Practical No-08

Title: Implementation of set theory using Linked List

Aim: Second year Computer Engineering class, set A of students like Vanilla ice-cream and set B of students like butterscotch ice-cream. Write a C/C++ program to store two sets using linked list. Compute & display –

1. Set of students who like either vanilla or butterscotch or both.
2. Set of students who like both vanilla and butterscotch
3. No of students who like neither vanilla nor butterscotch

Prerequisite:

- Basics of linked list and Set theory

Objectives:

- To understand implementation of linked list
- Understand the implementation of Set theory using singly linked list.

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Input: Roll no of student

Output:

- At end of this experiment, student will be able to illustrate the set theory concept with example.

Theory:

Linked List:

A linked list is a linear data structure, in which the elements are not stored at contiguous memory locations. The elements in a linked list are linked using pointers. In simple words, a linked list consists of nodes where each node contains a data field and a reference(link) to the next node in the list.

Set Theory:

Set theory is the branch of mathematical logic that studies sets, which can be informally described as collections of objects. Although objects of any kind can be collected into a set, set theory, as a branch of mathematics, is mostly concerned with those that are relevant to mathematics as a whole.

Types of Set:

1. Empty Set or Null set: It has no element present in it.Example: A = {} is a null set.
2. Finite Set: It has a limited number of elements.Example: A = {1,2,3,4}
3. Infinite Set: It has an infinite number of elements.Example: A = {x: x is the set of all whole numbers}
4. Equal Set: Two sets which have the same members.Example: A = {1,2,5} and B={2,5,1}: Set A = Set B
5. Subsets: A set 'A' is said to be a subset of B if each element of A is also an element of B.Example: A={1,2}, B={1,2,3,4}, then $A \subseteq B$
6. Universal Set: A set which consists of all elements of other sets present in a Venn diagram.Example: A={1,2}, B={2,3}, The universal set here will be, U = {1, 2,3}

Operations on sets:

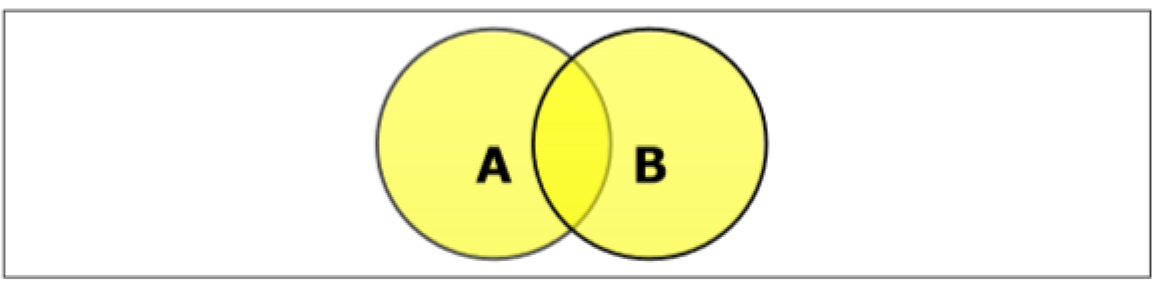
1.Set Union

The union of sets A and B (denoted by$A \cup B$) is the set of elements which are in A, in B, or in both A and B. Hence,

$A \cup B=\{x|x \in A \ OR \ x \in B\}$

Example – If A={10,11,12,13} and B ={13,14,15} , then $A \cup B$={10,11,12,13,14,15}

(The common element occurs only once)

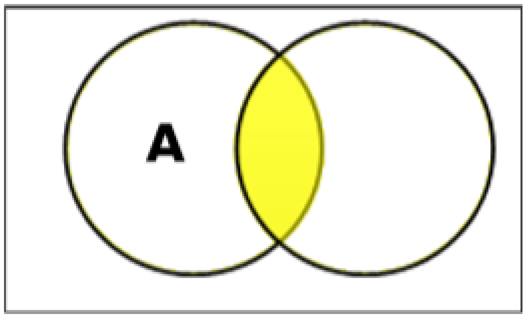


2.Set Intersection

The intersection of sets A and B (denoted by $A \cap B$) is the set of elements which are in both A and B. Hence,

$A \cap B=\{x|x \in A \text{ AND } x \in B\}$

Example – IfA={11,12,13} and B={13,14,15} , then $A \cap B$={13}

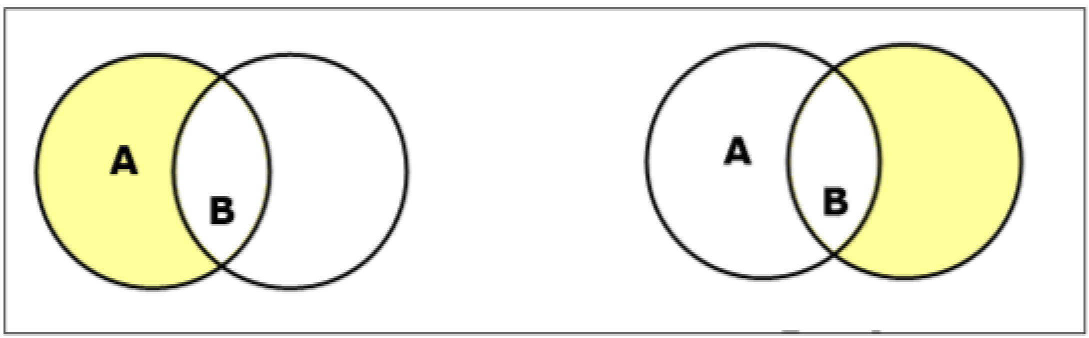


3.Set Difference/ Relative Complement

The set difference of sets A and B (denoted by A–B) is the set of elements which are only in A but not in B. Hence,

$A-B=\{x \mid x \in A \text{ AND } x \notin B\}$.

Example − If A={10,11,12,13} and B={13,14,15}, then (A−B)={10,11,12}and (B−A)={14,15}



Conclusion:
We have implemented the set operation using linked list