Alexandria University
Faculty of Engineering
Computer and Systems Engineering
Department

CS211: Mathematics for Computer Science
Assigned: Thursday, Oct 15th, 2021
Due: Saturday, October 23th, 2021

Programming Assignment 1
Implementing Different Set Operations

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-Problem Statement:

A Program that takes:

1.An input a list of strings as a Universe.
2.Then takes another input a number of sets (that are subsets of the universe).
3.Then ask the user about the operations they want to perform (**3 required features to be implemented in this assignment**) :
•Union of two sets.
•Intersection of two sets.
•Complement of a set.
•print a set.

-Used Data Structures:

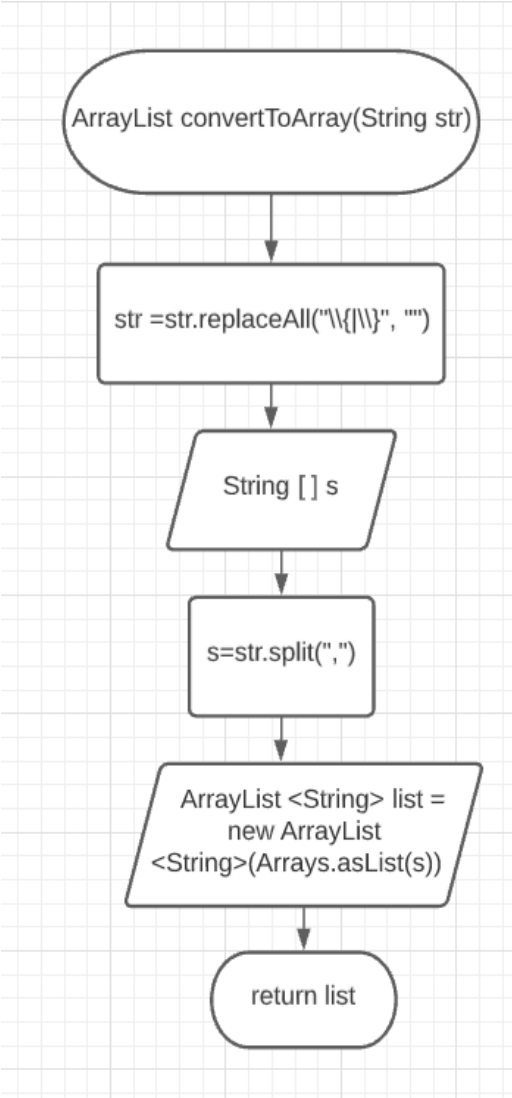
1.Array.
2.ArrayList : to store the values of the sets

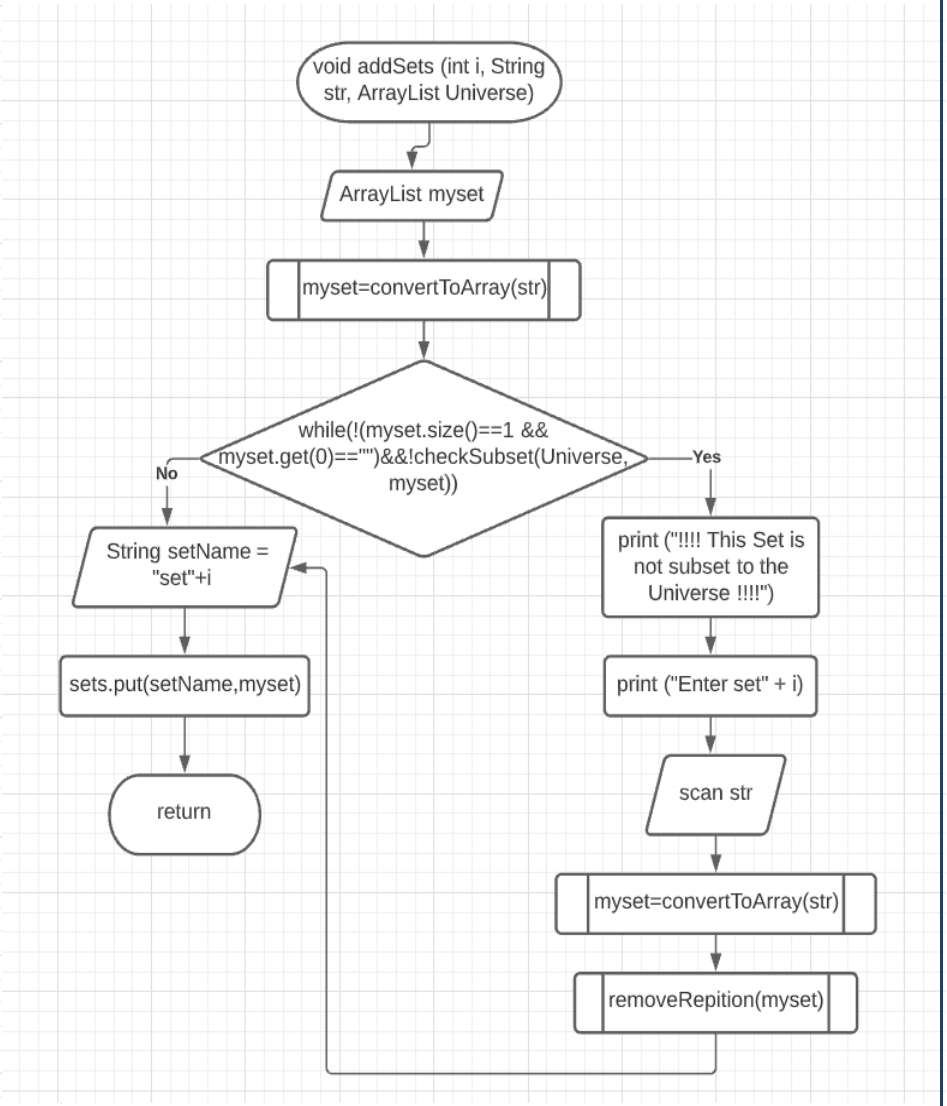
```
ArrayList<String> opp = new ArrayList<>();
```

