Function

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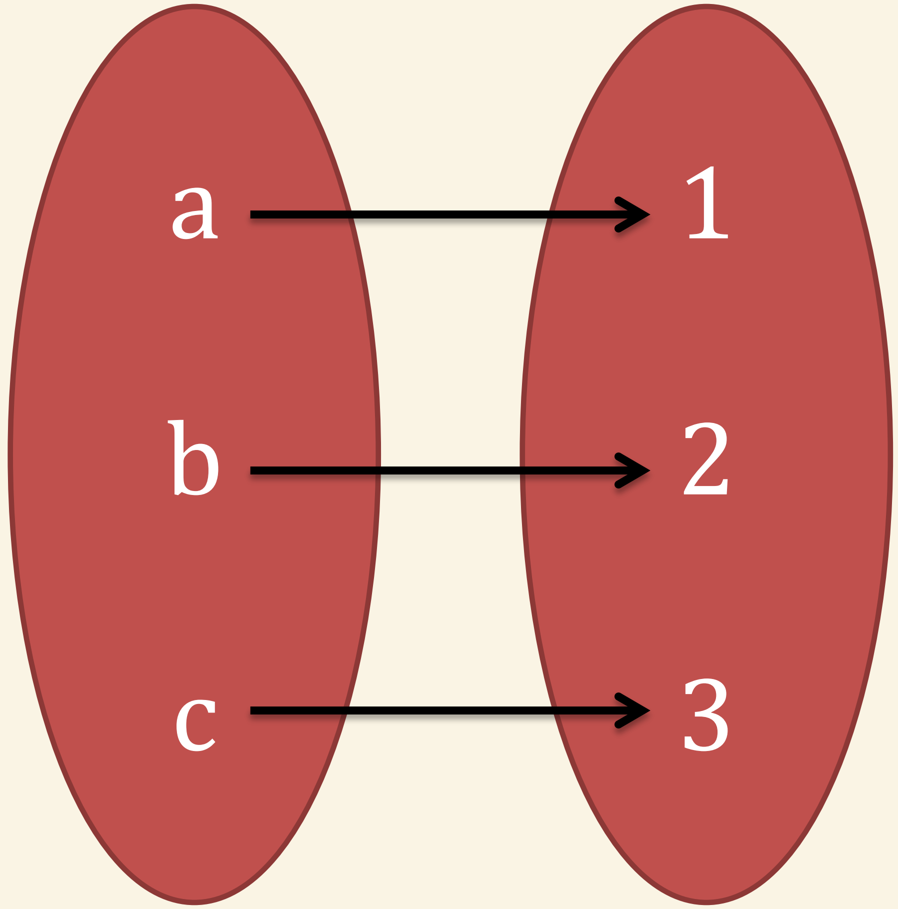
What is Function?

Function

- A **Function, f(x)** assigns to each element of a **set**, exactly **one** element of a related **set**.

A = {a, b, c}

B = {1, 2, 3}



Function Mapping

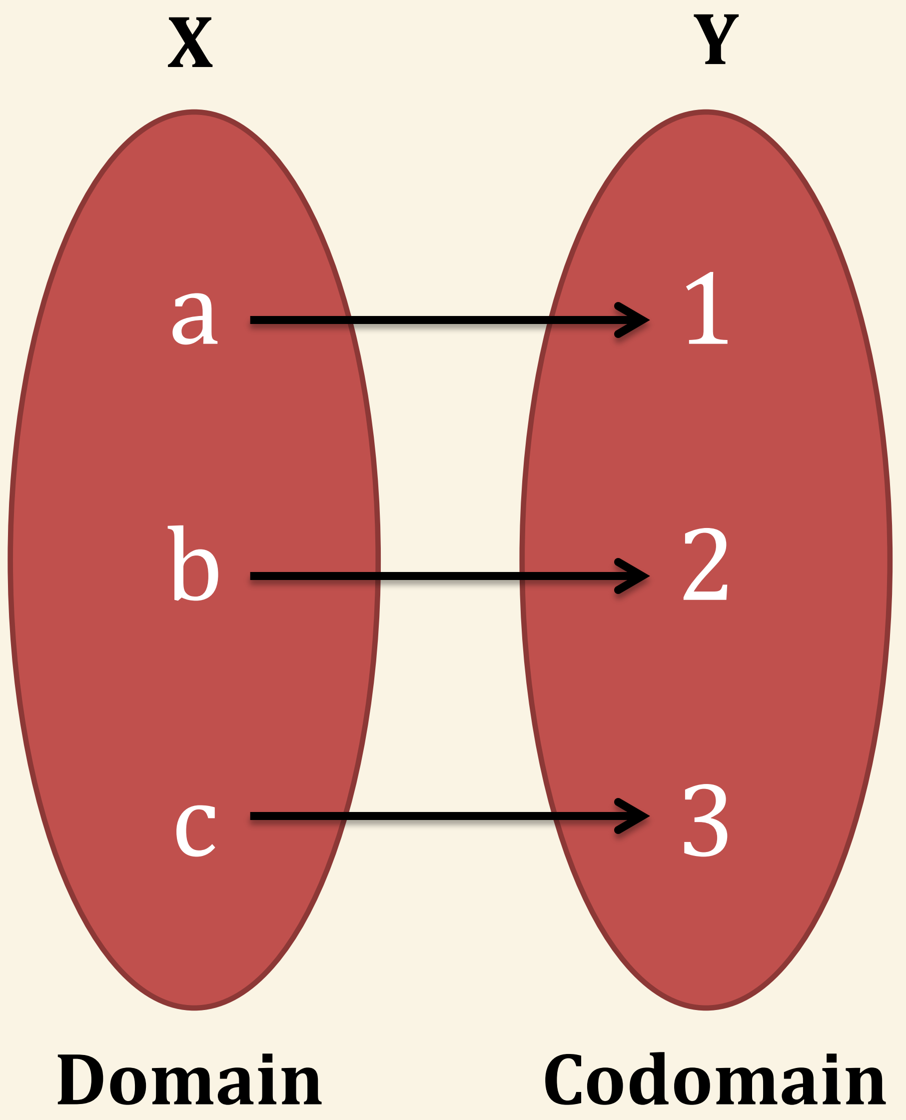
- A Function mapping defined as $\mathbf{f : X \rightarrow Y}$.
- It is relationship from element of one set **X** to element of another set **Y**. **X** and **Y** are **non-empty** sets.
- **X** is called domain and **Y** is called codomain of function **f**.

Function Mapping

- **Example:**

X = {a, b, c}

Y = {1, 2, 3}



Bijective Function

Bijective Function

- **Bijective function** is a function between the elements of **two sets**, where each element of **one** set is **paired** with exactly **one** element of the other set, and each element of the **other** set is **paired** with exactly one element of the **first** set.

