ASSIGNMENT 1

1. **Aim** –To create ADT that implements the SET concept.

a. Add (newElement) -Place a value into the set

b. Remove (element) Remove the value

c. Contains (element) Return true if element is in collection

d. Size () Return number of values in collection Iterator ()

Return an iterator used to loop over collection

e. Intersection of two sets

f. Union of two sets

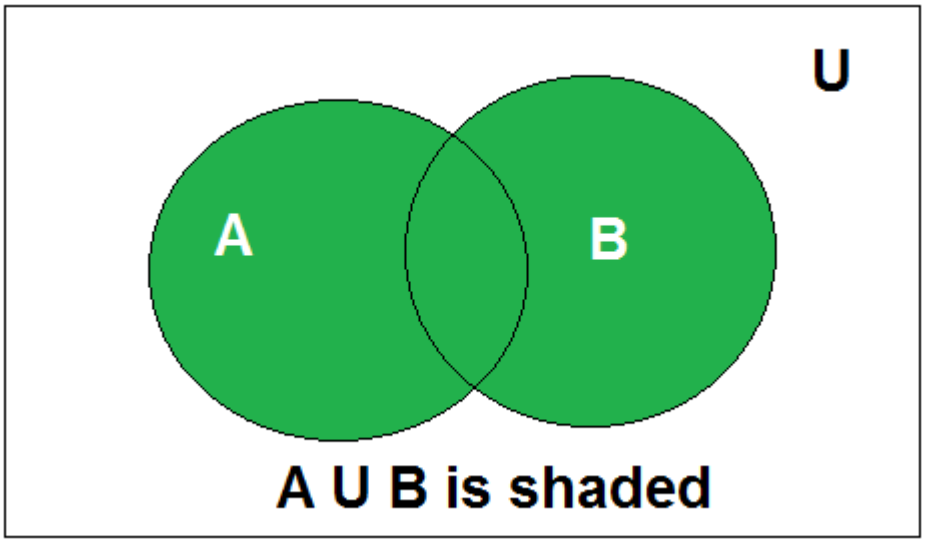
g. Difference between two sets, h. Subset

2. **Objective** – To implement all set operations and represent them by creating an ADT.

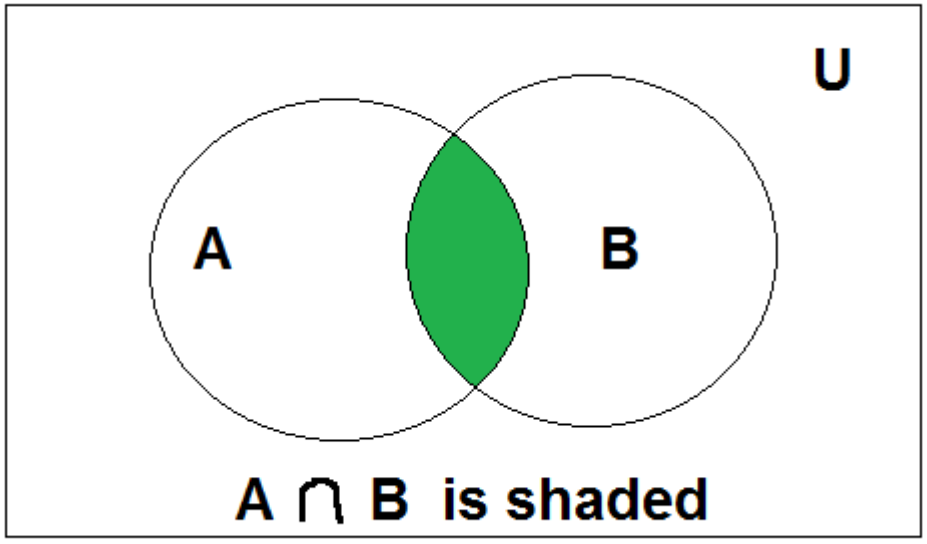
3. **Theory** - In computer science, a **set** is an abstract data type that can store unique values, without any particular order. It is a computer implementation of the mathematical concept of a finite set. Unlike most other collection types, rather than retrieving a specific element from a set, one typically tests a value for membership in a set.

Sets can be implemented using various data structures, which provide different time and space trade-offs for various operations. Some implementations are designed to improve the efficiency of very specialized operations, such as `nearest` or `union`. Implementations described as "general use" typically strive to optimize the `element_of`, `add`, and `delete` operations. A simple implementation is to use a list, ignoring the order of the elements and taking care to avoid repeated values. This is simple but inefficient, as operations like set membership or element deletion are $O(n)$, as they require scanning the entire list.[b] Sets are often instead implemented using more efficient data structures, particularly various flavors of trees, tries, or hash tables.

