**44-542 Object-Oriented Programming**

**Lab: Arrays and ArrayLists**

In this lab you have to create four classes: **Faculty**, **FacultyArray**, **FacultyList and FacultyDriver class (**which is provided for you). The **Faculty** class stores information about a faculty. The **FacultyArray** class creates an array of **Faculty** objects, and the **FacultyList** class creates an **ArrayList** of **Faculty** objects. You must include javadocs for all methods and constructors for these three classes.

**Note:** The name of the project will be your “*Lastname*\_Lab04ArraysAndArrayList”. For example “Smith\_ Lab04ArraysAndArrayList”.

All classes must be placed in a package named **faculty**.

**The Faculty class:**

Private instance variables for this class are

**private String firstName;**

**private String lastName;**

**private double salary;**

**private static int totalFaculty = 0;**

These instance variables are used to store the first and last name and the **salary** of a **Faculty** object. In addition, the static variable **totalFaculty** is used to keep track of the total number of **Faculty** objects created. Each time a **Faculty** object is created, **totalFaculty** will be incremented by one. If a faculty is removed, no change is made to **totalFaculty**, since it is used solely to keep track of the total number of faculty that have been created, not the number of faculty currently stored.

1. Constructor: There will be one constructor with parameters, with the following prototype. Constructor with three parameters. Creates a Faculty object with first name, last name, and **salary** as designated by the parameters. Increments totalFaculty by 1.

public **Faculty**(String firstName,String lastName,double salary)

1. Constructor: Constructor with two parameters. Creates a Faculty object by first name and last name as designated by the parameters. Salary of this Faculty is set to 0. Increments **totalFaculty** by 1.

public **Faculty**(String firstName,String lastName)

1. Constructor: No args constructor.

public **Faculty()**

1. Methods: Methods are described below. The setters do not return a value. Do not add any public methods beyond those shown here.
   1. getSalary(): Returns double value. This method returns the salary.
   2. setSalary(double salary): This method do not return any value. Sets the value of the salary.
   3. getTotalFaculty(): Returns int value. Returns the total number of faculty that have been created.
   4. toString():Returns a String representation of this Faculty object. The String representation consists of the label "Name: ", followed by the first and last name of the faculty, separated by a single space, followed by “;” and a single space, and the label "Salary: $", followed by the salary of the faculty.

**The FacultyList class:**

This class has one instance variable:

**private ArrayList<Faculty> facultyArrayList;**

1. Constructor: There will be one no-arg constructor, with the below prototype which is used to initialize arraylist to a new empty arraylist of Faculty objects.

public FacultyList()

1. Methods: Methods are described below. All the methods are public. Do not add any public methods beyond those shown here.
2. addFaculty(Faculty faculty): Return boolean value. This method will add the faculty object to the end of the list and returns true if the faculty is successfully added.
3. addFaculty(int facultyPosition, Faculty faculty): Return boolean value. This method adds a faculty to the list at the specified position. If the position specified is larger than the current size of the list, the faculty is not added, and false is returned. If the faculty is successfully added, true is returned. When adding a faculty, other faculty may need to be shifted to the right in order to make space. Note that the add method for ArrayList will automatically shift for you.

Note: facultyPosition defines the position in the array, faculty defines the faculty to be added).

1. removeFaculty(int facultyPosition): Return boolean value. Removes the faculty with specified position from the list of faculty. If a faculty is not stored at the specified position (which will be the case if the position is greater than or equal to the size of the list), the list is not changed and false is returned. If a faculty is stored at the specified position, the faculty is removed, and other faculty are shifted to fill the empty space, and true is returned. Note that the remove method of the ArrayList class automatically shifts elements to the left when necessary.

Note: facultyPosition defines the position of the faculty to be removed.

1. getNumberOfFaculty(): Returns int value. Returns the number of faculty in the list.
2. findAverageSalary():Returns double value. Returns the average Salary of the faculty in the list. If the list is empty, 0.0 is returned.
3. toString():Returns a String representation of the list of faculty. The String returned consists of each faculty in the list, followed by a newline character. The representation used for each faculty must be the same as provided by the toString method of the Faculty class. If the toString method of the Faculty class is changed, then the output produced by this method will also change.