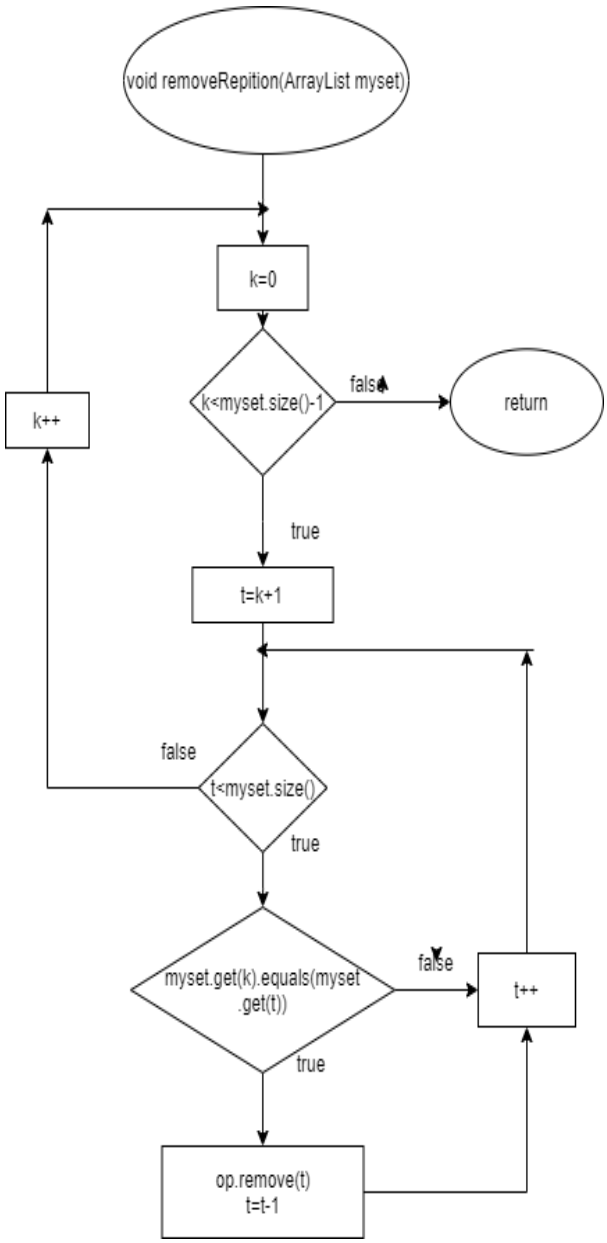
3.Hashmap: store each set's name with it's arraylist.

