Sets - Part I

Set

1. Any well - defined collection of objects.
2. Set are usually denoted by capital letters.
3. Elements of set are usually represented by small letters.
4. If a is an element of set A , then it is represented as $a \in A$
5. If a is not an element of set A , then it is represented $a \notin A$

Representation of Sets

1. **Roster Form :** Set is represented by listing its element in braces { } and they are separated by comma.
   For e.g. A = { a , e , i , o , u } , B = { 1 , 2 , 3 , 4 }
2. **Set - Builder Form :** Set is represented by using statements depicting relation among its elements.
   For e.g. A = {x : x is a vowel in English alphabetic series}
   B = {x : x is a natural number less than 5}

Types of Sets

1. **Empty or null or void set :** It contains no elements
   For e.g A = { }
2. **Finite set :** It contains countable number of elements
   For e.g A = { 1 , 4 , 9 , 16 }
3. **Infinite set :** It contains uncountable number of elements
   For e.g A = { 1 , 4 , 9 , 16,..... }
4. **Equal sets :** Two sets X and Y have same elements , represented as X = Y
5. **Unequal sets :** Two sets X and Y have atleast one uncommon elements , represented as $X \neq Y$
6. **Equivalent sets :** Two sets X and Y with same number of elements , irrespective of what elements are.
7. **Singleton set :** It contains only one element
   For e.g. A = { 0 } , B = { i }
8. **Universal set :** Set of all elements in a particular context. For e.g. A = { x : x is a real number }

Subset and Superset

For two sets A and B , every element of A is also an element of B ,

1. A is subset of B , denoted by $A \subseteq B$
2. B is superset of A , denoted by $B \supseteq A$

Proper Subset and Proper Superset

Set A and B , A is a subset of B and $A \neq B$

1. A is proper subset of B , denoted by $A \subset B$
2. B is proper superset of A , denoted by $B \supset A$

Sets - Part II

Power Set

For a set A , power set is set of all subsets including empty set and A itself
For e.g. A = { a , b , c }
Power set of A = $\{ \{\ \}, \{a\}, \{b\}, \{c\}, \{a,b\}, \{b,c\}, \{a,c\}, \{a,b,c\} \}$
For a set with m elements the power set has 2^m elements

Operations on Sets

For two sets A and B belong to universal set U

1. **Union of Sets :** It is collection of all the elements of A and B , represented as AUB
2. **Intersection of Sets :** It is collection of the elements common in both sets A and B , represented as $A \cap B$
3. **Difference of Sets :** It is collection of the elements of A which are not present in set B , represented as A - B
4. **Complement of Sets :** For set A , collection of elements which do not belong to A , represented as A^1

Preperties of Operation on Sets

1. **Commutative law** : $A \cup B = B \cup A$, $A \cap B = B \cap A$
2. **Associative law** : $(A \cup B) \cup C = A \cup (B \cup C)$, $(A \cap B) \cap C = A \cap (B \cap C)$
3. **Idempotent law** : $A \cup A = A$, $A \cap A = A$
4. **Distributive law** : $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
   $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
5. **Law of Universal set** : $A \cup U = U$
   $A \cap U = A$
   $A \cup A' = U$
   $A \cap A' = \phi$

Venn Diagrams

It is a digrammatic representation of all possible relationships between different sets of finite number of elements.
For e.g. A { 2,3,5,7 }, B = { 2,4,6,8,10 } can be represented using Venn Diagrams as