Lab Exercise 1: Array List, Composite Classes

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- This lab exercise is divided into four stages – Stage 1, Stage 2, Stage 3 and Stage 4.
- You need to complete Stage 1 without errors before you can proceed to Stage 2, and complete Stage 2 without errors before you can proceed to Stage 3 and Stage 4.
- For reference (e.g., list of methods in ArrayList class that you can use), you may refer to the following Java documentation:
    - ArrayList (Java Platform SE 8): https://docs.oracle.com/javase/8/docs/api/java/util/ArrayList.html

Question:

KiddoScience Learning Centre is a franchise business that offers two types of classes for children namely Kiddo Art and Kiddo Science. Kiddo Art class only has one level (For All) for children age 4-12 and classes are conducted in three themes which are Artwork, Clay art and Handicraft. Kiddo Science class has 3 levels which are Introductory Science (age 5-7), Discovery Science (age 8-9) and Experimental Science (age 10-14). All level has several lessons based on themes (Animal and Plants, Light and Sight, Machines and Technology, All about Human, Magnet and Electricity, Earth Science, Physics around Us, Insects, Energy and Its Interactions, Fun with Chemistry, Sound and Waves, Strength and Stability, Scientist Invention).

Task:

The owner of Kiddo Science Bangi hires you to develop a program to keep track of her students' records and stages of learning (which themes/lessons have they completed).

Stage 1:

1. Create a Java project named `Lab1-A-Stage1`.
2. Copy class `KiddoTester1.java` into your project.

Define a class named `KiddoClass` that has:

i. *Instance variables* to represent the type of class (eg: Kiddo Art or Kiddo Science), level (eg: For All, Introductory, Discovery, Experimental) and instructor's name.

ii. *Constructor* method which receives three parameters, and assigns the parameters to the instance variables of class `KiddoClass`.

Define a class named `Lesson` that has:

i. *Instance variables* to represent a lesson's theme and marks attain for each lesson.

Define a class named `Student` that has:

ii. *Instance variables* to represent a student's full name (e.g., Josh), IC number, age, which KiddoClass she/he is in and a list of lessons that a she/he has covered (the list should be an array list that is suitable to store references to `Lesson` objects).

iii. *Constructor* method which receives 4 parameters, and
   - assigns the parameters to the instance variables that represent a student's full name, IC number, age, her/his KiddoClass,
   - creates an array list of Lesson objects and assigns the array list to the instance variable that represents the student's list of lessons completed and associated marks.

Check your answer by invoking the `main` method in class `KiddoTester1`, and your output should be as follows:

```
Total number of students at Kiddo Bangi : 4
```

*Proceed to Stage 2 only after you have completed Stage 1 without errors.

Stage 2:

1. Create a Java project named `Lab1-A-Stage2`.
2. Copy class `KiddoTester2.java` into your project.
3. Copy class `KiddoClass, Lesson` and `Student` in Stage 1 into your Stage 2 Java project.

Add into the `KiddoClass` class:

i. A method named `getType` that returns the instance variable that represents a `KiddoClass`'s type.

ii. A method named `getLevel` that returns the instance variable that represents a `KiddoClass`'s level.

iii. A method named `getInstructor` that returns the instance variable that represents a `KiddoClass`'s instructor.

Add into the `Lesson` class:

i. A method named `getTheme` that returns the instance variable that represents a `Lesson`'s theme.
ii. A method named `getMarks` that returns the instance variable that represents a `Lesson`'s mark.

Add into the `Student` class:

i. A method named `getName` that returns the instance variable that represents a `Student`'s name.
ii. A method named `getICNo` that returns the instance variable that represents a `Student`'s IC No.
iii. A method named `getAge` that returns the instance variable that represents a `Student`'s age.
iv. A method named `getKclass` that returns the instance variable that represents a `Student`'s `KiddoClass` object.
v. A method named `getLessonList` that returns the array list that represents a `Student`'s list of completed lessons.

Check your answer by invoking the `main` method in class `KiddoTester2` and your output should be as follows:

```
Muhammad Munif bin Mohd Azlan
Kiddo class : Kiddo Science
Kiddo class level : Introductory
Kiddo class instructor : Miss Ana

Marwa Humaira bin Mohd Azlan
Kiddo class : Kiddo Art
Kiddo class level : For All
Kiddo class instructor : Miss Aliyah

Zureen binti Aziz
Kiddo class : Kiddo Science
Kiddo class level : Experimental
Kiddo class instructor : Mr Mansur Shah

Hang Li Po
Kiddo class : Kiddo Science
Kiddo class level : Discovery
Kiddo class instructor : Mr Aliff
```

*Proceed to Stage 3 only after you have completed Stage 2 without errors.

Stage 3:

1. Create a Java project named `Lab1-A-Stage3`.
2. Copy class `KiddoTester3.java` into your project.
4. Copy class `KiddoClass, Lesson` and `Student` in Stage 2 into your Stage 3 Java project.

Add into the `Student` class:

i. A void method named `addLesson` that receives a `Lesson` object as a parameter, and add it to the end of the student's list of completed lessons.

ii. A method named `listCompletedLessons` that will print a list of completed lesson(s) and associated mark(s).

iii. A method named `getAverageMark` that calculate and return the average mark of all marks from completed lessons.

Check your answer by invoking the `main` method in class `KiddoTester3` and your output should be as follows:

```
Muhammad Munif bin Mohd Azlan
Kiddo class : Kiddo Science
Kiddo class level : Introductory
Kiddo class instructor : Miss Ana
Lessons completed :
Animals and Plants    80.5
Light and Sight  90.0
Machines and Technology    95.0
Average marks for completed lessons  : 88.5

Marwa Humaira bin Mohd Azlan
Kiddo class : Kiddo Art
Kiddo class level : For All
Kiddo class instructor : Miss Aliyah
Lessons completed :
Art work   95.0
Clay art   85.5
Average marks for completed lessons  : 90.25

Zureen binti Aziz
Kiddo class : Kiddo Science
Kiddo class level : Experimental
Kiddo class instructor : Mr Mansur Shah
Lessons completed :
Animal and Plants     90.5
Average marks for completed lessons  : 90.5
```

```
Hang Li Po
Kiddo class : Kiddo Science
Kiddo class level : Discovery
Kiddo class instructor : Mr Aliff
Lessons completed :
Strength and Stability      81.5
Scientist Invention   90.0
Average marks for completed lessons  : 85.75

Jebat Iskandar
Kiddo class : Kiddo Art
Kiddo class level : For All
Kiddo class instructor : Miss Aliyah
Lessons completed :
Handicraft 95.0
Clay art   82.0
Average marks for completed lessons  : 88.5
```

*Proceed to Stage 3 only after you have completed Stage 2 without errors.

Stage 4: (Bonus)

3. Create a Java project named `Lab1-A-Stage4`.
4. Copy class `KiddoTester4.java` into your project.
5. Copy class `KiddoClass, Lesson` and `Student` in Stage 3 into your Stage 4 Java project.

Add into the `KiddoTester4.java` program :

In method `totalStudentEachClass()` add a for loop to find the total number of students in each KiddoClass. Use the `kiddoList` object.

Add the code at the specified place as follows:

```
public static void totalStudentEachClass(){
      int art = 0;
      int introductory = 0;
      int discovery = 0;
      int experimental = 0;

      /*

      Add for loop here to calculate the number of students in each KiddoClass

      */
      System.out.println("\nNo of student in Kiddo Art : "+ art);
      System.out.println("No of student in Kiddo Introductory Science  : "+
introductory);
      System.out.println("No of student in Kiddo Discovery Science : "+
discovery);
```

```
      System.out.println("No of student in Kiddo Experimental Science : "+
experimental);
   }
```

Check your answer by invoking the `main` method in class `KiddoTester4` and your output should be as follows:

```
Muhammad Munif bin Mohd Azlan
Kiddo class : Kiddo Science
Kiddo class level : Introductory
Kiddo class instructor : Miss Ana
Lessons completed :
Animals and Plants    80.5
Light and Sight  90.0
Machines and Technology     95.0
Average marks for completed lessons  : 88.5

Marwa Humaira bin Mohd Azlan
Kiddo class : Kiddo Art
Kiddo class level : For All
Kiddo class instructor : Miss Aliyah
Lessons completed :
Art work   95.0
Clay art   85.5
Average marks for completed lessons  : 90.25

Zureen binti Aziz
Kiddo class : Kiddo Science
Kiddo class level : Experimental
Kiddo class instructor : Mr Mansur Shah
Lessons completed :
Animal and Plants     90.5
Average marks for completed lessons  : 90.5

Hang Li Po
Kiddo class : Kiddo Science
Kiddo class level : Discovery
Kiddo class instructor : Mr Aliff
Lessons completed :
Strength and Stability      81.5
Scientist Invention   90.0
Average marks for completed lessons  : 85.75

Jebat Iskandar
Kiddo class : Kiddo Art
Kiddo class level : For All
Kiddo class instructor : Miss Aliyah
Lessons completed :
Handicraft 95.0
Clay art   82.0
Average marks for completed lessons  : 88.5
```