Bijective Function

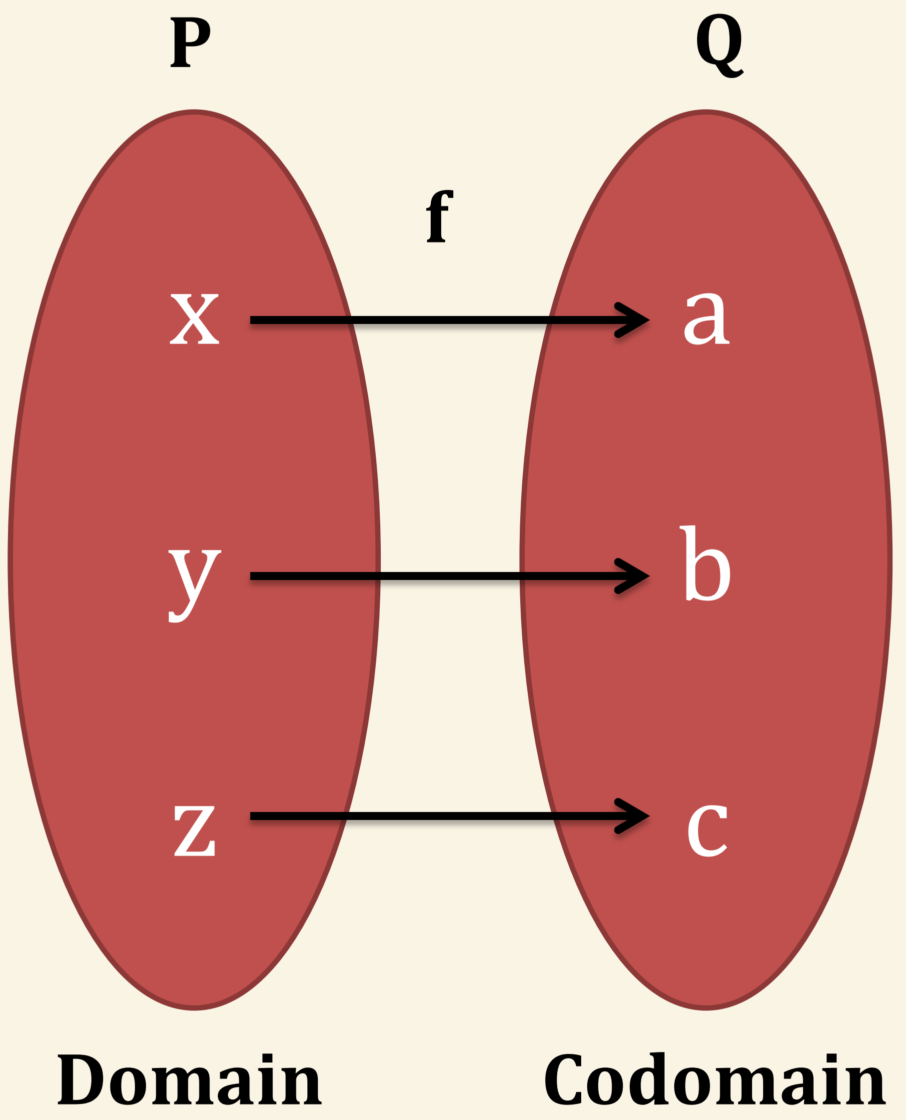
- **Example:**

Consider P = {x, y, z}

Q = {a, b, c}

and f : P → Q such that

f = {(x,a), ((y,b), (z,c)}



Question

Q1. What is bijective function (f) on set A and B. Draw the domain and codomain.

Consider $A = \{p, q, r\}$

$B = \{a, b, c\}$

$f = ?$

Inverse Function

Inverse Function

- The inverse function is a bijective function $\mathbf{f : A \to B}$, is the function $\mathbf{g : B \to A}$
- An inverse function reverses the assignment rule of **f**.
- It starts with an element **B** in the **codomain** of **f**, and **recovers** the element **A** in the **domain** of **f.**