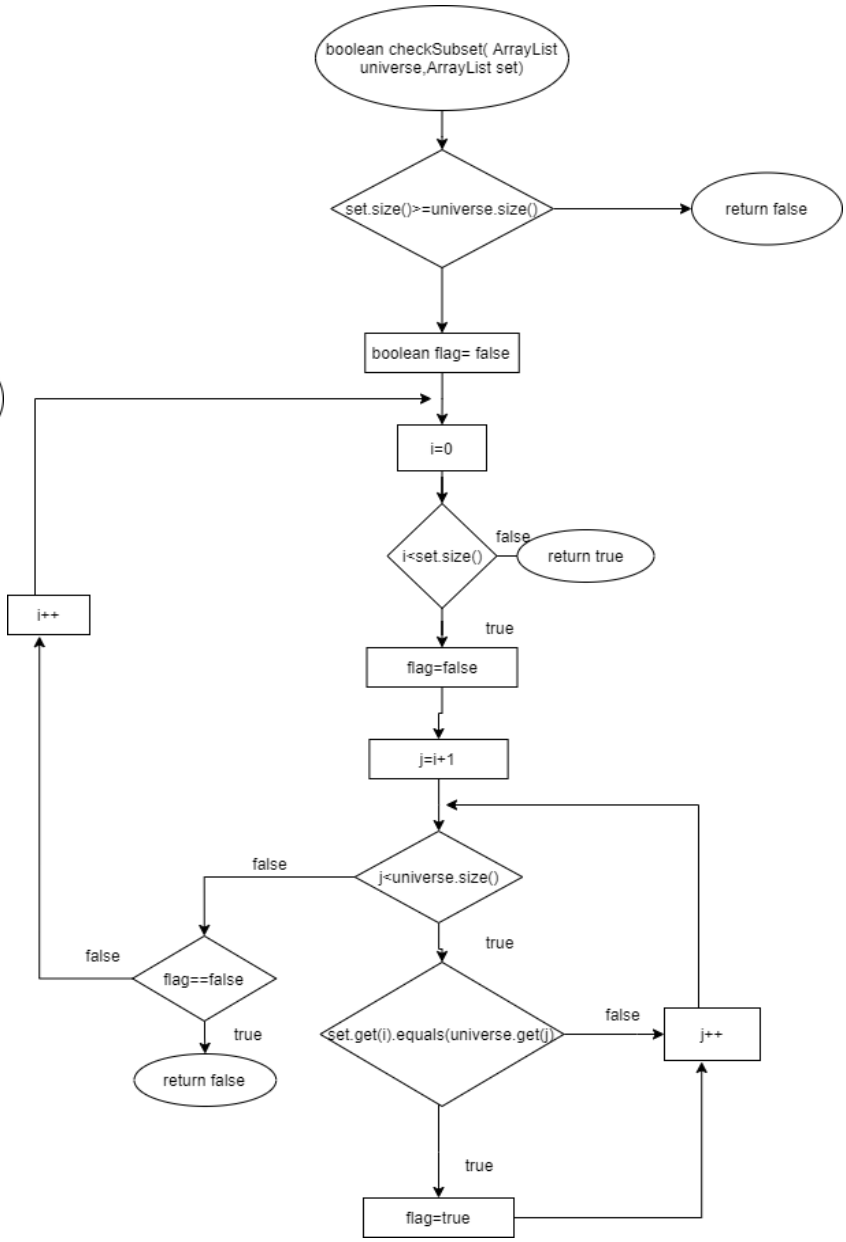
```
static HashMap<String, ArrayList> sets= new HashMap<String, ArrayList>();
```

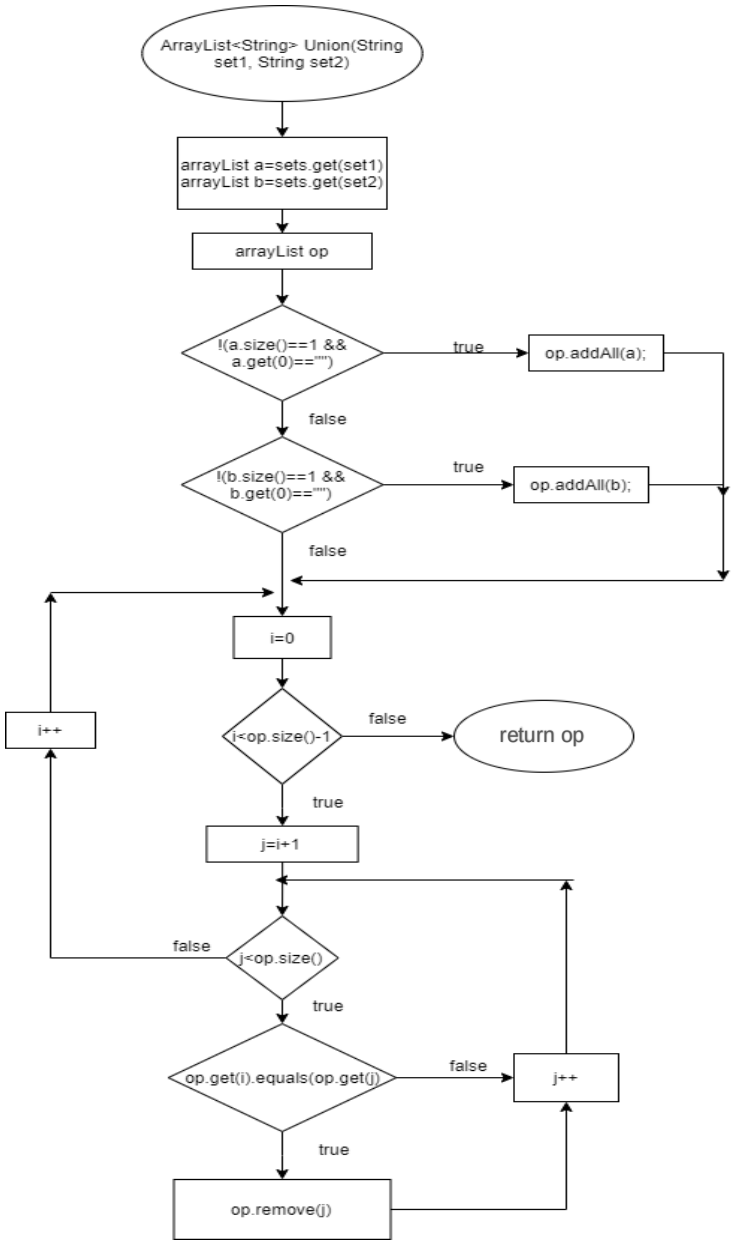
-Flowcharts for The Important Functions:

