Unit 1 :

Prior knowledge:

Set forms:

- Roster A= { 1,a,2,b,... }
- Builder

$$x/0 \leq x \leq 1, x \in \mathbb{R}$$

- Vendiagram

Cardinality:

The cardinal number of a set is defined as the number of elements in a finite set.

Represented by:

$$Card(A) \; or \; n(A) \; or \; (A)$$

Empty set:

Empty set or null set is represented by

$$\phi$$

Property of sets:

- Repetitions are not allowed . {1,1,1,1,1} is not allowed
- In a set order doesn't matter . {1 ,2} or {2,1} are the same

Books recommended for Discrete Math course:

- Discrete mathematics by K.H Rosen

- Schum outlines

Mathematical symbols:

$$\exists = There\ Exists$$

$$\in = Belongs\ to$$

$$\ni = Such\ That$$

$$\forall = For\ all$$

Mathematical representation of Subsets

When can we say

$$A \subseteq B$$

When

$$\forall x \in A \implies x \in B$$

Then

$$A \subseteq B$$

Proper Subset :

$$A \subset B$$

When all the elements are properly contained within B

When are two sets equal?

$$A \subset B\ and\ b \subset A$$

$$A = B$$

Set of factors of 12 and 2

$$A = \{12, 6, 4, 3, 2, 1\}$$

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

$$B \subseteq A \subseteq \phi$$

Union

- Combining of two or more sets

$$x = A \cup B$$

$$\forall x \in A \ \vee \ x \in B$$

Intersection

$$x = A \cap B$$

$$\forall x \in A \ \wedge \ x \in B$$

Union and intersection repetition notation

Union:

$$A_1 \cup A_2 \dots A_n = \cup_{i=1}^{n} A_i$$

$$\cup_{i=1}^{n} A_i = A_1$$

Intersection

$$A_1 \cap A_2 \dots A_n = \cap_{i=1}^{n} A_i$$

$$\cap_{i=1}^{n} A_i = A_n$$

Operations on sets

$$Card(A \cup B) = Card(A) + Card(B) - Card(A \cap B)$$

$$Card(A \cup B \ \cup C) = Card(A) + Card(B) + Card(C) - Card(A \cap B) - Card(B \cap C) + Card(C \cap A) +$$

- Difference
  - $$A \setminus B$$
  - $$\forall x \in A, x \notin B$$
- Symmetrical difference
  - $$A \Delta B$$

- $$(A \setminus B) \cup (B \setminus A) = (A \cap B) \setminus (A \cup B)$$

- Complement
  - $$A^C \ or \ A^{'}$$
  - $$\forall x \in A, x \notin U$$

Practice Problem:

100 students
M:50
P:40
C:25

$$M \cap C = 10$$
$$P \cap C = 10$$
$$M \cap P = 10$$
$$M \cap P \cap C = 5$$

Laws of sets:

Cartesian Point

Relations

Functions

Unit 2 :

Partial order set

Lattice Theory

Unit 3:

Group theory

Graph Theory

Prop logic

Counting Theory