Inverse Function

- **Example:**

Consider A = {x, y, z}

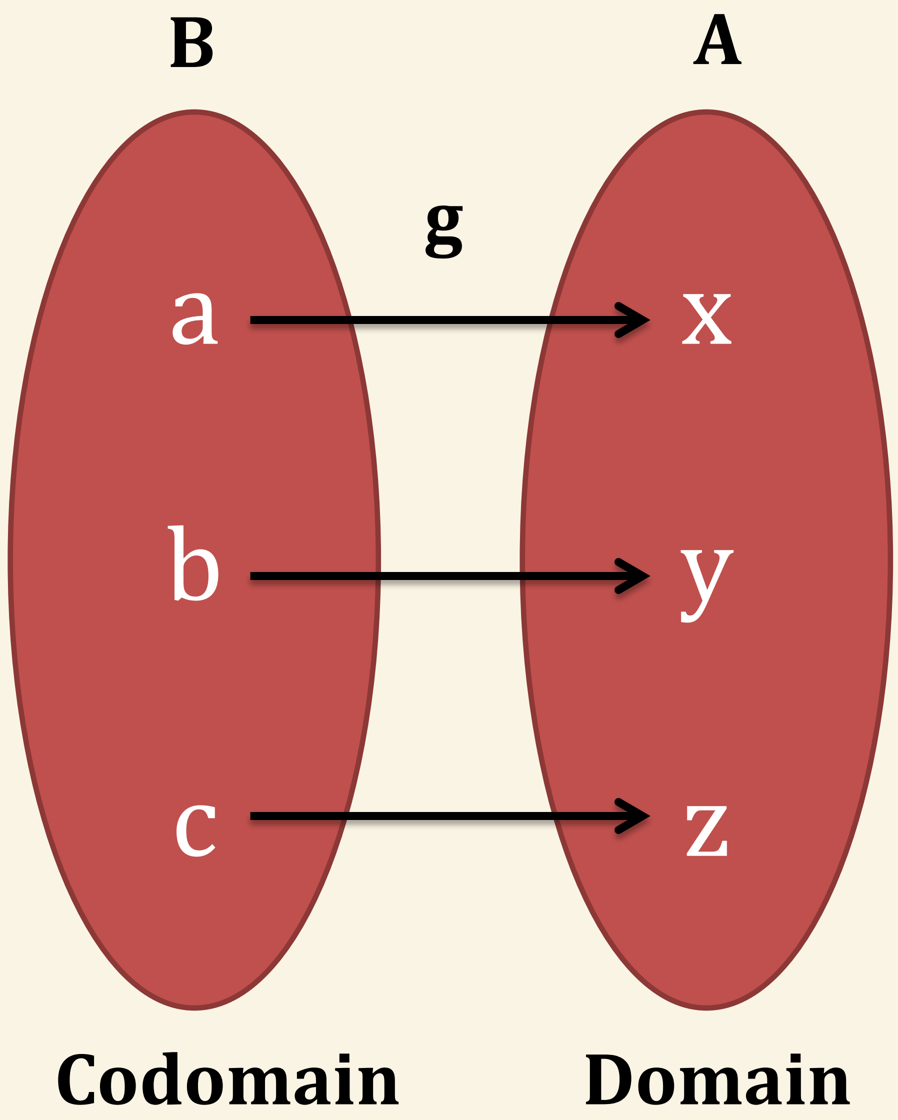
B = {a, b, c}

and f : A → B such that

f = {(x,a), ((y,b), (z,c)}

and g : B → A such that

g= {(a,x), ((b,y), (c,z)}



Question

Q1. What is bijective function (f) and inverse function (g) on set A and B. Draw the domain and codomain.

Consider A = {1, 3, 5}

