

Sit-in Lab #1

CS1020 AY2010/11 Semester 2

Date: 10 February 2011, Thursday

School of Computing, National University of Singapore

0 Instructions

There are **two** exercises in this lab. This is an **open book** test. Time limit is **1 hour 30 minutes**. **Please do NOT reveal the question to anybody until tomorrow, Feb 11th 2011.**

Restrictions: You are not allowed to use Vectors for these questions.

1 Exercise 1 (Sets of integers) [40 marks]

In this exercise you are given two skeleton codes: ***Set.java***, and ***TestSet.java*** and you are supposed to complete the code in the two files so that the program behaves as explained below. The two skeleton codes are included in your directory and are printed on the next page for your convenience.

Desired program behavior:

Recall that a Set is a collection of objects. In this question the class ***Set*** represents a collection of integers. We assume the sets can contain up to a maximum of 3 elements. The program should behave as follows (read the sample run on the next page too):

- The user enters two sets of integers. For each of the two sets
 - The user first enters the size of the set (0-3).
 - The user then enters the elements (integers) separated by space. See the sample run for examples. If the size of the set was 0, then the program just prints "The set is empty!" as shown in the sample runs.
- The program prints out two sums. The sum of the members in set 1, and the sum of the members in set 2.
- Finally the program prints the ratio of the two sums. The ratio should be printed correct to one decimal place as shown in the sample run.

Coding Restrictions:

- In order to perform the first point above, you are required to declare two objects of type ***Set*** in `main()`. In the class `set`, make the public method: ***insert(int x)*** that allows the elements to be inserted into the set.
- Inside the class ***Set***, store the set of integers using an integer array, which should be a ***private*** attribute in the class.

- No **attributes** (data fields) of the class Set, should be made **public**. In order to access the attributes, you should make public **methods** in the class Set.
- All input/output from the user should be performed in **TestSet.java**

Advices for making Set.java:

- Declare the private attributes (data fields) you may need.
- Create a constructor that does not take any arguments. This constructor initializes the private attributes. (At the beginning, the set is of course empty).

Skeleton Code

```
// CS1020 AY2010/11 Semester 2
// Sit-in Lab #1
// Set.java
// <Fill in your name, NUSNET id and plab account here>

class Set{
    // Advice: Declare the private attributes (data fields) you may need.
    // Represent the set using an integer array.

    // Advice: write a non-argument constructor that initializes
    // the private attributes (data fields).
    // At the start, the set is of course empty.
}
```

```
// CS1020 AY2010/11 Semester 2
// Sit-in Lab #1
// TestSet.java
// <Fill in your name, NUSNET id and plab account here>

import java.util.Scanner;

class TestSet{
    public static void main(String args[]){

        //Ask the user to enter two sets, each of maximum size 3.
        //Store the two sets in two objects of class Set.

        //Print the sums of the elements in the two sets.
        //Print the ratio of the sums as explained in the question.

    }
}
```

Sample Runs

Two sample runs of the program are given below. Outputs are shown in bold.

```
Enter the number of elements in your first set [0-3]: 3  
Enter the 3 elements: 1 5 11  
Enter the number of elements in your second set [0-3]: 2  
Enter the 2 elements: 3 1  
Sum of elements in set 1 is: 17  
Sum of elements in set 2 is: 4  
The ratio sum1/sum2 is: 4.3
```

```
Enter the number of elements in your first set [0-3]: 3  
Enter the 3 elements: 5 7 9  
Enter the number of elements in your second set [0-3]: 0  
The set is empty!  
Sum of elements in set 1 is: 21  
Sum of elements in set 2 is: 0  
The ratio sum1/sum2 is: Infinity
```

2 Exercise 2 (Set Intersection and Set Difference) [60 marks]

For this question you do not need to make any new files. You are required to continue editing the files `Set.java` and `TestSet.java` that you wrote for the first question. Just as before the user enters the data for the two sets. The program now also prints the **intersection** of the two sets, and the **difference** of the two sets (see the sample output). Recall that an intersection of sets `Set1` and `Set2`, is a set `Set3`, that contains the elements *common* to the two sets. For e.g. the intersection of `{1, 5, 8}` and `{5, 9, 1}` is the set `{1, 5}`. We may assume that the sets entered by user contain **distinct** elements. In other words, no integer is included twice in the same set.

Desired program behavior:

The program is required to do the following two:

- It takes the intersection of the two sets that were entered by the user, and stores the result as a third set. It prints the elements in this third set (see sample output).
- Removes all the elements in `Set2` from `Set1`, and prints the remaining elements in `Set1`. For e.g removing `{7, 5, 15}` from `{1, 5, 8}` leaves the set `{1, 8}`.

Coding Restrictions:

All coding restrictions from question 1 still apply. Also, you are required to make at least the following two methods, along with any other methods that you may need:

- A method in **Set** named "**intersection**". This method takes the intersection of two sets in the following way. If `set1`, `set2` and `set3` are three sets, then writing: **`set3 = set1.intersection(set2)`**, should take the intersection of `set1` and `set2`, and return the result as `set3`.
- A method in **Set** with the signature **`void remove(int x)`**. This method removes the integer 'x' from the set, if 'x' is an element in the set. Otherwise if 'x' is not an element in the set, the set is left unchanged. The order of the remaining elements in the set, should remain unchanged.

Advice:

You may consider making a method **`isInSet(int x)`** that returns true if x is an element of the set, and returns false otherwise.

Sample Runs

The program output is in bold.

```
Enter the number of elements in your first set [0-3]: 3
Enter the 3 elements: 5 7 9
Enter the number of elements in your second set [0-3]: 2
Enter the 2 elements: 7 28
```

Sum of elements in set 1 is: 21
Sum of elements in set 2 is: 35
The ratio sum1/sum2 is: 0.6
The intersection of the two sets is the set: 7
After removing elements of Set 2 from set 1, remaining elements in set 1: 5 9

Enter the number of elements in your first set [0-3]: 3
Enter the 3 elements: 7 14 4
Enter the number of elements in your second set [0-3]: 3
Enter the 3 elements: 14 28 7
Sum of elements in set 1 is: 25
Sum of elements in set 2 is: 49
The ratio sum1/sum2 is: 0.5
The intersection of the two sets is the set: 7 14
After removing elements of Set 2 from set 1, remaining elements in set 1: 4

Enter the number of elements in your first set [0-3]: 3
Enter the 3 elements: 5 7 9
Enter the number of elements in your second set [0-3]: 0
The set is empty!
Sum of elements in set 1 is: 21
Sum of elements in set 2 is: 0
The ratio sum1/sum2 is: Infinity
The intersection of the two sets is the set: Empty!
After removing elements of Set 2 from set 1, remaining elements in set 1: 5 7 9

Marking Scheme

This lab constitutes of 100 marks. 80 marks are allocated to the correctness of the methods that you are supposed to complete or write. 20 marks are allocated to design and style. Mistakes that result in penalty include (but not limited to) the following:

- No name and discussion group (under style/design)
- Poor indentation (under style/design)
- Poor naming of variable or method (under style/design)
- Messy logic, even if the code produces correct result (under style/design)

=== End of paper ===