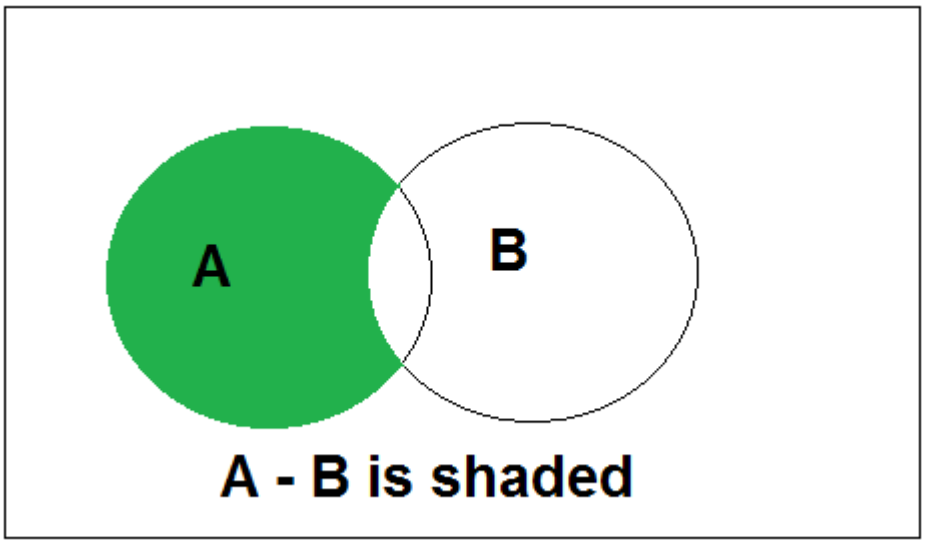
1. `union(S,T)`: returns the union of sets *S* and *T*.



2. `intersection(S,T)`: returns the intersection of sets *S* and *T*.



3. `difference(S,T)`: returns the difference of sets *S* and *T*.



4. `subset(S,T)`: predicate that tests whether the set *S* is a subset of set T

5. `create()`: creates a new, initially empty set structure.

6. `add(S,x)`: adds the element *x* to *S*, if it is not present already.

7. `remove(S, x)`: removes the element *x* from *S*, if it is present.

8. `capacity(S)`: returns the maximum number of values that *S* can hold.

4. **Algorithm** –

1. Intersection is an associative operation; that is, for any sets *A*, *B*, and *C*, one has $A \cap (B \cap C) = (A \cap B) \cap C$. Intersection is also commutative; for any *A* and *B*, one has $A \cap B = B \cap A$. It thus makes sense to talk about intersections of multiple sets. The intersection of *A*, *B*, *C*, and *D*, for example, is unambiguously written $A \cap B \cap C \cap D$.
2. We say that *A and B are disjoint* if *A* does not intersect *B*. In plain language, they have no elements in common. *A* and *B* are disjoint if their intersection is empty, denoted

3. .The union of two sets *A* and *B* is the set of elements which are in *A*, in *B*, or in both *A* and *B*. In symbols,

5. **Program code –**

```
#include<bits/stdc++.h>
#include <iostream>
using namespace std;
int set1[100],set2[100],no1,no2;
void insert()
{
	cout<<"Enter number of elements u want to insert in set 1"<<endl;
	cin>>no1;
	for(int i=0;i<no1;i++)
		cin>>set1[i];
	cout<<"Enter number of elements u want to insert in set 2"<<endl;
	cin>>no2;
	for(int i=0;i<no2;i++)
		cin>>set2[i];
}
void remove()
{
```

```
int num,i;
bool x=0;
cout<<"Enter a number u want to delete"<<endl;
cin>>num;
for(i=0;i<no1;i++)
{
	if(set1[i]==num)
	{
		x=1;
		break;
	}
}
while(i<(no1-1) && x==1)
{
	set1[i]=set1[i+1];
	i++;
}
if(x==1)
	no1--;
x=0;
for(i=0;i<no2;i++)
{
```

```
            if(set2[i]==num)
            {
                  x=1;
                  break;
            }
      }
      while(i<(no2-1) && x==1)
      {
            set2[i]=set2[i+1];
            i++;
      }
      if(x==1)
            no2--;
}
void search()
{
      int num,i;
      cout<<"Enter a number u want to search"<<endl;
      cin>>num;
      for(i=0;i<no1;i++)
      {
            if(set1[i]==num)
```

```
            {
                cout<<"Number is present in set1"<<endl;
                break;
            }
        }
        if(i==no1)
            cout<<"Number doesn't exist in set1"<<endl;
        for(i=0;i<no2;i++)
        {
             if(set2[i]==num)
            {
                cout<<"Number is present in set2"<<endl;
                break;
            }
        }
        if(i==no2)
            cout<<"Number doesn't exist in set2"<<endl;
}
void size()
{
        cout<<"Number of elements present in set 1 is
"<<no1<<endl;
```

```
        cout<<"Number of elements present in set 2 is
"<<no2<<endl;
}
void display()
{
        for(int i=0;i<no1;i++)
                cout<<set1[i]<<"\t";
        cout<<endl;
        for(int i=0;i<no2;i++)
                cout<<set2[i]<<"\t";
        cout<<endl;
}
void intersection()
{
        int a[100],m=0,k=0;
        for(int i=0;i<no1;i++)
        {
                for(int j=0;j<no2;j++)
                {
                        if(set1[i]==set2[j])
                        {
                                a[k]=set1[i];
```

```
                        k++;
                        m++;
                        break;
                    }
                }
            }
        for(int i=0;i<m;i++)
            cout<<a[i]<<"\t";
        cout<<endl;
}
void uni(int x)
{
        int a[100],max=set1[0];
        memset(a,0,sizeof(a));
        for(int i=0;i<no1;i++)
        {
            a[set1[i]]=1;
            if(max<set1[i])
                max=set1[i];
        }
        for(int i=0;i<no2;i++)
        {
```

```
        a[set2[i]]=1;
        if(max<set2[i])
                max=set2[i];
    }
    if(x==0)
    {
        for(int i=0;i<=max;i++)
        {
            if(a[i]==1)
                cout<<i<<"\t";
        }
        cout<<endl;
    }
    if(x==1)
    {
        for(int i=0;i<no2;i++)
        {
            if(a[set2[i]]==1)
                a[set2[i]]=0;
        }
        for(int i=0;i<=max;i++)
        {
```

