Java 程序设计实验报告

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实验五：集合对象程序设计

一、实验目的

1）了解集合的概念和基本接口

2）掌握增强 for 循环语句

3）掌握范型的应用

4）掌握基本集合对象 ArrayList 的应用

二、 实验内容

1）将 OOBMI 改造为 CollectionBMI 类；将 CollectionBMI 中的 Student[] students 改造为 **ArrayList<Student> students**；

2）改造 genStudents 函数，将随机生成的学生对象保存到 **ArrayList<Student> students** 中。

3）增加 inputStudents 函数和相关的 isExists 函数，不要求用户输入学生人数，通过询问用户是否继续输入来决定是否继续输入学生，并判断输入的学生是否已经存在，如果不存在则将输入的学生对象保存到 **ArrayList<Student> students** 中。

4）增加五个 comparator 子类(内部类)，能够利用 Collections.sort 函数对学生分别按照学号、姓名、身高、体重、BMI 进行排序

5）改造 printStatics 函数，该函数可以打印所有学生基本信息（**利用增强 for 语句**），以及统计结果信息。打印时，每个学生的信息打印为一行，为了清晰，学号、姓名、身高、体重和计算后的 bmi 值之间用制表符(\t)隔开；打印完学生信息后，打印 BMI 统计信息。

6）分别改造统计 bmi 的均值、中值、众数、方差等统计信息的 4 个函数。

7）改造 menu 函数，提供输入学生、随机生成学生、打印学生、5 种排序、打印统计信息、退出程序等 10 个菜单功能，用户输入指定选项后，运行相应函数功能。

8）在 CollectionBMI 的 main 函数中，调用 menu 函数，测试运行各项功能。

注意，身高、体重、及 bmi 等数值均需保留两位小数的格式进行存储和显示。

三、实验结果

注意：将程序代码和运行结果截图粘贴在此处，注意源代码中注释行数不少于全部代码的 1/3，程序源代码请压缩后上传，压缩文件按照 学号.zip 进行命名，注意源程序于报告请分别上传到不同的文件夹中！

```
package edu.hit.java.exp3;

import java.util.ArrayList;
import java.util.Comparator;
import java.util.Random;
import java.util.Scanner;
```

```
public class L170300901 {
	private static Scanner in = new Scanner(System.in);
	private static ArrayList<StudentInfo> listStudents = new ArrayList<>();

	public static void main(String[] args) {
		System.out.println("Welcome To The Students' Healthy Information System!\n");
		printMenu();
		in.close();
	}

	private static void printMenu() {
		int selMenu;

		while (true) {
			System.out.println("1. Create students at random");
			System.out.println("2. Print students' information");
			System.out.println("3. Sort the students by IDs");
			System.out.println("4. Sort the students by Names");
			System.out.println("5. Sort the students by Heights");
			System.out.println("6. Sort the students by Weights");
			System.out.println("7. Sort the students by BMIs");
			System.out.println("8. Print statics");
			System.out.println("9. Exit the students' healthy information system\n");
			System.out.print("Please input the number you want to do: ");

			selMenu = Integer.parseInt(in.nextLine());
			switch (selMenu) {
			case 1:
				inputStudents();
				break;
			case 2:
				printStudents();
				break;
			case 3:
				sortByID();
				break;
			case 4:
				sortByName();
				break;
			case 5:
				sortByHeight();
				break;
			case 6:
				sortByWeight();
```

```
            break;
        case 7:
            sortByBMI();
            break;
        case 8:
            printStatics();
            break;
        case 9:
            System.out.println("Goodbye! Thank you for using.");
            return;
        default:
            System.out.print("You input the wrong number. Please input again.");
            break;
        }
        System.out.print("\n\n");
    }
}

private static void inputStudents() {
    int numInputStudents, i;
    Random rand = new Random();

    System.out.print("\nPlease input the numbers of the students: ");
    numInputStudents = Integer.parseInt(in.nextLine());

    for (i = 0; i < numInputStudents; i++) {
        StudentInfo student = new StudentInfo();

        student.setID("Hit" + (int) getRandomValueRange(1170000000, 1171000000));
        student.setName(getGeneratedRandomName(3));
        student.setHeight(getRandomValueRange(140, 210));
        student.setWeight(getRandomValueRange(30, 150));
        student.setBMI(calculateBMI(student.getHeight(), student.getWeight()));

        listStudents.add(student);
    }
}

private static float getRandomValueRange(int min, int max) {
    return (float) ((Math.random() * (max - min + 1)) + min);
}

private static String getGeneratedRandomName(int length) {
    char[] randName = new char[length];
```

```
        for (int i = 0; i < length; i++)
            randName[i] = (char) Math.round((int) getRandomValueRange((int) 'a', (int)
'z'));
        randName[0] = Character.toUpperCase(randName[0]);

        return String.valueOf(randName);
    }

    public static float calculateBMI(float height, float weight) {
        return (float) (weight / Math.pow(height / 100, 2.0));
    }

    public static void printStudents() {
        StudentInfo student = new StudentInfo();

        for (int i = 0; i < listStudents.size(); i++) {
            System.out.printf(listStudents.get(i).getID() + "\t" +
listStudents.get(i).getName() + "\t"
                    + String.format("%.2f", listStudents.get(i).getHeight()) + "\t"
                    + String.format("%.2f", listStudents.get(i).getWeight()) + "\t"
                    + String.format("%.2f", listStudents.get(i).getBMI()) + "\t");
            checkHealth(listStudents.get(i).getBMI());
        }
    }

    public static void checkHealth(float bmi) {
        if (bmi <= 18.5)
            System.out.println("Underweight");
        else if (bmi <= 23)
            System.out.println("Normal Range");
        else if (bmi <= 25)
            System.out.println("Overweight--At Risk");
        else if (bmi <= 30)
            System.out.println("Overweight--Moderately Obese");
        else
            System.out.println("Overweight--Severely Obese");
    }

    public static void sortByID() {
        listStudents.sort(Comparator.comparing(StudentInfo::getID));
    }

    public static void sortByName() {
        listStudents.sort(Comparator.comparing(StudentInfo::getName));
}

public static void sortByHeight() {
        listStudents.sort(Comparator.comparing(StudentInfo::getHeight));
}

public static void sortByWeight() {
        listStudents.sort(Comparator.comparing(StudentInfo::getWeight));
}

public static void sortByBMI() {
        listStudents.sort(Comparator.comparing(StudentInfo::getBMI));
}

public static void printStatics() {
        float maxBMI, minBMI, sumBMI;
        float maxHeight, minHeight, sumHeight;
        float maxWeight, minWeight, sumWeight;

        // Initialize
        maxBMI = minBMI = sumBMI = listStudents.get(0).getBMI();
        maxHeight = minHeight = sumHeight = listStudents.get(0).getHeight();
        maxWeight = minWeight = sumWeight = listStudents.get(0).getWeight();

        // Calculate
        for (int i = 1; i < listStudents.size(); i++) {
                StudentInfo currStudent = listStudents.get(i);

                sumBMI += currStudent.getBMI();
                sumHeight += currStudent.getHeight();
                sumWeight += currStudent.getWeight();

                if (maxBMI < currStudent.getBMI())
                        maxBMI = currStudent.getBMI();
                if (minBMI > currStudent.getBMI())
                        minBMI = currStudent.getBMI();
                if (maxHeight < currStudent.getHeight())
                        maxHeight = currStudent.getHeight();
                if (minHeight > currStudent.getHeight())
                        minHeight = currStudent.getHeight();
                if (maxWeight < currStudent.getWeight())
                        maxWeight = currStudent.getWeight();
                if (minWeight > currStudent.getWeight())
                minWeight = currStudent.getWeight();
        }

        // Print result
        float avgBMI = sumBMI / listStudents.size();
        float avgHeight = sumHeight / listStudents.size();
        float avgWeight = sumWeight / listStudents.size();

        System.out.println("Average of height: " + String.format("%.2f", avgHeight) +
"\n" + "Biggest of height: "
                + String.format("%.2f", maxHeight) + "\n" + "Smallest of height: " +
String.format("%.2f", minHeight)
                + "\n");
        System.out.println("Average of weight: " + String.format("%.2f", avgWeight) +
"\n" + "Biggest of weight: "
                + String.format("%.2f", maxWeight) + "\n" + "Smallest of weight: " +
String.format("%.2f", minWeight)
                + "\n");
        System.out.println("Average of BMI: " + String.format("%.2f", avgBMI) + "\n" +
"Biggest of BMI: "
                + String.format("%.2f", maxBMI) + "\n" + "Smallest of BMI: " +
String.format("%.2f", minBMI) + "\n");
    }
}
```

运行结果

```
Welcome To The Students' Healthy Information System!

1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 1

Please input the numbers of the students: 3
```

```
1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 2
Hit1170645760   Xrk 140.83   140.21   70.69    Overweight--Severely Obese
Hit1170831360   Qtr  202.04  133.10   32.61    Overweight--Severely Obese
Hit1170838656   Zem144.94    51.64    24.58    Overweight--At Risk


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 3


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 2
Hit1170645760   Xrk 140.83   140.21   70.69    Overweight--Severely Obese
Hit1170831360   Qtr  202.04  133.10   32.61    Overweight--Severely Obese
Hit1170838656   Zem144.94    51.64    24.58    Overweight--At Risk
```

```
1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 4


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 2
Hit1170831360      Qtr  202.04     133.10     32.61       Overweight--Severely Obese
Hit1170645760      Xrk 140.83     140.21     70.69       Overweight--Severely Obese
Hit1170838656      Zem144.94     51.64       24.58       Overweight--At Risk


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 5


1. Create students at random
```

```
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 2
Hit1170645760      Xrk 140.83     140.21     70.69      Overweight--Severely Obese
Hit1170838656      Zem144.94      51.64      24.58      Overweight--At Risk
Hit1170831360      Qtr  202.04    133.10     32.61      Overweight--Severely Obese


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 6


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 2
Hit1170838656      Zem144.94      51.64      24.58      Overweight--At Risk
Hit1170831360      Qtr  202.04    133.10     32.61      Overweight--Severely Obese
Hit1170645760      Xrk 140.83     140.21     70.69      Overweight--Severely Obese
```

```
1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 7


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 2
Hit1170838656     Zem144.94    51.64     24.58     Overweight--At Risk
Hit1170831360     Qtr  202.04  133.10    32.61     Overweight--Severely Obese
Hit1170645760     Xrk 140.83   140.21    70.69     Overweight--Severely Obese


1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 8
Average of height: 162.60
Biggest of height: 202.04
Smallest of height: 140.83
```

```
Average of weight: 108.32
Biggest of weight: 140.21
Smallest of weight: 51.64

Average of BMI: 42.63
Biggest of BMI: 70.69
Smallest of BMI: 24.58



1. Create students at random
2. Print students' information
3. Sort the students by IDs
4. Sort the students by Names
5. Sort the students by Heights
6. Sort the students by Weights
7. Sort the students by BMIs
8. Print statics
9. Exit the students' healthy information system

Please input the number you want to do: 9
Goodbye! Thank you for using.
```