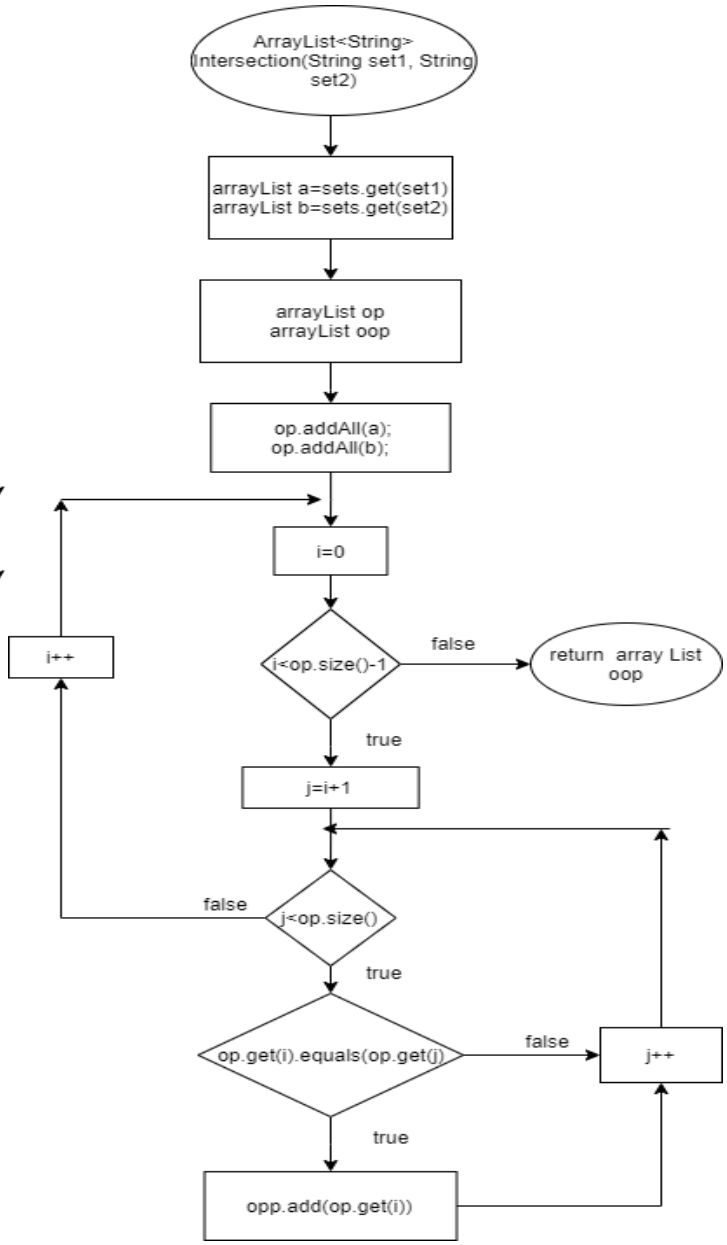


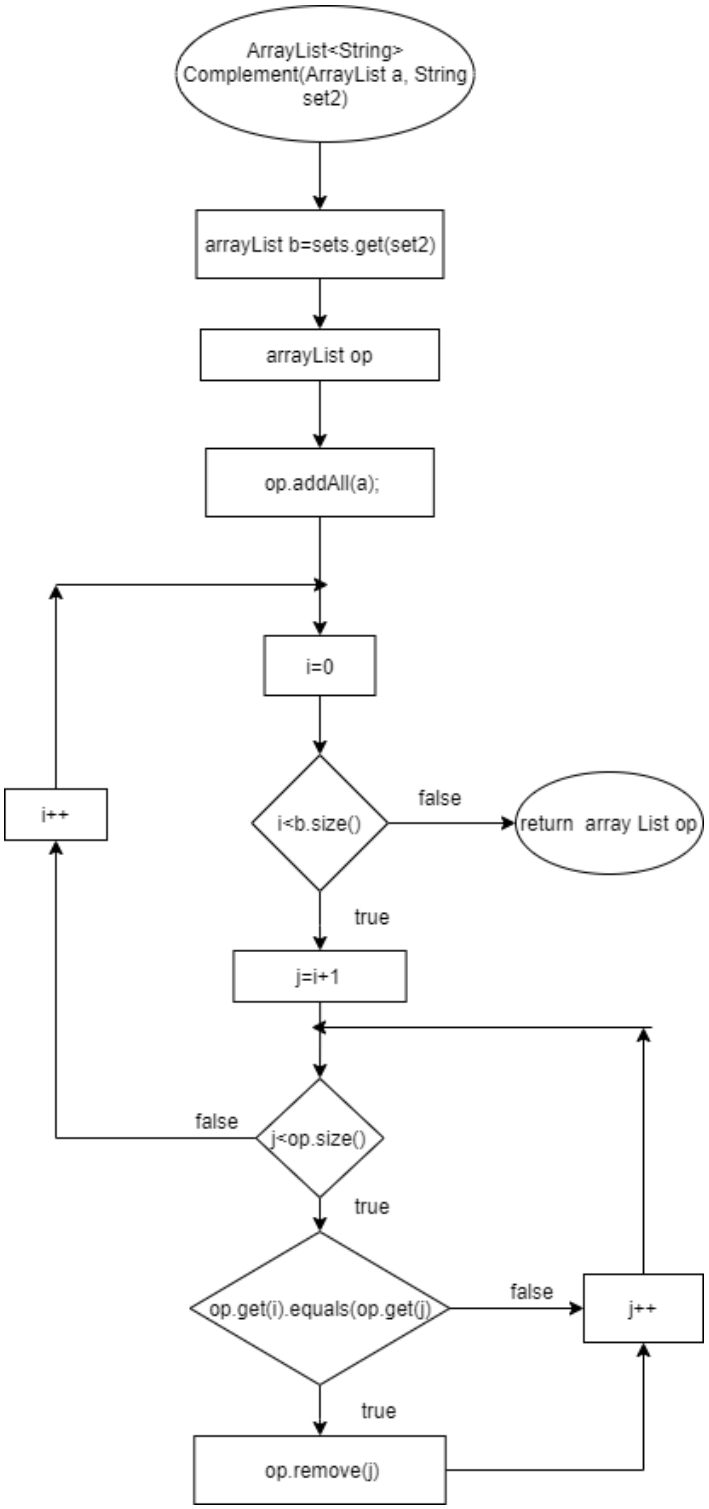



void removeRepition(ArrayList myset)
k=0
k<myset.size()-1
false
return
k++
true
t=k+1
false
t<myset.size()
true
myset.get(k).equals(myset .get(t))
false
t++
true
op.remove(t)
t=t-1


boolean checkSubset(ArrayList universe,ArrayList set)
set.size()>=universe.size()
return false
boolean flag= false
i=0
i<set.size()
false
return true
true
flag=false
j=i+1
j<universe.size()
false
true
flag==false
false
true
return false
set.get(i).equals(universe.get(j))
false
j++
true
flag=true
i++


ArrayList<String> Union(String set1, String set2)
arrayList a=sets.get(set1)
arrayList b=sets.get(set2)
arrayList op
!(a.size()==1 && a.get(0)=="")
true
op.addAll(a);
false
!(b.size()==1 && b.get(0)=="")
true
op.addAll(b);
false
i=0
i<op.size()-1
false
return op
true
j=i+1
j<op.size()
false
true
op.get(i).equals(op.get(j)
false
j++
true
op.remove(j)
i++


ArrayList<String> Intersection(String set1, String set2)
arrayList a=sets.get(set1)
arrayList b=sets.get(set2)
arrayList op
arrayList oop
op.addAll(a);
op.addAll(b);
i=0
i<op.size()-1
false
return array List oop
true
j=i+1
j<op.size()
false
true
op.get(i).equals(op.get(j)
false
j++
true
opp.add(op.get(i))
i++