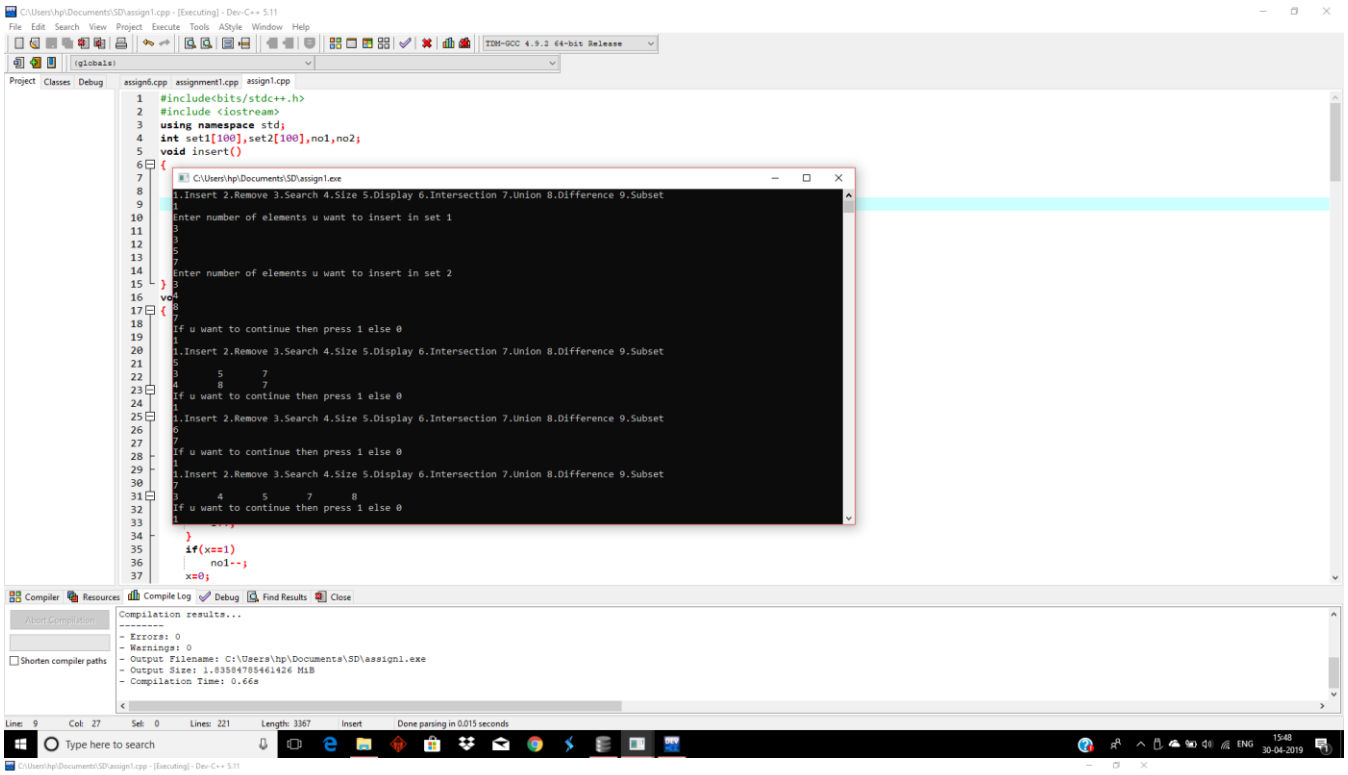
```
                if(a[i]==1)
                        cout<<i<<"\t";
            }
            cout<<endl;
        }
}
void difference()
{
        uni(1);
}
void subset()
{
        int a[100],i;
        memset(a,0,sizeof(a));
        for(i=0;i<no1;i++)
        {
            a[set1[i]]=1;
        }
        for(i=0;i<no2;i++)
        {
            if(a[set2[i]]==0)
            {
```

