Set Theory

8/1/25

Collection of distinct object is called set.

Subset

If ~~a set A~~ the elements of set A are contained in set B, then A is subset of B. $A \subseteq B$

If no of elements in A is at least 1 lesser than elements of B, then A is called proper subset of B. It is denoted by $A \subset B$.

Cardinality = no of element in set A
$n(A)$

Power set

A is a non empty set. Taking all subset including empty set, the power set of A is generated. It is denoted by $P(A)$.

$A = \{1, 2\}$

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

if $n(A) = n$ no. of elements then power set contains 2^n no. of elements.

Compliment of set

If a set A is non empty then A its compliment is denoted by $\bar{A}$ or A^c or A'

such than $\bar{A} = \{x : x \notin A\}$

universally we find $\bar{A} = U - A$

Operators of set

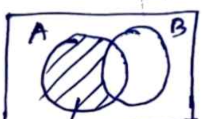
① Union ; If A & B non empty set then their union, $A \cup B = \{x : x \in A \text{ or } x \in B\}$

② Intersection; If A & B non empty sets when comes under intersection, then

$A \cap B = \{x : x \in A \text{ and } x \in B\}$

③ Difference; Difference between A & B non empty sets given in the form,

$\left.\begin{matrix} A \setminus B \\ A - B \end{matrix}\right\} = \{x : x \in A \text{ but } x \notin B\}$



A - B

$$\boxed{\begin{matrix} A - B = A \cap \overline{B} \\ B - A = \overline{A} \cap B \end{matrix}}$$

Algebric ~~operations~~ Property :

① Reflexive property :

$$\boxed{\begin{matrix} A \cup B = B \cup A \\ A \cap B = B \cap A \end{matrix}}$$

Proof :

$x \in A \cup B$

$\Rightarrow x \in A$ or $x \in B$

$\Rightarrow x \in B$ or $x \in A$

$\Rightarrow x \in B \cup A$

$\therefore A \cup B \subseteq B \cup A$ — ①

$y \in B \cup A$

$\Rightarrow y \in B$ or $y \in A$

$\Rightarrow y \in A$ or $y \in B$

$\Rightarrow y \in$ ~~BUA~~ $A \cup B$

$\therefore B \cup A \subseteq A \cup B$ — ②

$\therefore A \cup B = B \cup A$

⑪ Associative property;

$$\boxed{\begin{matrix} A \cup (B \cup C) = (A \cup B) \cup C \\ A \cap (B \cap C) = (A \cap B) \cap C \end{matrix}}$$

(iii) Distributive property:

$$\boxed{\begin{aligned} A\cup(B\cap C) &= (A\cup B)\cap(A\cup C) \\ A\cap(B\cup C) &= (A\cap B)\cup(A\cap C) \end{aligned}}$$

De morgan's law:

for 3 non-empty sets A, B & C, De morgan's law shows the compliment of diferent operators such as $\boxed{(A\cup B)^c = A^c\cap B^c}$ and $\boxed{(A\cap B)^c = A^c\cup B^c}$

proof: