Exercise – Objects with Arrays

1. Define and encapsulate the following class called *student*. Include fields to hold the following data:
   last name;
   age;
   Student number
   A set of four marks;
   Students mean average calculated from the four marks;

   Create a constructor that will initialize *last name* to "MRSX" and *age* to 18 and initialize *student number* to 555555 and all marks to 0. Create all necessary instance methods. Do not allow the programmer to manipulate any of the fields in a manner that is inappropriate. Create an instance method that will print an object of type *student*.

```
class Student {
	String lastName;                          //Stores student last name
	int age;                                        //Stores student age
	int studentNumber;                        //Stores student student number
	double [] marks = new double[4]; //Stores student 4 marks
	double average;                                 //Stores student average

	/*
	 * This constructor initializes the class fields
	 * pre: none
	 * psot: none
	*/
	public Student () {
		lastName = "MRSX";
		age = 18;
		studentNumber = 555555;
		for (int x = 0; x < marks.length; x++)
			marks[x] = 0;
	}

	/*
	 *This accessor method returns the last name of the student
	 *pre : none
	 *post: last name
	*/
	public String displayName () {
		return lastName;
	}

	/*
	 *This accessor method returns the age of the student
	 *pre : none
	 *post: age
	*/
	public int displayAge () {
		return age;
	}
```

```java
/*
 *This accessor method returns the student number of the student
 *pre : none
 *post: student number
*/
public int displayStudentNumber () {
	return studentNumber;
}

/*
 *This accessor method returns the average of the student
 *pre : none
 *post: average
*/
public double displayAverage () {
	for (int x = 0; x < marks.length; x++) {
		average = average + marks[x];
	}
	average = average/marks.length;
	return average;
}

/*
 *This mutator method edits the name of the student
 *pre : name
 *post: none
*/
public void editName (String name) {
	lastName = name;
}

/*
 *This mutator method edits the age of the student
 *pre : age
 *post: none
*/
public void editAge (int age) {
	if (age <= 0)
		this.age = 18;
	else
		this.age = age;
}

/*
 *This mutator method edits the student number of the student
 *pre : student number
 *post: none
*/
public void editStudentNumber (int number) {
	if (number < 0)
		studentNumber = Math.abs(number);
	else
		studentNumber = number;
}
```

```
	/*
	 *This mutator method edits the 4 marks of the student
	 *pre : marks array
	 *post: none
	*/
	public void editMarks (double [] m) {
		for (int x = 0; x < marks.length; x++) {
			marks[x] = m[x];
		}
	}

	/*
	 *This mutator method edits the average of the student
	 *pre : average
	 *post: none
	*/
	public void editAverage (double average) {
		if (average > 100 || average < 0)
			average = 0;
		else
			this.average = average;
	}
}
```

2. Define and encapsulate the following class called *classroom* with fields to hold the following data:
   Class code
   An array of Students
   Class average

   a. In classroom, write a constructor that will receive one parameter: an int called *y*. The constructor will initialize the *class code* to "ICS4U0" and create an array of students of size *y*. Class average will be initialized to 0

   b. Create an instance method called *average*, that will calculate the class average.

   c. In classroom, create an instance method called *insertstudent (student s)*. This method will insert *s* as the last element in the array of students in *list*.

   d. In classroom, create an instance method called *sort*. This method will sort the list of students by their average in order from highest to lowest.

   e. In classroom, create an instance method called *printstudent()*. This method will print all students in an object of type *classroom*.

```
class Classroom {
	String classCode;
	Student [] student;
	double classAverage;
```

```java
/*
 * This constructor initializes the class fields
 * pre: none
 * psot: none
*/
public Classroom (int y) {
	classCode = "ICS4U0";
	student = new Student [y];
	classAverage = 0;
}

/*
 *This method calculates and returns the class average
 *pre : none
 *post: class average
*/
public double average () {
	int average = 0;
	for (int x = 0; x < student.length; x++) {
		classAverage = classAverage + student[x].displayAverage();
	}
	classAverage = classAverage/student.length;
	return classAverage;
}

/*
 *This method inserts students into the array
 *pre : student
 *post: none
*/
public void insertstudent (Student s) {
	Student [] list = null;
	if (student[student.length-1] == null) {
		list = new Student [student.length];
		for (int x = 0; x < student.length; x++) {
			if (student[x] == null) {
				list[x] = s;
				break;
			}
			else
				list[x] = student[x];
		}

	}
	else {
		list = new Student [student.length + 1];
		for (int x = 0; x < student.length; x++)
			list[x] = student[x];
		list[student.length-1] = s;
	}
	student = list;

}
```

```
	/*
	 *This method sorts the list of students by their average in order from
highest to lowest.
	 *pre : none
	 *post: none
	*/
	public void sort () {
		for (int x = 0; x < student.length; x++) {
			for (int y = 0; y < student.length-1; y++) {
				if (student[y].displayAverage() >
student[y+1].displayAverage()) {
					Student temp = student[y+1];
					student[y+1] = student[y];
					student[y] = temp;
				}
			}
		}
	}

	/*
	 *This method prints the name of all students in the class
	 *pre : none
	 *post: Prints students name
	*/
	public void printstudent() {
		for (int x = 0; x < student.length; x++) {
			System.out.println((x+1) + " - " + student[x].displayName());
		}
	}

}
```