B = {2, 4, 6}

f = ?

g = ?

Permutation Function

Permutation Function

- A permutation is a one-to-one function from a set onto itself.
- A permutation is a function that rearranges the order of terms in a sequence.

A = {a, b} |A|= 2	Permutation Function (A) = 2! 2! = 2 X 1 2! = 2

Permutation Function

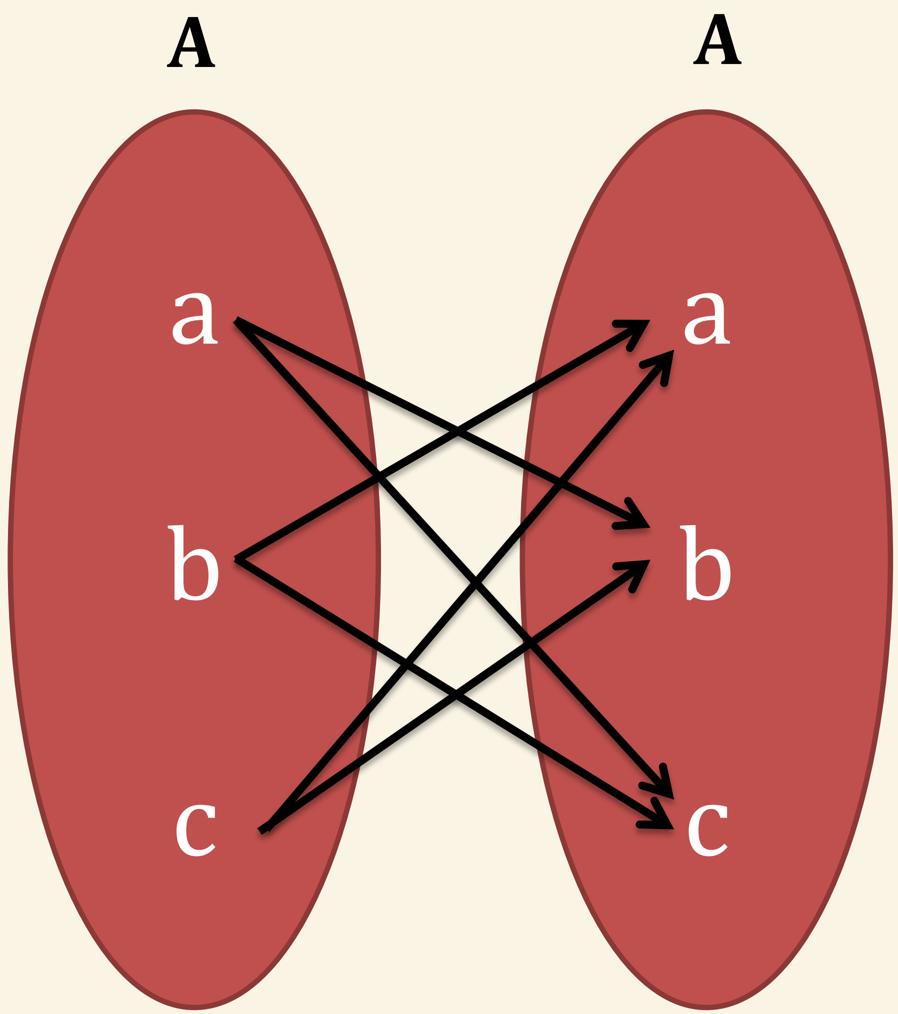
- **Example**:

A = {a, b, c}

|A| = 3

3! = 3 x 2 x 1 = 6

f = {(a,b), (a,c), (b,a), (b,c), (c,a), (c,b)}



Compositions of Functions

Compositions of Functions

- Consider functions, **f : A → B** and **g : B → C**.
- The composition of **f** with **g** is a function from **A** into **C**.
- **Example**

A = {1, 2, 3} B = {a, b} C = {5, 6, 7}	Consider the function **f = {(1, a), (2, a), (3, b)}** and **g = {(a, 5), (b, 7)}** Find the composition?

Compositions of Functions

A = {1, 2, 3}

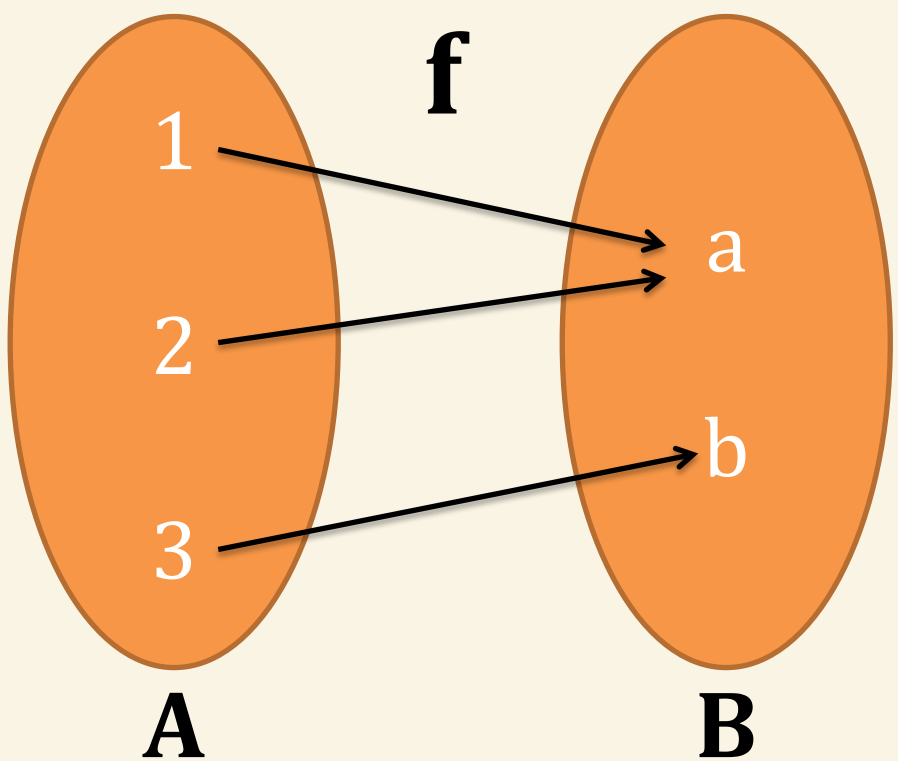
B = {a, b}

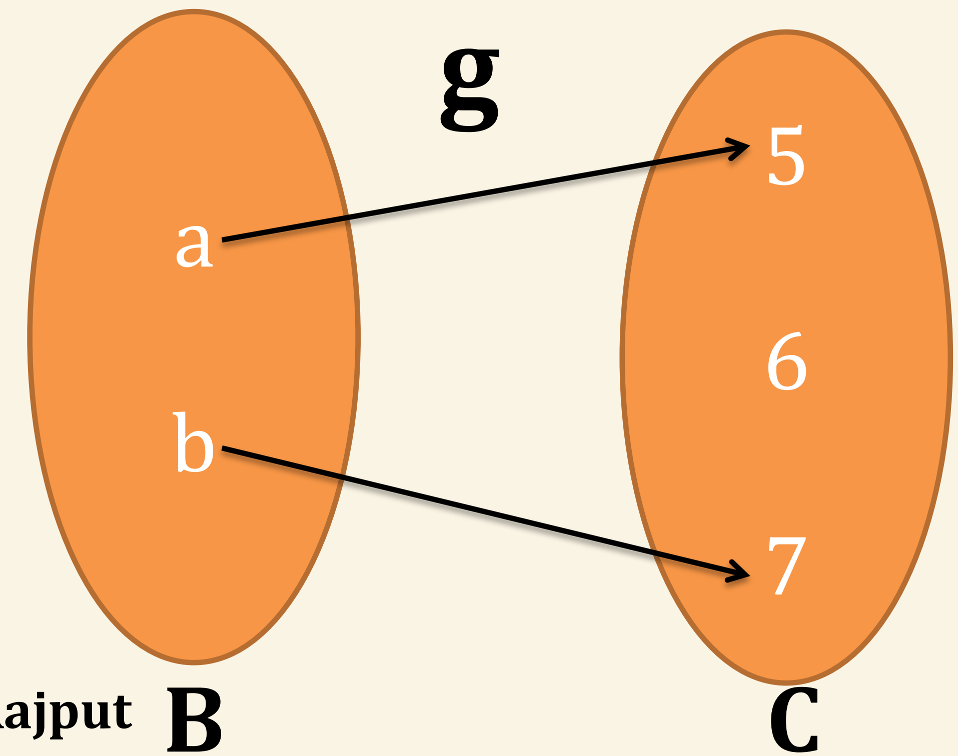
C = {5, 6, 7}

Consider the function

f = {(1, a), (2, a), (3, b)} and

g = {(a, 5), (b, 7)} Find the composition?





