CS & IT ENGINEERING

Discrete Maths
Set Theory
Basic of sets

Lecture No.1

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TOPICS TO BE COVERED

01 Basics of sets

02 Types of sets

03 Types of Interval

04 Set Operations

05 Set formulas

Set : Unordered collections of an objects.

$a \in A$

$\downarrow$

A : $\boxed{a, b, c}$ object/element/member(a) element $\in$ Set.

$$A = \{ \underbrace{x}_{e1}, \underbrace{\{x\}}_{e2}, \underbrace{\{\{x\}\}}_{e3} \}$$

$$x \qquad \boxed{x} \qquad \boxed{\boxed{x}}$$

$e2 \quad \{x\} \in A$

$e3 \quad \{\{x\}\} \in A$

element $\in$ Set

1. order does not matter.

$\{a, b, c\}$ OR $\{b, a, c\}$

$$\{a\} \qquad \boxed{a}$$

2. Rept^n are not allowed.

Roster method :

$\{1, 2, 3\}$

$\{1 \ldots\ldots 100\}$

$\{1 \ldots\ldots \infty\}$

Set builder notation :

$\{\text{element} \mid \text{conditions}\}$

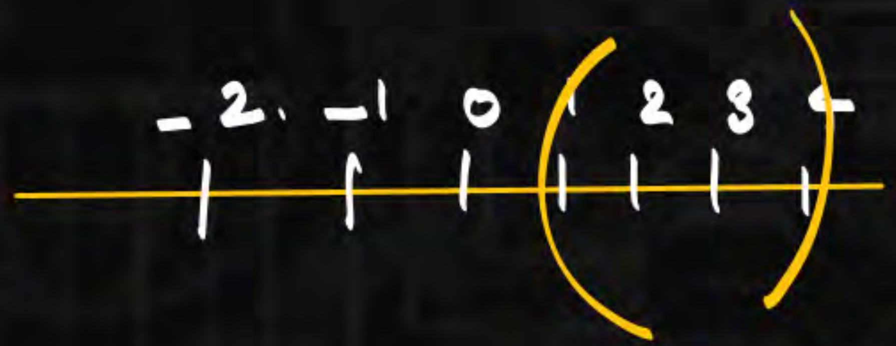
$\{x \mid 1 \leq x \leq 3\}$

$\{x \mid x \text{ is perfect square}\}$.

Interval :

$[1, 4] = \{1, 2, 3, 4\}$

$[a, b] = \{x \mid a \leq x \leq b\}$



$(1, 7) = \{2, 3, 4, 5, 6\}$

$(a, b) = \{x \mid a < x < b\}$

$$[1, 7) = \{1, 2, 3, 4, 5, 6\}$$

$$A_n = [-2n, 3n]$$

$$A_1 = [-2, 3]$$

$$A_2 = [-4, 6]$$

equal sets:

A, B

$\forall x (x \in A \leftrightarrow x \in B)$ $\quad A = B$

Cardinality: $|A|$ = no. of elements present in set

$|A| = 1$ (singleton set)

empty set: ($\emptyset$)

$A = \boxed{}$ $\quad A = \{\ \}$

$|A| = 0$

eg: $A = \{\{\ \}\}$ or $\{\emptyset\}$

$|A| = 1.$

$\{ \quad \}$

Subset ($\subseteq$)

set1 $\subseteq$ set 2.

$A \subseteq B$

$$\boxed{\forall x (x \in A \rightarrow x \in B)}$$

$\forall x (x \in \phi \longrightarrow x \in S)$

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

$A \subseteq B$

Any set S.

1) $\phi \subseteq S$.

2) $S \subseteq S$.

proper subset ($\subset$)

$A \subset B$

$|A| < |B|$

$\forall x(x \in A \rightarrow x \in B) \land \exists x(x \in B \land x \notin A)$

$\subseteq$

$A \subseteq B$

$|A| \leq |B|$

$|A| < |B|$ OR $|A| = |B|$

$\subset$ OR $=$

$\subseteq$

$\underline{\subset}$

Set : A :

Power set : (P(A) / 2^A) ⟶ set of all subsets.

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

$P(A) = \{ \phi, \{1\}, \{2\}, \{3\}, \{2\,3\}, \{1\,3\}, \{1\,2\}, \{1\,2\,3\} \}$

e_1 e_2

a	b	c	
0	0	0	→ ϕ
1	0	0	→ {a}
0	1	0	→ {b}
0	0	1	→ {c}

a, b, c

$2 \times 2 \times 2 = 2^3$

element $\in$ set

set $\subseteq$ set

OR

$\{$element$\}$ $\subseteq$ set

$x \subseteq A$

set $\subseteq$

$\underline{\{\text{element}\}}$

$$A = \{\overset{e_1}{x}, \overset{e_2}{\{x\}}, \overset{e_3}{\{\{x\}\}}\}$$

(T)

1. $x \in A$ $\underline{\{x\}} \in A$ 3.

2. ✗ $x \subseteq A$ $\{\underset{e_1}{x}\} \subseteq A$ 4. ✓

5. $\underline{\{\{x\}\}} \in A$

6. $\{\{x\}\} \subseteq A$

e_2

$$A = \{ \underset{e_1}{1}, \underset{e_2}{\{1\}}, \underset{e_3}{\{2\}} \}$$

1. $1 \in A$
2. $\{1\} \in A$
3. $\{1\} \subseteq A$
4. $\boxed{2 \in A}$
5. $\{2\} \in A$
6. $\{\{2\}\} \subseteq A$

$$A = \{ \overset{e_1}{\phi}, \overset{e_2}{\{\phi\}}, \overset{e_3}{\{\{\phi\}\}} \}$$

1. $\phi \in A$ (T) (e_1)
2. $\phi \subseteq A$ (Thm)
3. $\{\phi\} \in A$ (T) (e_2)
4. $\{\underbrace{\{\phi\}}_{e_2}\} \subseteq A$

$\{e_2\} \subseteq$


THANK YOU GW
SOLDIERS !