3. In your main program:
    a. Prompt the user for the size of a class and write a segment of code that will create an object of type *classroom* of that size.
    b. Prompt the user for all the student data.
    c. Provide the user with the following actions
        1. Edit student (search by student number)
        2. Add student
        3. Print class average
        4. Print list of students

```
import java.util.Scanner;

public class Question3 {

	public static void main(String[] args) {
		// TODO Auto-generated method stub
		Scanner input = new Scanner (System.in);
		System.out.println("Enter the size of the classroom");
		int size = input.nextInt();
```

```
		Classroom classroom = new Classroom (size);

		for (int x = 0; x < size; x++) {
			Student student = new Student();
			System.out.println("Enter the name of student " + (x+1));
			String name = input.next();
			System.out.println("Enter the age of student " + (x+1));
			int age = input.nextInt();
			System.out.println("Enter the student # of student " + (x+1));
			int studentNumber = input.nextInt();
			double marks [] = new double [4];
			for (int y = 0; y < 4; y++) {
				System.out.println("Enter student's mark " + (y+1));
				marks[y] = input.nextDouble();
			}

			student.editName(name);
			student.editAge(age);
			student.editStudentNumber(studentNumber);
			student.editMarks(marks);
			classroom.insertstudent(student);
		}

		System.out.println("\t\t*MENU*");
		System.out.println("1 - Edit student (search by student number)");
		System.out.println("2 - Add student");
		System.out.println("3 - Print class average");
		System.out.println("4 - Print list of students");
		System.out.println("Enter option from the following MENU:");
		int option;
		do {
			option = input.nextInt();
			if (option > 4 || option < 1) {
				System.out.println("Invalid option");
				System.out.println("Please enter an option from the menu
between 1 -4 ");
			}
		}
		while (option > 4 || option < 1);

		if (option == 1) {
			System.out.println ("Enter student number of the student you wish
to edit");
			int studentNumber = input.nextInt();
			int studentIndex = 0;
			for (int x = 0; x < classroom.student.length; x++) {
				if (studentNumber ==
classroom.student[x].displayStudentNumber()) {
					studentIndex = x;
					break;
				}
				else {
					studentIndex = -1;
				}
			}
```

```
                    if (studentIndex >= 0) {
                          System.out.println("\t\t*ENTER EDIT*");
                          System.out.println("1 - Edit Name");
                          System.out.println("2 - Edit Age");
                          System.out.println("3 - Edit Student Number");
                          System.out.println("4 - Edit Average");
                          do {
                                option = input.nextInt();
                                if (option > 4 || option < 1 ) {
                                      System.out.println("Invalid option");
                                      System.out.println("Please enter a valid
option between 1 - 4");
                                }
                          }
                          while (option > 4 || option < 1);

                          if (option == 1) {
                                System.out.println ("Enter student new Name:");
                                String name = input.next();
                                classroom.student[studentIndex].editName(name);
                          }
                          else if (option == 2) {
                                System.out.println ("Enter student new Age:");
                                int age = input.nextInt();
                                classroom.student[studentIndex].editAge(age);
                          }
                          else if (option == 3) {
                                System.out.println ("Enter student new Student
Number:");
                                studentNumber = input.nextInt();

      classroom.student[studentIndex].editStudentNumber(studentNumber);
                          }
                          else if (option == 4) {
                                System.out.println ("Enter student new Average:");
                                double average = input.nextDouble();

      classroom.student[studentIndex].editAverage(average);
                          }
                          System.out.println("Student successfully edited");
                    }
              }

              else if (option == 2) {
                    Student student = new Student();
                    System.out.println("Enter the name of student:");
                    String name = input.next();
                    System.out.println("Enter the age of student:");
                    int age = input.nextInt();
                    System.out.println("Enter the student # of student:");
                  int studentNumber = input.nextInt();
                    double marks [] = new double [4];
                    for (int y = 0; y < 4; y++) {
                          System.out.println("Enter student's mark " + (y+1));
```

```
                        marks[y] = input.nextDouble();
                    }

                    student.editName(name);
                    student.editAge(age);
                    student.editStudentNumber(studentNumber);
                    student.editMarks(marks);
                    classroom.insertstudent(student);
            }

            else if (option == 3) {
                    System.out.println("The class average is " + classroom.average()
+ "%");
            }
            else if (option == 4) {
                    System.out.println("\t\t*Student List*");
                    for (int x = 0; x < classroom.student.length; x++)
                        System.out.println((x+1) + " - " +
classroom.student[x].displayName());
            }
      }
}
```