Compositions of Functions

A = {1, 2, 3}

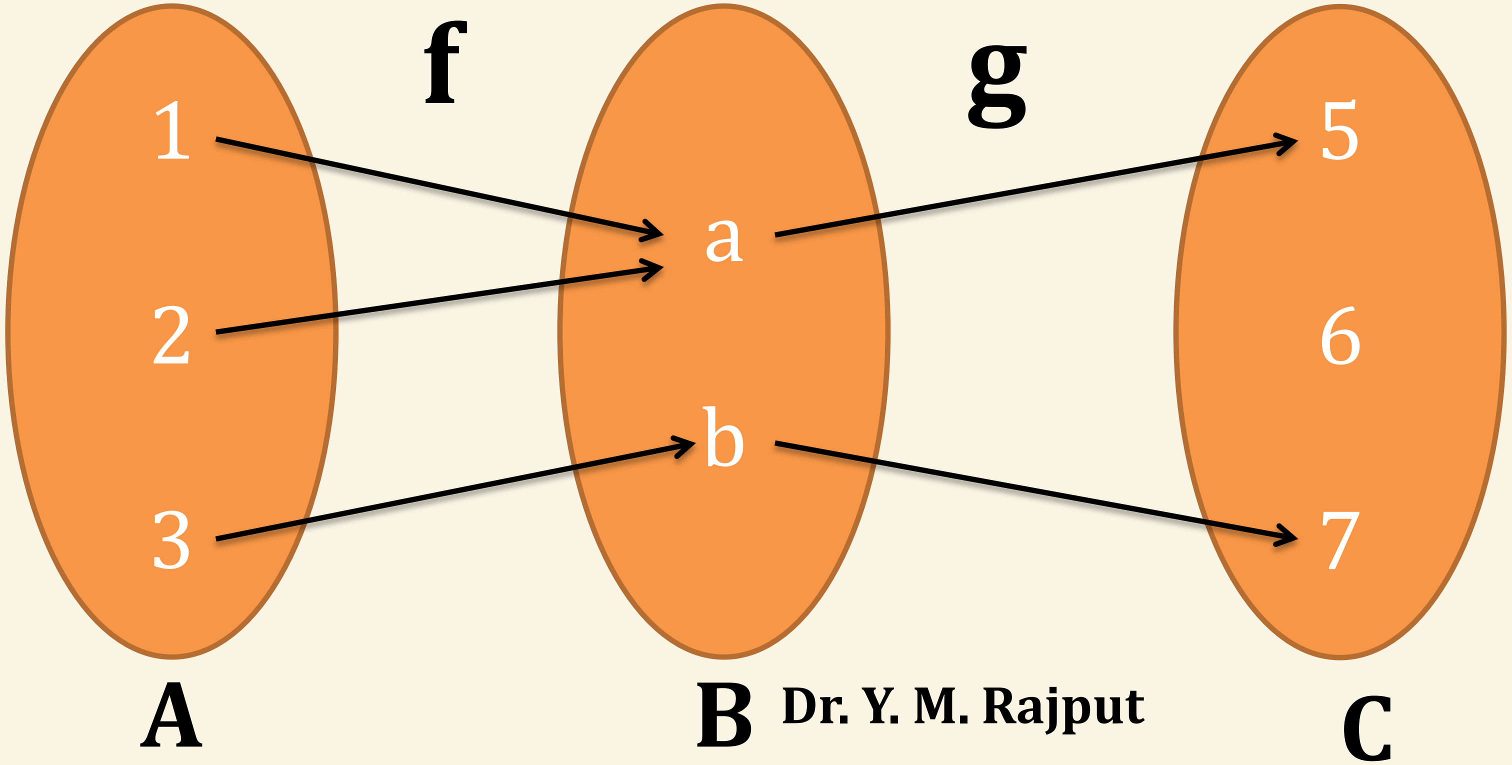
B = {a, b}

C = {5, 6, 7}

Consider the function

f = {(1, a), (2, a), (3, b)} and

g = {(a, 5), (b, 7)} Find the composition?



Question

X = {a, b, c}

Y = {1, 2, 3}

Z = {e, f, g}

Consider the function

f = {(a,1), (b,2), (c,3)} and

g = {(1,e), (2,g), (3,f)}

Find the composition?

Lattice and Its Properties

Lattice

- Let **L** be a non-empty set closed under two binary operations called **meet (lower bound)** and **join (upper bound)** , denoted by ∧ and ∨.

- Then L is called a **lattice** if **a, b, c** are elements in **L**.

Properties of Lattice

1. Idempotent Law:

(i) $a \vee a = a$

(ii) $a \wedge a = a$

a = {1, 2, 3}

a ∪ a = {1, 2, 3} or a ⋁ a = {1, 2, 3} = **a**

a ∩ a = {1, 2, 3} or a ⋀ a = {1, 2, 3} = **a**

Properties of Lattice

2. Commutative Law:

(i) $\boldsymbol{a} \vee \boldsymbol{b} = \boldsymbol{b} \vee \boldsymbol{a}$

(ii) $\boldsymbol{a} \wedge \boldsymbol{b} = \boldsymbol{b} \wedge \boldsymbol{a}$

a = {1, 2, 3}

b = {2, 3, 4}

a ∨ b = {1, 2, 3, 4}

b ∨ a = {1, 2, 3, 4}

a ∧ b = {2, 3}

b ∧ a = {2, 3}

Properties of Lattice

3. Associative Law:

(i) $(\boldsymbol{a} \vee \boldsymbol{b}) \vee \boldsymbol{c} = \boldsymbol{a} \vee (\boldsymbol{b} \vee \boldsymbol{c})$

(ii) $(\boldsymbol{a} \wedge \boldsymbol{b}) \wedge \boldsymbol{c} = \boldsymbol{a} \wedge (\boldsymbol{b} \wedge \boldsymbol{c})$

$(a \vee b) = \{1, 2, 3, 4\}$

$(a \vee b) \vee c = \{1, 2, 3, 4, 5\}$

$a = \{1, 2, 3\}$

$b = \{2, 3, 4\}$

$c = \{3, 4, 5\}$

$(b \vee c) = \{2, 3, 4, 5\}$

$a \vee (b \vee c) = \{1, 2, 3, 4, 5\}$

Properties of Lattice

3. Associative Law:

(i) $(a \vee b) \vee c = a \vee (b \vee c)$

(ii) $(a \wedge b) \wedge c = a \wedge (b \wedge c)$

$a = \{1, 2, 3\}$

$b = \{2, 3, 4\}$

$c = \{3, 4, 5\}$

$(a \wedge b) = \{2, 3\}$

$\mathbf{(a \wedge b) \wedge c = \{3\}}$

$(b \wedge c) = \{3, 4\}$

$\mathbf{a \wedge (b \wedge c) = \{3\}}$

Thank You