ArrayList<String> Complement(ArrayList a, String set2)
arrayList b=sets.get(set2)
arrayList op
op.addAll(a);
i=0
i<b.size()
false
return array List op
true
i++
j=i+1
j<op.size()
false
true
op.get(i).equals(op.get(j))
false
j++
true
op.remove(j)

-Code Snippets:

-Snippets From The Main:

```java
package setss;
import java.util.ArrayList;
import java.util.Scanner;

public class mainSet  {

    public static ArrayList Universe;

    public static void main(String[] args) {

    Myset my =new Myset();
    Scanner input =new Scanner(System.in);

    System.out.println("!!!WELCOME TO OUR SIMPLE SET OPERATIONS EVALUATOR!!!");

    //taking the Universe set
    System.out.println("\nEnter The Universe Set");
    String uni=input.nextLine();
    Universe=my.convertToArray(uni);
    my.removeRepition(Universe);
    System.out.println("Enter The Number of Sets You Want to Deal With : ");
    int noSets = input.nextInt();
    input.nextLine();  //for the enter

    for(int i=1 ; i<= noSets ;i++) {
        System.out.println("Enter set" + i);
        String elements = input.nextLine();
        my.addSets(i,elements,Universe);
    }

```

```
    //while loop taking infinite no of operations until the user want to exit

    while(true) {

      System.out.println("to chosse operation write number: ");
      System.out.println("1- for intersection");
      System.out.println("2- for union");
      System.out.println("3- for complement");
      System.out.println("4- to print any set");
      System.out.println("5- to exit");


      int operation=input.nextInt();
      input.nextLine();
      boolean flag=true;

      switch(operation) {

        case 1:{
            System.out.println("The name of the first set : ");
            String set1 = input.nextLine();
            System.out.println("The name of the second set : ");
            String set2 = input.nextLine();
            ArrayList res = my.Intersection(set1, set2);
            System.out.println(res.toString().replace("[","{").replace("]","}"));


        }break;

        case 2:{
            System.out.println("The name of the first set : ");
            String set1 = input.nextLine();
            System.out.println("The name of the second set : ");
            String set2 = input.nextLine();
            ArrayList res =my.Union(set1,set2);

            System.out.println(res.toString().replace("[","{").replace("]","}"));
        }break;

        case 3:{
            System.out.println("The name of set : ");
            String set1 = input.nextLine();
            ArrayList res = my.Complement(Universe, set1);
            System.out.println(res.toString().replace("[","{").replace("]","}"));

        }break;

        case 4:{
            System.out.println("enter name of the set");
            String set1 = input.nextLine();

            ArrayList res =my.printset(set1);
             System.out.println(res.toString().replace("[","{").replace("]","}"));

        }break;

        case 5:{
            flag=false;
            break;
        }

        default:
            System.out.println("Wrong Operation!! Please, Write It in The Correct Form!!");

        }

        if (flag==false) {
            break;
        }

    }
    }
```

-Snippets From The Class of The Functions:

```java
package setss;
import java.util.ArrayList;
import java.util.Arrays;
import java.util.HashMap;
import java.util.Scanner;

public class Myset {

    //we used hash map to store every set name with it's values
    static HashMap<String, ArrayList> sets= new HashMap<String, ArrayList>();

    //this function convert the string  the input set to arraylist
    public static  ArrayList convertToArray(String str) {

        str =str.replaceAll("\\{|\\}", "");
        String [] s=str.split(",");
        ArrayList <String> list = new ArrayList <String>(Arrays.asList(s));

        return list;
    }


```

```java
    /*in this function we call the convert function
     * check if it is a set if not remove duplicate
     *the checksubset  function and if it is subset we add the set and it's name to our hash map if not
     *we make user input the set again until he write a subset set then put in the hash map
     */

    public static void addSets(int i ,String str,ArrayList Universe){

        Scanner scan =new Scanner(System.in);
        ArrayList myset=convertToArray(str);
        removeRepition(myset);

        while(!(myset.size()==1 && myset.get(0)=="")&&!checkSubset(Universe, myset)) {
            System.out.println("!!!! This Set is not subset to the Universe !!!!");
            System.out.println("Enter set" + i);
            str = scan.nextLine();
            myset=convertToArray(str);
            removeRepition(myset);
        }

        String setName= "set"+i;
        sets.put(setName,myset);

    }

