CS & IT ENGINEERING

DISCRETE MATHS
SET THEORY

Lecture No.2

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TOPICS TO BE COVERED

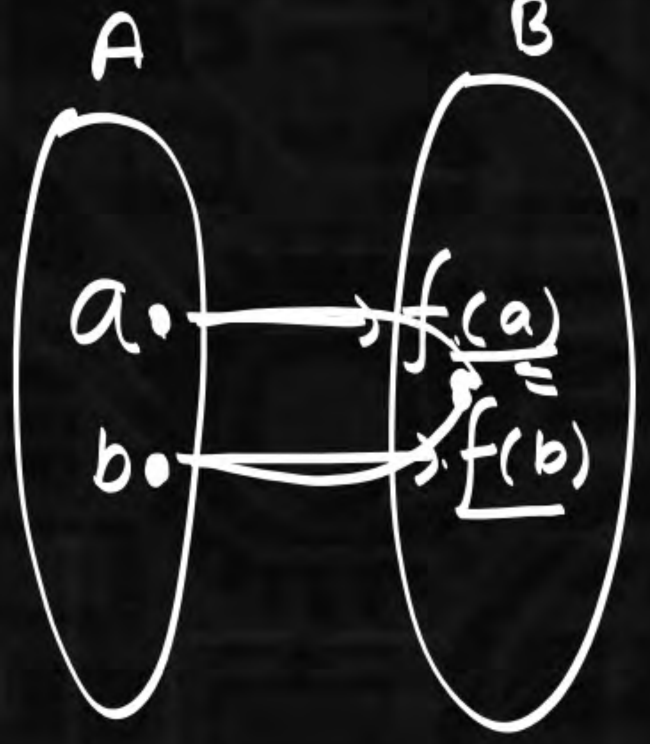
- 01 Basics of Functions
- 02 Terms in Functions
- 03 Number of Functions
- 04 Types of Functions
- 05 Various Examples in Functions

Functions

Types of functions:

1) 1 : 1 (injective)

$$\left(f(a) = f(b) \rightarrow a = b\right)$$



Functions

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

eg1: $f(x)=x^2$ (not 1:1 Function)

$f: Z \to Z$

$1 \longrightarrow 1$

$a=2 \longrightarrow 4$

$b=-2 \longrightarrow 4$

$a=2 \quad f(2)=4$ ✓

$b=-2 \quad f(-2)=4$ ✓

$2 \longrightarrow 4$

$-2 \longrightarrow 4$

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

$\underbrace{f(2)=f(-2)}_{\text{True}} \to \underbrace{2=-2}_{F}$

✗ not 1:1

Functions

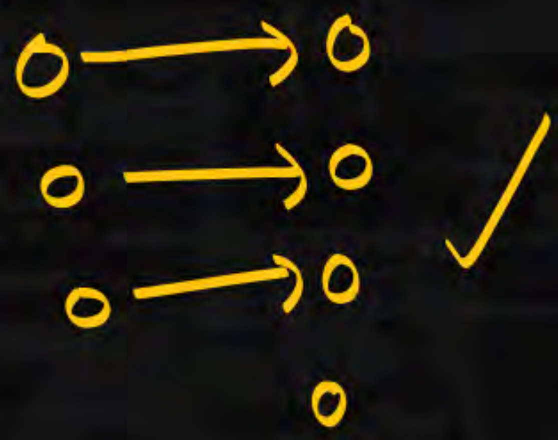
$f(a) = f(b) \longrightarrow a = b$

OR.

