Final Programming Test

IS 147 Section 4

Exam Starts: Dec 8, 6:00 PM (EST)

Exam Ends: Dec 10, 11:59 PM (EST)

Submission through Blackboard

Problem 1: RangeNumbers.java (30 points)

Generate two random integers, a and b, between 0 and 500. Make sure b is always greater than a. Now, count and sum, between a and b all:

1. Triangular numbers (an integer x is triangular if and only if 8x + 1 is a square: https://en.wikipedia.org/wiki/Triangular_number)
2. Pentagonal numbers (an integer x is pentagonal if and only if 24x+1 is a perfect square. https://en.wikipedia.org/wiki/Pentagonal_number)
3. Hexagonal numbers (an integer x is Hexagonal if and only if $\frac{\sqrt{8x+1}+1}{4}$ is an integer.)

Tasks:

a) Write a method name isTriangular() which takes one integer number, returns true if that number is triangular, and returns false otherwise. (**5 points**)
b) Write a method name isPentagonal() which takes one integer number, returns true if that number is pentagonal, and returns false otherwise. (**5 points**)
c) Write a method name isHexagonal() which takes one integer number, returns true if that number is hexagonal, and returns false otherwise. (**10 points**)
d) Write a program that can generate two integers a and b where each of them are between 0 and 500, and b must be greater than a. Now take each of the integer between a and b, check whether it is triangular, pentagonal or hexagonal number or not, and finally print, how many triangular, pentagonal and hexagonal numbers are present between a and b. Also print, the summation of all triangular, pentagonal and hexagonal numbers. (**10 points**)

Hints:

1. Take a look into Assignment 3 and Lab Test 3 solutions. Reuse the methods if necessary.
2. You can create 6 integers, countTriangle, countPentagonal, countHexagonal, sumTriangle, sumPentagonal, sumHexagonal. Then, check each number between a and b, increase appropriate variables based on the check.
3. For, isHexagonal() method, to check whether a number, x, is integer or not, use the following trick:

```
if(x%Math.floor(x)==0)
    return true;
else
    return false;
```

Sample Outputs:

```
The input numbers are 384 and 485
There are 3 triangular numbers and their sum is 1306
There are 4 pentagonal numbers and their sum is 1736
There are 1 hexagonal numbers and their sum is 435
```

Problem 2: RandomGrader.java (40 points)

Write a program which contains a class, name Students which has 5 data fields and four methods

All of the data fields are private and they are as follows:

- String variable courseName
- Integer variable numberOfStudents
- Integer array, points[] with a size of numberOfStudents
- Character array, grades[] with a size of numberOfStudents. It is calculated grades
- Character array, randomGrades[] with a size of numberOfStudents. It is randomly generated grades.

Methods are:

- A constructor with two parameters, String courseName and integer numberOfStudents. The constructor initializes the variable grades with a size numberOfStudents.
- generatePoints() that initializes points[] array elements which would be random number between 50 and 100.
- calculateGrades() that initializes grades[] character array elements which would be the calculated grade of corresponding points of points[] array.
    - If element of points[] array >= 90, assign grade[] array element ‘A’
    - If element of points[] array >= 80 and <90, assign grade[] array element ‘B’
    - If element of points[] array >= 70 and <80 assign ‘C’
    - If element of points[] array >= 60 and <70 assign ‘D’
    - If element of points[] array >= 50 and <60 assign ‘E’
    - If element of points[] array <50, assign ‘F’
    - displayGrades() display the coursename and grades of each students.
- generateRandomGrades() that initializes randomGrades[] character array elements which would be random characters between ‘A’ and ‘F’
- displayGradesDetails() displays the grades of each student, check and display whether randomly generated grades are equal to calculated grades or not, and display how many students were graded less than they were calculated.

Now create an object of class, Students, generate points randomly using generatePoints(), calculate grades by calling calculateGrades() method, generate grades randomly using generateRandomGrades() and display grade details using displayGradesDetails()

The main method must look like this:

```
public static void main(String[] args) {
        Students is147=new Students("Introduction to Java Programming",24);
        is147.displayGradesDetails();
}
```

Tasks:

- Create a file, RandomGrader.java, with a public class, RandomGrader, where the main method has been placed. Now create a class, Students with required data fields and constructor. (**10 points**)
- Write method generatePoints() following appropriate requirements. (**2 points**)
- Write method calculateGrades () following appropriate requirements. (**10 points**)
- Write method generateRandomGrades () following appropriate requirements. (**3 points)**
- Write method displayGradesDetails () following appropriate requirements. (**10 points**)
- Properly formatted and error free outputs. (**5 points**)

Hints:

- Take a look into Lab Test 4 solution.
- You can create more than required methods.

