Mathimatics for computers

Assignment one report

By : Bassem Mohamed

1 problem statement

Write a program that takes an input a list of strings as a Universe, then takes another input a number of sets (that are subsets of the universe) then ask the user about the operations they want to perform:

Union of two sets

Intersection of two sets

Complement of a set

2 code description

The code consists of two class ,the Main class which run the program ,and Set class whish consists of the main logic of the program .

Set class consists of one main variable (**Elements**) ,which is the **data Structure** used to save the set .The class also contain some getters and setters for the array list ,and also contain the three methods Intersection , Union , and Complement .

1. **Used data structure**
   The used data str. is ArrayList of String from Java library
2. **Algorithms and it's complexity**
   This the code used to implement the tree methods (Intesection , Union ,and Complement)
   the three methods depends on 2 for loops of complexity O(|set| * |universe|)

```
public Set getIntesectionWith(Set x) {
	Set intersection = new Set();
	for (int i = 0; i < x.getElements().size(); i++) {
		for (int j = 0; j < elements.size(); j++) {
			if (x.getElements().get(i).equals(elements.get(j))) {
				intersection.AddElemet(elements.get(j));
			}
		}
```

```
        }
        return intersection;
    }

    public Set getUnionWith(Set x) {
        Set union = new Set();
        for (int i = 0; i < elements.size(); i++) {
            union.AddElemet(elements.get(i));
        }
        for (int i = 0; i < x.getElements().size(); i++) {
            boolean intersection = false;
            for (int j = 0; j < elements.size(); j++) {
                if (x.getElements().get(i).equals(elements.get(j))) {
                    intersection = true;
                    break;
                }
            }
            if (!intersection)
                union.AddElemet(x.getElements().get(i));
        }
        return union;
    }

    public Set getComplementWith(Set x) {
        Set comp = new Set();
        for (int i = 0; i < x.getElements().size(); i++) {
            for (int j = 0; j < elements.size(); j++) {
                if (!x.getElements().get(i).equals(elements.get(j))) {
                    comp.AddElemet(x.getElements().get(i));
                }
            }

        }
        return comp;
    }
```

3 User guide and sample runs

- When you the program you will find this menu

```
                welcome to the set operations program
                -------------------------------------

Main menu

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = {  }
```

- Before doing anything you must enter a universe , to enter a universe press 1 the enter

```
Enter an element or type '}' to close the set :
```

- You should type the element you want to add the press enter after you finish adding type '}' then type enter

```
Enter an element or type '}' to close the set :
2
{ 2
5
{ 2, 5
5s
{ 2, 5, 5s
5
{ 2, 5, 5s
rrrrtttt
{ 2, 5, 5s, rrrrtttt
}
{ 2, 5, 5s, rrrrtttt }

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
```

- Secondly to add a set you must choose from the universe

```
1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
2
choose elements form the unvierse type the number beside the element :
{ 2 [0]  , 5 [1]  , 5s [2]  , rrrrtttt [3]  }
enter the number of set elements :
3
enter the index of the element in the universe
1
{ 5
2
{ 5, 5s
3
{ 5, 5s, rrrrtttt
{ 5, 5s, rrrrtttt }

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
Set 0 = { 5, 5s, rrrrtttt }
2
```

```
choose elements form the unvierse type the number beside the element :
{ 2 [0]  , 5 [1]  , 5s [2]  , rrrrtttt [3]  }
enter the number of set elements :
5
enter the index of the element in the universe
0
{ 2
1
{ 2, 5
2
{ 2, 5, 5s
2
{ 2, 5, 5s
2
{ 2, 5, 5s
{ 2, 5, 5s }

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
Set 0 = { 5, 5s, rrrrtttt }
Set 1 = { 2, 5, 5s }
```

- You can make the intersection and Union of two sets (Note : the new sets is added to the sets list) . You can make also the complement of a set .

```
1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
Set 0 = { 5, 5s, rrrrtttt }
Set 1 = { 2, 5, 5s }

3
type the name of the two sets :
Set 1 number =
0
Set 2 number =
1
Intersection = { 5, 5s }

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
Set 0 = { 5, 5s, rrrrtttt }
Set 1 = { 2, 5, 5s }
```

```
Set 2 = { 5, 5s }
4
type the name of the two sets :
Set 1 number =
0
Set 2 number =
1
Union = { 5, 5s, rrrrtttt, 2 }

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
Set 0 = { 5, 5s, rrrrtttt }
Set 1 = { 2, 5, 5s }
Set 2 = { 5, 5s }
Set 3 = { 5, 5s, rrrrtttt, 2 }
5
type the set
The set number =
0
Complement = { 2 }

1- Enter new univers press                          [1]
2- Add a set press                                  [2]
3- Find the intersection between two sets press     [3]
4- Find the union between two sets press            [4]
5- Find the complement of a set press               [5]
6- Exit                                             [6]
Universe = { 2, 5, 5s, rrrrtttt }
Set 0 = { 5, 5s, rrrrtttt }
Set 1 = { 2, 5, 5s }
Set 2 = { 5, 5s }
Set 3 = { 5, 5s, rrrrtttt, 2 }
Set 4 = { 2 }

6
```