**The FacultyArray class:**

This class has the following private instance variable:

**private Faculty[] facultyArray;**

**private int numberOfFaculty;**

**private final int MAX = 100;**

The variable **numberOfFaculty** is used to keep track of the current number of faculty in the array

1. **Constructor:** There will be one no-arg constructor, with the below prototype used to create an empty list of faculty with size set to MAX, and sets **numberOfFaculty** to 0.

public FacultyArray()

1. Methods: Methods are described below. All the methods are public. Do not add any public methods beyond those shown here.
2. addFaculty(Faculty facultyIn): Returns boolean value. This method adds a faculty at the end of the list. If the list is full, the faculty cannot be added and false is returned. Otherwise, the faculty is added, numberOfFaculty is incremented by 1, and true is returned.
3. addFaculty(int facultyPosition, Faculty faculty): Returns boolean value. This method adds a faculty to the list at the specified position. If the list is full, or if the position specified is larger than **numberOfFaculty**, the faculty is not added, and false is returned. If the faculty is successfully added, true is returned, and numberOfFaculty is incremented by 1. When adding a faculty, other faculty may need to be shifted to the right in order to make space. That is, this should be treated as an "insert" operation, not a "replace" operation.

Note: facultyPosition defines the position in the list where the faculty, and faculty defines the faculty to be added.

1. removeFaculty(int facultyPosition): Returns boolean value. Removes the faculty with specified position from the list of faculty. If a faculty is not stored at the specified position (which will be the case if the position is greater than or equal to **numberOfFaculty**), the list is not changed and false is returned. If a faculty is stored at the specified position, the faculty is removed, and other faculty are shifted to fill the empty space. **numberOfFaculty** is also decremented by 1, and true is returned.

Note: facultyPosition defines the position of the faculty to be removed.

1. getNumberOfFaculty():Returns int value. Returns the number of faculty in the list.
2. findAverageSalary():Returns double value. Returns the average salary of the faculty in the list. If the list is empty, 0.0 is returned.
3. toString():Returns a String representation of the list of faculty. The String returned consists of each faculty in the list, followed by a newline character. The representation used for each faculty must be the same as provided by the toString method of the Faculty class. If the toString method of the Faculty class is changed, then the output produced by this method will also change.

Test **FacultyList** using **FacultyDriver,** which is provided for you. Be sure to comment out the appropriate line at the beginning of the program to ensure that you are using the **FacultyList** class.

The driver reads from a file named **faculty.txt**, which is provided for you. This file should be placed in your project directory. A sample run, using this input file, is at the end of this document.

Test **FacultyArray** using **FacultyDriver**. Be sure to comment out the appropriate line at the beginning of the program to ensure that you are using the **FacultyArray** class. The same input file is used as for the **FacultyList** class, and the output should be identical.

After testing **FacultyArray**, change the value of **MAX** to 5, and then run again using both **FacultyArray** and **FacultyList**. Output will be different for the two runs because you will not be able to store all the records when using the **FacultyArray** class. However, both versions should run without exceptions. Repeat your tests again, with the value of **MAX** set to 10.

**Note:** The output should be shown both on the console and saved to a file. Use Printwriter to save the console output to a file.

**Note**: Limit the value of the average salary to 2 decimal points.

**Sample Run (FacultyList object):**

Total Faculty objects created from faculty.txt = 8

Contents of faculty list (8 faculty members)

Name: Andrew Kabasele; Salary: $36000.47

Name: Jonathan Abarbanel; Salary: $48000.45

Name: Hessamoddin Abbassi; Salary: $38403.46

Name: Khaled Abdelhady; Salary: $74000.89

Name: Jeremiah Abiade; Salary: $98403.47

Name: Joanna Abraham; Salary: $94803.46

Name: Rafail Abramov; Salary: $84903.45

Name: Daniel Benette; Salary: $98409.34

Average salary: $71615.62

Adding one faculty to end of list

Attempting to add one faculty to list at index 3

Successfully added

Attempting to add one faculty to list at index 40

Unable to add faculty

Number of faculty members in list: 10

Attempting to remove a faculty at index equal to the number of faculty members in the list (currently 10)

