DISCRETE STRUCTURES

CS21001

SCRIBE SUBMISSION

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On Topic

SET THEORY

SET THEORY

DEFINITIONS

SET THEORY : This is a branch of mathematics that deals with the studies of collection of objects.

SETS : A set is simply a collection of objects.

Eg: {1, 2, 3…}, { cat, dog, cow…}, {CSE, ECE, OENA …}

SUBSETS : A set A is said to be a subset of a set B if all the elements of the set A are also in the set B .

This can be symbolically written as

$A \subseteq B$

Eg A = {1,3,5}, B={1,2,3,4,5,6}

$A \subseteq B$

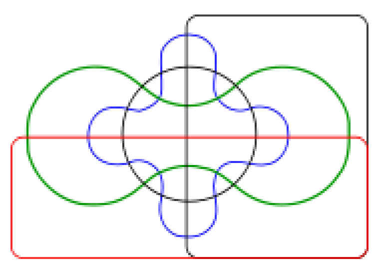
UNIVERSAL SET : A Universal set is a set for which all possible sets are subsets . Symbol (U)

NULL SET : A set with no element, also called empty set. Symbol ϕ

POWER SET: A set of all subsets of a set.

VENN DIAGRAM: This is a pictorial way of representing a set, by drawing geometric figures for a set, where the area in the figure represents the elements owned.

Eg:



This is the venn diagram for five sets, common regions indicate the common elements.

BASIC OPERATIONS ON SETS

UNION (∪) :

This is a binary operation on sets which results in another set which contains elements of both the sets.

Symbolically,

$$A \cup B = C$$
$$A \cup B = \{ x : x \in A \ or \ x \in B \}$$

C is the set which contains elements of both B and A

INTERSECTION (∩) :

This is a binary operation on sets (say A and B) which results in a set whose elements are common to both the sets (A and B).

Symbolically,

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

Elements of C are common to both A and B.

SYMMETRIC DIFFERENCE:

This is a binary operation on sets A and B which results in a set whose elements belong either to A or in B, but no element is common to both A and B.

Symbolically,

$$A \vartriangle B = C$$
$$A \vartriangle B = \{ x : x \in A \ XOR \ x \in B \}$$

COMPLEMENT :

This is a unary operation on a set A which results in a set which contains those elements which are not present in A.

Symbolically,

$$A^C = B$$
$$A^C = \{ x : x \notin A \}$$

B is the complement of A.

PROPERTIES OF SETS/ SET OPERATIONS

COMMUTATIVE:

$$A \cap B = B \cap A$$
$$and$$
$$A \cup B = B \cup A$$

ASSOCIATIVE:

$$A \cap (B \cap C) = (A \cap B) \cap C$$
$$and$$
$$A \cup (B \cup C) = (A \cup B) \cup C$$

IDEMPOTENCE:

$$A \cap A = A$$
$$and$$
$$A \cup A = A$$

COMPLEMENT:

$$A^{c^c} = A$$

DEMORGAN'S LAWS:

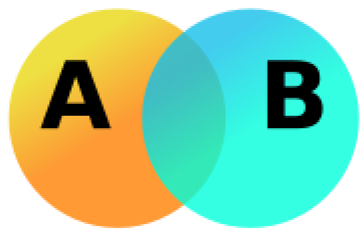
$$(A \cap B)^C = A^C \cup B^C$$

$$and$$
$$(A \cup B)^C = A^C \cap B^C$$

COUNTING PRINCIPLE:

$$n(A \cup B) = n(A) + n(B) + n(A \cap B)$$

This principle can be easily understood by considering the venn diagram representation of this operation



APPLICATIONS:

Set theory is used in many areas of mathematics, Eg group theory, relations, Equivalence, probability.

Concepts of set theory are also applied to the area of logic algebra or Boolean algebra.