

CS1020: DATA STRUCTURES AND ALGORITHMS I

Tutorial 2 – OO Design and Programming

(Week 4, starting 1 February 2016)

1. Class Design

Design a **simple** *module registration system* for SoC to manage students joining and leaving modules. List two **classes** you think are necessary for this system. For each class, specify its **attributes** and **behaviors**, and provide at least one **constructor**, one **accessor** and one **mutator**. Refer to the lecture notes for these concepts if you are not familiar with them. As this is a design question, implementation is not required.

The following webpage provides a brief introduction to UML, a design language suited for the OO Model. The UML Class Diagram will prove useful for you to express your answer in a drawing that many others understand.

<https://www.ibm.com/developerworks/rational/library/content/RationalEdge/sep04/bell/>

2. Object-Oriented Programming

You might have heard the nursery rhyme “Old McDonald”. Its lyrics teach kids about the sounds animals make. You may recall the part of the lyrics about the Cow:

Old McDonald had a farm, E-I-E-I-O
And on his farm he had a Cow, E-I-E-I-O
With a **Moo Moo** here and a **Moo Moo** there...

The lyrics can be generalized for different animals, each having a different *name* and **sound**. With knowledge of object-oriented programming, you want to demonstrate that it is possible to write a program that *sings* “Old McDonald”. To show that your program works, add the following (*animal*, **sound**) to the list: (Cow, Moo), (Dog, Woof), and (Duck, Quack).

Use the following template below to solve your problem:

```
public class OldMcDonald {
    private Animal[] _farm; // Old McDonald had a farm (still has now)
    private static final int SIZE = 3; // Fixed farm size

    public OldMcDonald() {
        /* TODO: Create your farm, an Animal array */
    }

    public void sing() {
        for (int i = 0; i < SIZE; i++)
            System.out.println("Old McDonald had a farm, E-I-E-I-O"+
                               /* TODO: Add the rest of the lyrics here... */
                               );
    }
}
```

```

    public static void main(String[] args) {
        (new OldMcDonald()).sing();
    }
}
class Animal {
    /* TODO: Implement data and functionality of an Animal here */
}

```

3. Members

There are 4 types of members: instance variables, class variables, instance methods, class methods.

(a) Identify where each of them appears in the following code fragment.

```

class TutorialGroup {
    private String _groupNum;
    private static int _totalGroups;

    public TutorialGroup(String groupNum) {
        _groupNum = groupNum;
        _totalGroups++;
    }

    public String toString() {
        return "Tutorial " + _groupNum + " out of " + _totalGroups
            + " groups";
    }

    public static int getTotalGroups() {
        return _totalGroups;
    }
}

```

(b) Is it possible, within (1), to **directly access** (2) **without** specifying any instance?

(1)	(2)	Yes and what is accessed / No and why not
Instance method	Instance variable	
Instance method	Class variable	
Class method	Instance variable	
Class method	Class variable	

(c) In (a), `_totalGroups` was not explicitly initialized. If not explicitly done so, are class variables initialized? How about instance variables, local variables, array elements?

- Practise consistently 😊 -

Explore the Java API
Test out its functions
Code incrementally