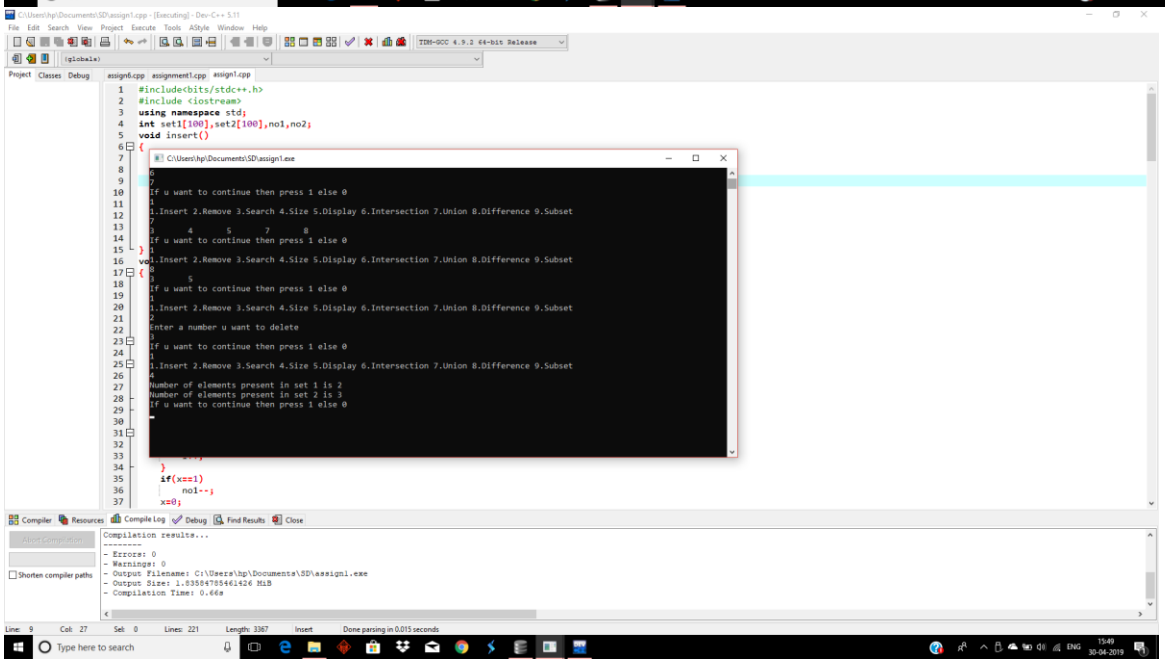
```
                cout<<"Set 2 in not a subset of Set 1"<<endl;
                break;
            }
        }
        if(i==no2)
            cout<<"Set 2 is subset of Set 1"<<endl;
}
int main()
{
        int ch;
        bool f=1;
        while(f)
        {
            cout<<"1.Insert 2.Remove 3.Search 4.Size 5.Display
6.Intersection 7.Union 8.Difference 9.Subset"<<endl;
            cin>>ch;
            switch(ch)
            {
                case 1:
                    insert();
                    break;
                case 2:
```

```
            remove();
            break;
        case 3:
            search();
            break;
        case 4:
            size();
            break;
        case 5:
            display();
            break;
        case 6:
            intersection();
            break;
        case 7:
            uni(0);
            break;
        case 8:
            difference();
            break;
        case 9:
            subset();
```

```
                    break;
                default:
                    cout<<"Wrong choice"<<endl;
            }
            cout<<"If u want to continue then press 1 else 0"<<endl;
            cin>>f;
        }
        return 0;
}
```

6. **Output screen shots/Copy Past From Terminal –**





7. **Conclusion –**

The importance of sets is one. They allow us to treat a *collection of mathematical objects* as a mathematical object on its own right.

They are **important** everywhere in mathematics because every field of mathematics uses or refers to **sets** in some way. They are **important** for building more complex mathematical structure