$a \neq b \longrightarrow f(a) \neq f(b)$

$a \longrightarrow f(a)$

$b \longrightarrow f(b)$



$f : z \to z$

$f(x) = x + 1.$

$f(x_1) = f(y_1)$

$x_1 + 1 = y_1 + 1$

$x_1 = y_1$

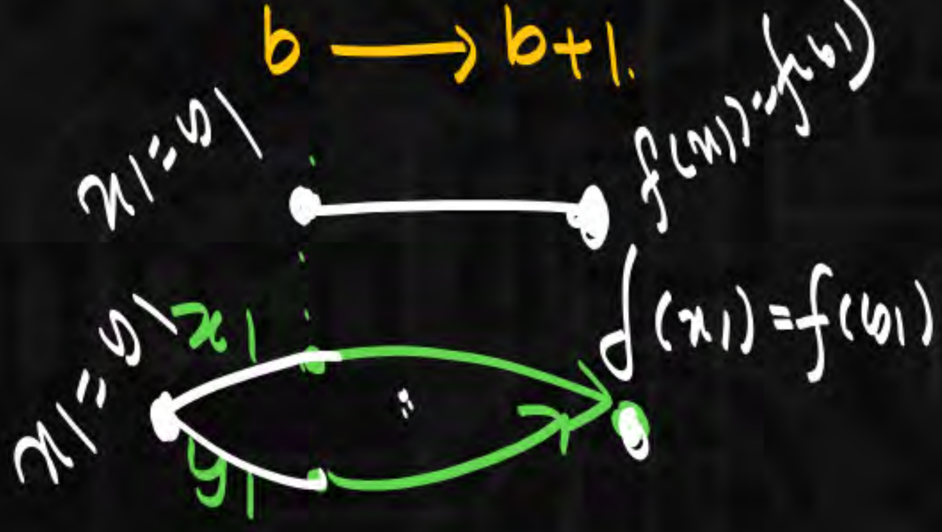
$1 \longrightarrow 2$

$2 \longrightarrow 3$

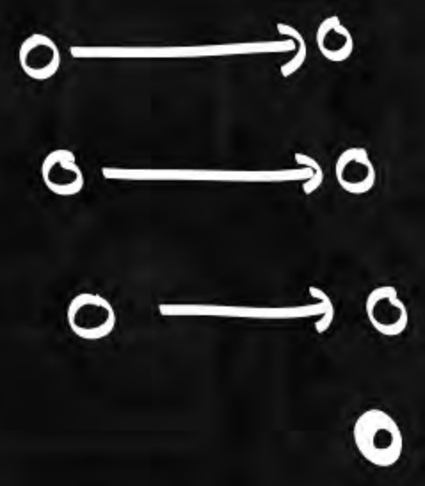
$3 \longrightarrow 4$

$a \longrightarrow a+1$

$b \longrightarrow b+1.$



Functions



$a \neq b \rightarrow f(a) \neq f(b)$

$f(a)=f(b) \rightarrow a=b.$

$f: R \rightarrow R.\ (\neq 1)$

$f(x) = \dfrac{4x}{x-1}.$

to check.

$f(a)=f(b) \rightarrow a=b.$

$$\frac{\cancel{4}a}{a-1} = \frac{\cancel{4}b}{b-1}$$

$$a(b-1) = b(a-1)$$

$$a\cancel{b} - a = b\cancel{a} - b$$

$$-a = -b$$

$$a = b$$

Functions

$f: Z \to Z$

$f(x) = 3x + 4$

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

$3a + 4 = 3b + 4$

$3a = 3b$

$a = b$

Functions

$f: A \to B$ (L.S > R.S)

$|A| = 5 \quad |B| = 3$

(1:1 is not possible)

1:1 Function: (L.S ≤ R.S)

$f: A \to B$

$|A| = 3 \quad |B| = 5$

$^{R.S}P_{L.S}$

Total 1:1 Functions:

= total arrows representation.

$$= 5 \cdot 4 \cdot 3 \times \frac{2!}{2!}$$

$$= \frac{5!}{2!}$$

$$= \frac{5!}{(5-3)!} = {}^5P_3$$

Functions

$1:1$

$f: A \to B$ $\quad A_1, A_2 \subseteq A$

$f(A_1 \cup A_2) = f(A_1) \cup f(A_2)$ ✓

$f(A_1 \cap A_2) = f(A_1) \cap f(A_2)$

A	B
$x \longrightarrow$	1
$y \longrightarrow$	2
$z \longrightarrow$	3
	4
	5

$A_1 = \{x\}$ $\quad A_2 = \{y, z\}$

$f(A_1 \cup A_2) = f(A_1) \cup f(A_2)$

$f(xyz) = f(x) \cup f(yz)$

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

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

Functions

$1:1$

$f: A \to B \qquad A_1, A_2 \subseteq A$

$$\boxed{f(A_1 \cup A_2) = f(A_1) \cup f(A_2)} \checkmark$$

$$f(A_1 \cap A_2) = f(A_1) \cap f(A_2) \checkmark$$

	A		B
A_1	x	$\longrightarrow$	1
A_2	y	$\longrightarrow$	2
	z	$\longrightarrow$	3
			4
			5