```

```java
    /*
     * this function to remove duplication from the set as it one of the set properties
     * */

    public static void removeRepition(ArrayList myset) {

        for(int k=0;k<myset.size()-1;k++) {
            for(int t=k+1;t<myset.size();t++) {
                if(myset.get(k).equals(myset.get(t))) {
                    myset.remove(t);
                    t=t-1;
                }
            }
        }

    }


```

```java
    /***union function
     * @param string  name of first set
     * @param string name of second set2
     * and by using their name we get array list from hash map
     *we add  all the both sets in op array list and then remove the duplicate
     *@return the op array list
     **/

    public ArrayList<String> Union(String set1, String set2) {

        ArrayList a=sets.get(set1);
        ArrayList b=sets.get(set2);
        ArrayList<String> op = new ArrayList<>();
        if(!(a.size()==1 && a.get(0)=="")) {
            op.addAll(a);
        }
        if(!(b.size()==1 && b.get(0)=="")) {
            op.addAll(b);
        }


        for(int i=0;i<op.size()-1;i++){
            for(int j=i+1;j<op.size();j++){
                if(op.get(i).equals(op.get(j))) {
                   op.remove(j);

                }
            }
        }

        return op;
     }


```

```java
    /***intersection function
        * @param string  name of first set
        * @param string  name of second set2
        * and by using their name we get array list from hash map
        *we add  all the both sets in op array list and the duplicate put in array list oop
        *@return the oop array list
        **/

     public ArrayList<String> Intersection(String set1, String set2){

        ArrayList a=sets.get(set1);
        ArrayList b=sets.get(set2);
        ArrayList<String> op = new ArrayList<>();
        ArrayList<String> opp = new ArrayList<>();
        op.addAll(a);op.addAll(b);

        for(int i=0;i<op.size()-1;i++){
            for(int j=i+1;j<op.size();j++){
                if(op.get(i).equals(op.get(j))) {
                   opp.add(op.get(i));

                }
            }
        }

        return opp;
     }

```

```java
    /***complement function
       * @param string  name of first set which is the universe
       * @param string  name of set
       * and by using their name we get array list from hash map
       *we add  all the both sets in op array list and then remove the intersection
       *@return the op array list
       **/

    public ArrayList<String> Complement(ArrayList a, String set2){

        ArrayList b=sets.get(set2);
        ArrayList<String> op = new ArrayList<>();
        op.addAll(a);

        for(int i=0;i<b.size();i++){
            for(int j=0;j<op.size();j++) {
                if(op.get(j).equals(b.get(i))) {
                    op.remove(j);
                }
            }
        }

        return op;
    }

```

```java
    /*
     * this function check if the set is subset to the universe or not
     * by checking if the values present in universe then the flag assign to true
     * */

    public static boolean checkSubset( ArrayList universe,ArrayList set) {

          boolean flag= false;

          if(set.size()>=universe.size()){
                return false;
            }



          for (int i=0 ; i<set.size() ; i++) {
               flag=false;
              for(int j=0 ; j<universe.size() ; j++ ) {
                  if(((String)set.get(i)).equals((String)universe.get(j))) {
                      flag =true;
                  }
              }

              if(flag==false) {
                  return false;
              }
          }

          return true;

      }

```

```java
   /*
    * this function print the sets.
    */
   public ArrayList printset(String set) {
       return sets.get(set);

   }
}
```

-Test Cases:

Test Case 1:

```
Enter The Universe Set
{1,2,3,4,5,6}
Enter The Number of Sets You Want to Deal With :
3
Enter set1
{1,2,3,3,3}
Enter set2
{2,3,4,6}
Enter set3
{}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set1
The name of the second set :
set2
{2, 3}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set1
The name of the second set :
set2
{1, 2, 3, 4, 6}
```

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set3
{1, 2, 3, 4, 5, 6}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set2
{1, 5}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set1
{4, 5, 6}
```

Test Case 2:

```
Enter The Universe Set
{Ahmed,Omar,Mohamed,Adel,Ibrahim}
Enter The Number of Sets You Want to Deal With :
3
Enter set1
{Ahmed,Adel}
Enter set2
{Ahmed}
Enter set3
{Ahmed,Ibrahim}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set1
The name of the second set :
set2
{Ahmed, Adel}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set3
{Omar, Mohamed, Adel}
```

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set1
The name of the second set :
set3
{Ahmed}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set2
{Omar, Mohamed, Adel, Ibrahim}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
5
```

Test Cases 3:

```
Enter The Universe Set
{+,x,=,_,*}
Enter The Number of Sets You Want to Deal With :
3
Enter set1
{+,+,x}
Enter set2
{-,-,-}
!!!! This Set is not subset to the Universe !!!!
Enter set2
{_}
Enter set3
{+,_,+}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set1
The name of the second set :
set3
{+}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set1
The name of the second set :
set3
{+, x, _}
```

