Unit 05 Quiz – FRQ – Corrections

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1. If there is an answer box, answer with the appropriate word or phrase. If there are lines below the question, answer each in complete sentences with proper grammar. Points will be given for neatness. Use the number of lines given to estimate the relative length of the answer required.

   a) If `numStudents` were changed to be a `public` field, how would the test code need to change so that it would continue to run with the same output? Explain why.

   The test code would not need to change. The private modifier prevents direct access to and modification of the field, but since the test code does not attempt to access or modify the field, the code does not require any change.

   b) If the `static` modifier were to be removed from the definition of method `getNumStudents`, how would the test code need to change in order to continue to run and to be able to output the number of students?

   The `static` modifier allows the method to be called without an instance of the class by using the class name, such as: `Student.getNumStudents()`. If the `static` modifier were removed, the code would need to use an instance of the class. The first call is not possible, but all other calls to `getNumStudents` could use the variable `anna` to get the value, like so: `anna.getNumStudents()`.

   c) The class as written has no mutator method for `name` or `birthYear`. How are these fields initialized and how can they be subsequently modified? Assume you cannot change the `Student` class.

   These fields must be initialized by passing values as parameters to one of the constructors. There is not way to subsequently modify those fields of the object. If one wishes to change a student name or birth year , one must create a new object.

   d) The ***class declaration*** is the first line of the class definition. Write the correct class definition for this quiz.

   ```
   public class Student
   ```

   e) A ***field*** is a variable defined at the top level within a class. Write the proper declaration of the field `name` of type `String` as specified in the quiz. This field should not be able to be accessed from outside the class.

   ```
   private String name;
   ```

   f) What word from the statement in (e) makes the field inaccessible from outside the class?

   `private`

   g) An additional requirement for the Student class is that it maintains the maximum GPA from all the students. This only requires one value for the entire class. Write the definition of the field `maxGpa` that satisfies these requirements. Ensure it is `private`, and explicitly initialize its value to zero.

   ```
   private static double maxGpa = 0.0;
   ```

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h) What word from the statement in (g) makes the definition create only one value for the class rather than one value per instance of the class?

`static`

i) Write the correct method header for the three-parameter constructor

```
public Student(String name, int birthYear, double gpa)
```

j) Write the correct method header for the two-parameter constructor

```
public Student(String name, int birthYear)
```

k) For the `Student` class, what is the type of variable returned by the constructor?

The constructor returns an *object* of type `Student`.

l) To keep track of the number of students, we created the field `numStudents` that included the modifier `static` so that there is only one value for all instances of the class. Where do we need to increment the value of `numStudents` so that it keeps track of the number of instances of class `Student`?

Since a constructor must be called to create an instance of the class, if we increment the value in each and every constructor, this will count the number of instances of the class that are created.

m) When setting a field in a constructor, it is common to see a statement similar to "`this.gpa = gpa;`". Describe when and why statements like this example require the keyword "`this`".

When a local variable (including a parameter) uses the same identifier as a field in the class, the identifier always refers the local variable. In this case, `gpa` will refer to the parameter, `gpa`, so we must use `this.gpa` to unambiguously refer to the field of the class.

n) A programmer wishes to include the student's school, so updates the toString method to take the school name as a parameter: `public String toString(String school)`. They then update the method to include the school name in the returned String. However, the test code no longer outputs any of the information about the student. Describe the reason why.

When using the `System.out.print` method to print an object, the method `toString` is called with no parameters to obtain a string representation of the object. As the programmer has changed the `toString` method defined in the `Student` class to include a parameter, it will no longer be called by the `print` method. The print method will be calling the default zero-parameter `toString` method that is inherited from the object class, the same as if the `Student` class did not contain any `toString` method.

o) On a separate piece of paper, write a corrected version of the `Student` class.