$A_1 = \{x\} \quad A_2 = \{y\,z\}$

$f(A_1) = 1 \quad f(A_2) = 2\,3$

$$f(A_1 \cap A_2) = f(A_1) \cap f(A_2)$$

$$\phi = \phi$$

$A_1 = xy \quad A_2 = yz$

$A_1 \cap A_2 = \{xy\} \cap \{yz\} = \{y\}$

$f(A_1) = \{1\,2\}$

$f(A_2) = \{2\,3\}$

$$f(A_1 \cap A_2) = f(A_1) \cap f(A_2)$$

$$f(y) = \{1\,2\} \cap \{2\,3\}$$

$$2 = 2.$$

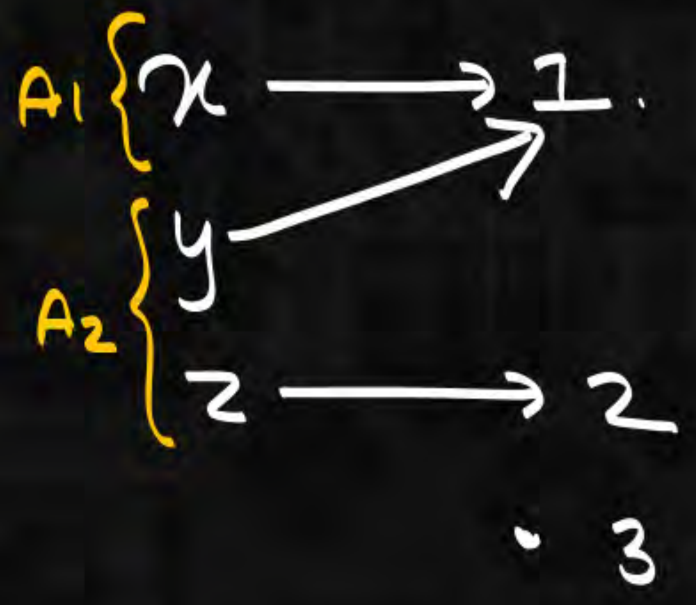
Functions

Function :

$f : A \to B \quad A_1, A_2 \subseteq A$

$f(A_1 \cup A_2) = f(A_1) \cup f(A_2)$ ✓

$f(A_1 \cap A_2) \subseteq f(A_1) \cap f(A_2)$



$A_1 = \{x\}$

$\underbrace{f(A_1) = 1}$

$A_2 = \{y\, z\}$

$f(A_2) = \{1\, 2\}$

$f(A_1 \cap A_2) = f(A_1) \cap f(A_2)$

$= \{1\} \cap \{1\, 2\}$

$\phi \subseteq \{1\}$

$A_1 = x \quad A_2 = y\, z$

$A_1 \cap A_2 = \phi$

Functions

$$f : A \to B$$

$$A_1, A_2 \subseteq A$$

1) $f(A_1 \cup A_2) = f(A_1) \cup f(A_2)$

2) $f(A_1 \cap A_2) \subseteq f(A_1) \cap f(A_2)$

1:1

$$f(A_1 \cap A_2) = f(A_1) \cap f(A_2)$$

Functions

Q.1) $f: Z \to Z$ Q.2) $f: R \to R$ 1:1 ?

a) $f(x) = x + 7$

b) $f(x) = 2x - 3$

c) $f(x) = -x + 5$

d) $f(x) = x^2$

e) $f(x) = x^2 + x$

f) $f(x) = x^3$


THANK YOU GW
SOLDIERS !