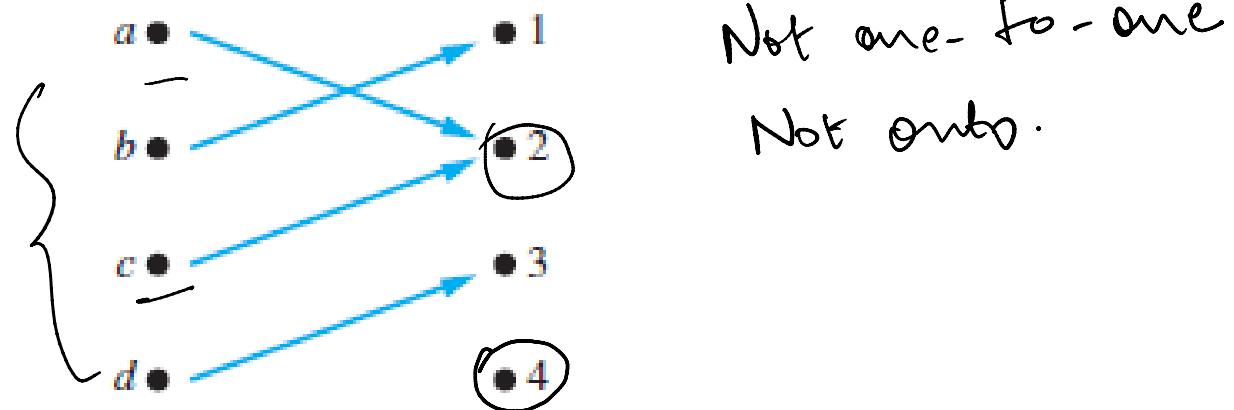
Not one-to-one
Onto? ✓

Examples of Different Types of Correspondences



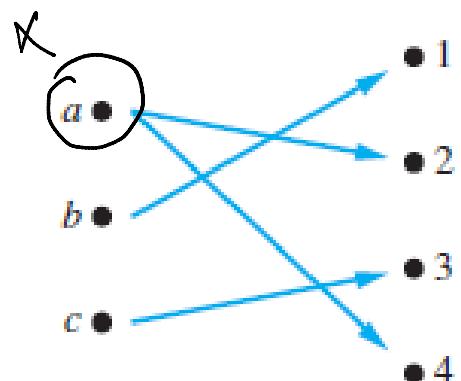
One-to-one ✓
onto ✓

Examples of Different Types of Correspondences

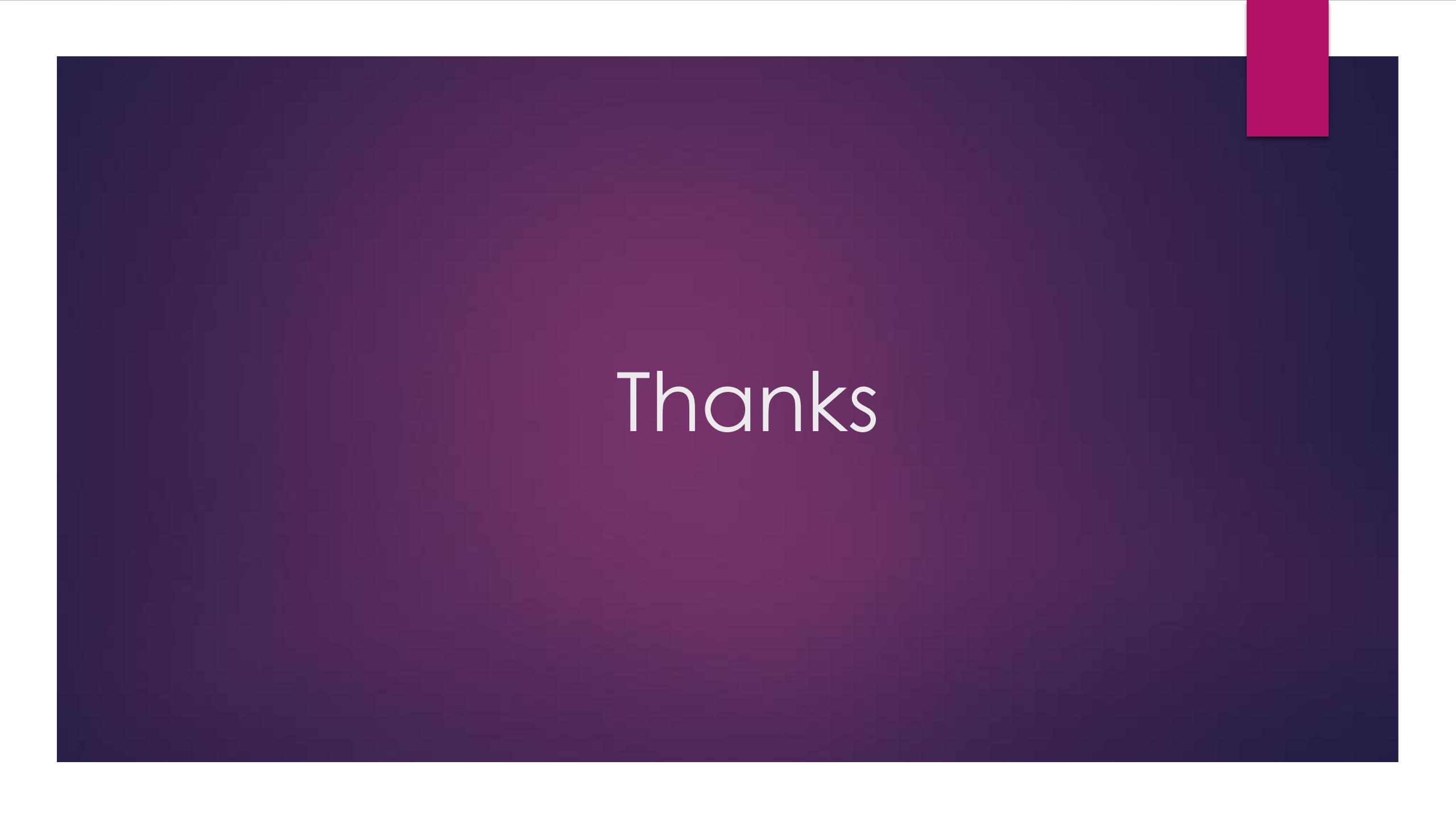


Not one-to-one
Not onto.

Examples of Different Types of Correspondences



Not a ~~function~~.



Thanks