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set3
{x, =, *}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set2
{+, x, =, *}
```

Test Case 4:

```
Enter The Universe Set
{1,2,3,4,9}
Enter The Number of Sets You Want to Deal With :
2
Enter set1
{5,k}
!!!! This Set is not subset to the Universe !!!!
Enter set1
{10,12}
!!!! This Set is not subset to the Universe !!!!
Enter set1
{1,2,3,5}
!!!! This Set is not subset to the Universe !!!!
Enter set1
{1,2,3}
Enter set2
{9}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
4
enter name of the set
set2
{9}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
4
enter name of the set
set1
{1, 2, 3}
```

Test Case 5:

```
Enter The Universe Set
{a,b,c,d,e,Ahmed,e,f,Mohamed,h}
Enter The Number of Sets You Want to Deal With :
6
Enter set1
{a,b}
Enter set2
{a,a}
Enter set3
{d,e,f}
Enter set4
{Mohamed}
Enter set5
{f,g,h}
!!!! This Set is not subset to the Universe !!!!
Enter set5
{}
Enter set6
{Ahmed,h}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set1
The name of the second set :
set4
{}
```

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set5
{a, b, c, d, e, Ahmed, f, Mohamed, h}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set2
{b, c, d, e, Ahmed, f, Mohamed, h}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set3
The name of the second set :
set4
{d, e, f, Mohamed}
```

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set5
{a, b, c, d, e, Ahmed, f, Mohamed, h}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set2
{b, c, d, e, Ahmed, f, Mohamed, h}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set3
The name of the second set :
set4
{d, e, f, Mohamed}
```

Test Case 6:

```
Enter The Universe Set
{1,2,5,2,1,1,2,1,2,4,3}
Enter The Number of Sets You Want to Deal Wit
2
Enter set1
{1,2,1,2,1,2,1,1,1,2}
Enter set2
{3,2,1,4,1}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
4
enter name of the set
set1
{1, 2}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set1
The name of the second set :
set2
{1, 2}
```

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set1
The name of the second set :
set2
{1, 2, 3, 4}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set1
{5, 4, 3}
```

Test Case 7:

```
<terminated> mainSet (2) [Java Application] C:\Users\Dell\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_15
!!!WELCOME TO OUR SIMPLE SET OPERATIONS EVALUATOR!!!

Enter The Universe Set
{"Discrete Maths","Programming 2","Computer Orgnizing","Numerical"}
Enter The Number of Sets You Want to Deal With :
2
Enter set1
{"Discrete Maths","Programming 2"}
Enter set2
{"Discrete Maths","Programming 2","Discrete Maths","Programming 2"}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set1
```

```
{"Computer Orgnizing", "Numerical"}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set1
The name of the second set :
set2
{"Discrete Maths", "Programming 2"}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set2
The name of the second set :
set1
{"Discrete Maths", "Programming 2"}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
5
```

Test Case 8:

```
!!!WELCOME TO OUR SIMPLE SET OPERATIONS EVALUATOR!!!

Enter The Universe Set
{2,3,5,7,11,13,17}
Enter The Number of Sets You Want to Deal With :
3
Enter set1
{1,3,5,5,3}
!!!! This Set is not subset to the Universe !!!!
Enter set1
{2,3,5,3,3,5}
Enter set2
{5,7,13}
Enter set3
{17}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
1
The name of the first set :
set2
The name of the second set :
set3
{}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
3
The name of set :
set3
{2, 3, 5, 7, 11, 13}
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
2
The name of the first set :
set1
The name of the second set :
set3
{2, 3, 5, 17}
```

-Assumptions and Details necessary:

- If the user entered **repeated values** in the set the program will remove the duplicate .
- The empty set is acceptable in the form **{}**
- If the out is empty set it will be in the form **{}**

- ### Guideline for The User:

  - The user input the set in the form **{a,b,c}** curly braces and each value separated by comma .
  - First user input the universe set.
  - Then, a number of sets will be entered.
  - Then enter the set and they are named **set1 ,set2,..seti** , the set must be subset to the universe.
  - Then choose one of the operations by entering it's number.

```
to chosse operation write number:
1- for intersection
2- for union
3- for complement
4- to print any set
5- to exit
```

  - Then enter the name of the set you want to do an operation on it ,The **name** of each set is as follows: "**set (with small s)** + "**the number of the entered set**".

- ### Features:

  - Get the intersection of two sets.
  - Union of two sets.
  - Complement of a set.
  - Print any set.
  - Do all this operation as much as the user wants and if want to stop choose exit.