Unable to remove

Attempting to remove a faculty at index 5

Successfully removed

Attempting to remove a faculty at index 20

Unable to remove

Contents of faculty list (9 faculty members)

Contents of list

Name: Andrew Kabasele; Salary: $36000.47

Name: Jonathan Abarbanel; Salary: $48000.45

Name: Hessamoddin Abbassi; Salary: $38403.46

Name: Bilbo Baggins; Salary: $45000.48

Name: Khaled Abdelhady; Salary: $74000.89

Name: Joanna Abraham; Salary: $94803.46

Name: Rafail Abramov; Salary: $84903.45

Name: Daniel Benette; Salary: $98409.34

Name: Gwen DeMarco; Salary: $39000.45

Average salary: $62058.05

**Sample Output (FacultyArray object):**

Total Faculty objects created from faculty.txt = 8

Contents of faculty list (8 faculty members)

Name: Andrew Kabasele; Salary: $36000.47

Name: Jonathan Abarbanel; Salary: $48000.45

Name: Hessamoddin Abbassi; Salary: $38403.46

Name: Khaled Abdelhady; Salary: $74000.89

Name: Jeremiah Abiade; Salary: $98403.47

Name: Joanna Abraham; Salary: $94803.46

Name: Rafail Abramov; Salary: $84903.45

Name: Daniel Benette; Salary: $98409.34

Average salary: $71615.62

Adding one faculty to end of list

Attempting to add one faculty to list at index 3

Successfully added

Attempting to add one faculty to list at index 40

Unable to add faculty

Number of faculty members in list: 10

Attempting to remove a faculty at index equal to the number of faculty members in the list (currently 10)

Unable to remove

Attempting to remove a faculty at index 5

Successfully removed

Attempting to remove a faculty at index 20

Unable to remove

Contents of faculty list (9 faculty members)

Contents of list

Name: Andrew Kabasele; Salary: $36000.47

Name: Jonathan Abarbanel; Salary: $48000.45

Name: Hessamoddin Abbassi; Salary: $38403.46

Name: Bilbo Baggins; Salary: $45000.48

Name: Khaled Abdelhady; Salary: $74000.89

Name: Joanna Abraham; Salary: $94803.46

Name: Rafail Abramov; Salary: $84903.45

Name: Daniel Benette; Salary: $98409.34

Name: Gwen DeMarco; Salary: $39000.45

Average salary: $62058.05

**Sample Output (FacultyArray object with MAX = 5):**

Total Faculty objects created from faculty.txt = 8

Contents of faculty list (5 faculty members)

Name: Andrew Kabasele; Salary: $36000.47

Name: Jonathan Abarbanel; Salary: $48000.45

Name: Hessamoddin Abbassi; Salary: $38403.46

Name: Khaled Abdelhady; Salary: $74000.89

Name: Jeremiah Abiade; Salary: $98403.47

Average salary: $58961.75

Adding one faculty to end of list

Attempting to add one faculty to list at index 3

Unable to add faculty

Attempting to add one faculty to list at index 40

Unable to add faculty

Number of faculty members in list: 5

Attempting to remove a faculty at index equal to the number of faculty members in the list (currently 5)

Unable to remove

Attempting to remove a faculty at index 5

Unable to remove

Attempting to remove a faculty at index 20

Unable to remove

Contents of faculty list (5 faculty members)

Contents of list

Name: Andrew Kabasele; Salary: $36000.47

Name: Jonathan Abarbanel; Salary: $48000.45

Name: Hessamoddin Abbassi; Salary: $38403.46

Name: Khaled Abdelhady; Salary: $74000.89

Name: Jeremiah Abiade; Salary: $98403.47

Average salary: $58961.75