Sample outputs:

```
Course Name Introduction to Java Programming
Student no.   0: Grade is   B which is not correct
Student no.   1: Grade is   A which is not correct
Student no.   2: Grade is   C which is not correct
Student no.   3: Grade is   D which is not correct
Student no.   4: Grade is   A which is not correct
Student no.   5: Grade is   B which is not correct
Student no.   6: Grade is   C which is correct
Student no.   7: Grade is   A which is correct
Student no.   8: Grade is   A which is correct
Student no.   9: Grade is   D which is correct
Student no.   10: Grade is   B which is correct
Student no.   11: Grade is   D which is correct
Student no.   12: Grade is   B which is correct
Student no.   13: Grade is   B which is correct
Student no.   14: Grade is   A which is correct
Student no.   15: Grade is   D which is correct
Student no.   16: Grade is   A which is correct
Student no.   17: Grade is   A which is correct
Student no.   18: Grade is   D which is correct
Student no.   19: Grade is   B which is correct
Student no.   20: Grade is   B which is correct
Student no.   21: Grade is   A which is correct
Student no.   22: Grade is   C which is correct
Student no.   23: Grade is   D which is correct
Total 5 students are wrongly graded
```

Problem 3: BookStore.java (30 points)

Write a class name, Book, with 5 data fields, one constructor and one method. The details are as stated bellow:

Class name: Book

Data fields: variables, int id, String author, String title, int noOfPages,boolean fiction

Constructor: Book() with 5 parameters int id, String author,String title, int noOfPages, boolean fiction that set the values to corresponding data fields.

Method: toString() that takes no parameters but returns an String object concatenating id, author, title, noOfPages and fiction all together as follows:

id: 10, Title: The Red Sari, Author: Javier Moro, No. of pages: 102, Fiction: false

Now write a program, with a public class BookStore with a main method in it to use your implemented Book class.

Tasks:

1. Write Book class with proper implementation of constructor, data fields and methods. (**10 points)**
2. Write a public class BookStore in a file name, BookStore.java. Inside main method, use Book class to initialize an array of object of Book class, name books. (**3 points**)
3. Now, insert the following 10 books details into the books array of object. (**4 points**)

id: 10, Title: The Red Sari, Author: Javier Moro, No. of pages: 102, Fiction: false

id: 4, Title: Neither a Hawk nor a dove, Author: Khurshid M Kasuari , No. of pages: 350, Fiction: true

id: 1, Title: Faces and Places Professor, Author: Deepak Nayyar, No. of pages: 311, Fiction: false

id: 6, Title: Indian Parliamentary Diplomacy, Author: Meira Kumar, No. of pages: 89, Fiction: true

id: 5, Title: Farishta, Author: Kapil Isapuari, No. of pages: 600, Fiction: false

id: 3, Title: Super Economies, Author: Raghav Bahal, No. of pages: 201, Fiction: true

id: 2, Title: China :Confucius in the Shadow, Author: Poonam Surie, No. of pages: 199, Fiction: false

id: 7, Title: My country My Life, Author: L.K.Advani, No. of pages: 143, Fiction: false

id: 9, Title: Joseph Anton, Author: Sulman Rushdie, No. of pages: 454, Fiction: true

id: 8, Title: Narendra Modi: A Political Biography, Author: Andy Marino, No. of pages: 411, Fiction: false

4. Display all of the book details using toString method of book class with insertion order (**5 points**)
5. Count and print, number of books with fiction false, number of books with fiction true, number of books page number is more than 200, number of books page number is less than 200 (**8 points**)

Sample output:

id: 10, Title: The Red Sari, Author: Javier Moro, No. of pages: 102, Fiction: false

id: 4, Title: Neither a Hawk nor a dove, Author: Khurshid M Kasuari , No. of pages: 350, Fiction: true

id: 1, Title: Faces and Places Professor, Author: Deepak Nayyar, No. of pages: 311, Fiction: false

id: 6, Title: Indian Parliamentary Diplomacy, Author: Meira Kumar, No. of pages: 89, Fiction: true

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id: 8, Title: Narendra Modi: A Political Biography, Author: Andy Marino, No. of pages: 411, Fiction: true

6 books have number of pages more than 200.

4 books have number of pages less than 200.

4 books are fiction.

6 books are not fiction.

Hints:

To initialize an array of object, you can follow this: Book[] books=new Book[10]. Then you have to initialize each of the array element with proper constructor. For example,

book[0]=new Book(10,"Javier Moro","The Red Sari",102,false);