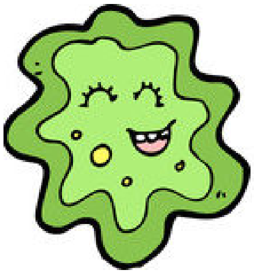
CS161: Introduction to Computer Science
Lab Assignment 4



This week you will practice writing your own Java classes. In particular, you'll be writing 2 Java classes that simulate:

- a primitive stomach
- a primitive brain

Sounds weird, but it will all make sense next week when we use your brain and stomach classes to construct primitive organisms.

This lab has starter code. You can download the starter code from the course webpage.

The Stomach Class

Let's begin by thinking about a primitive stomach. What would it do? What would it require? At the minimum, I think a primitive stomach should be able to take in some amount of food and digest it.

1. In BlueJ, open the lab4 project that was created for you. Inside, create a Java class named `Stomach`. This class does *not* need a `main` method.
2. Recall that when we write our own class, we need to specify three things: the instance variables, the constructors, and the methods
   (a) Your stomach class should have 3 instance variables:
      - an `int` to hold the current amount of food in the stomach
      - an `int` to hold the total amount of food that has been digested
      - a `Random` object that you'll use to help aid you with digestion.

   (b) What is the purpose of a constructor? If you know the answer to this question, then you should know what 3 lines of code you'll need inside the constructor. Let's assume that the stomach begins having eaten no food and having digested no food.

   (c) Add the following methods to your `Stomach` class
      - `public void ingest(int amount)` – This method causes the stomach to ingest the specified amount of food. This amount should be added to the current amount of food in the stomach.
      - `public void digest()` – This method causes a random amount of the current food in the stomach to be "digested". You can use methods from the `Random` class to help you generate a random amount of food.
      - `public int getAmountFood()` – Returns the current amount of food in the stomach.
      - `public int getAmountDigested()` – Returns the total amount of food that the stomach has digested.
      - `public String toString()` – Return a `String` that summarizes the *state* of the stomach. In other words, the `String` you return should contain the current amount of food and the total amount of food digested.

The Brain Class

Now let's think about a primitive brain. What does it need? What should it be able to do?

Thinking a bit, here is a list that I came up with for the minimum functionality of a brain:

1. A primitive brain should be able to hold a single thought
2. A primitive brain should be able to remember a single memory
3. A primitive brain should keep track of whether or not the organism (that the brain is a part of) is asleep

This part of the lab asks you to write a Java class called `Brain` that is able to do the things listed above.

1. In BlueJ, create a Java class named `Brain`. This class does *not* need a `main` method.
2. Your brain class should have 3 instance variables:
   - a `String` to hold the brain's current thought
   - a `String` to hold the brain's single stored memory
   - a `boolean` to keep track of whether or not the organism is asleep.

   Remember to make your instance variables `private`.

3. What is the purpose of a constructor? If you know the answer to this question, then again you should know what 3 lines of code you'll need inside the constructor. Let's assume that a brain starts off asleep with no memory and no thought.

4. Finally, add the following methods to your `Brain` class
   - `public void setThought(String newThought)` – Takes in a new thought and stores it in the brain.
   - `public String getThought()` – Returns the current thought. Remember that returning a `String` is different than printing a `String`. You'll need to use the `return` keyword.
   - `public void setAwake(boolean newStatus)` – Sets the status of the brain to either awake (true) or asleep (false).
   - `public boolean getAwake()` – Returns whether or not the organism is awake.
   - `public void remember()` – Copies the current thought into the memory.
   - `public void recall()` – Loads the memory back into the current thought.
   - `public String toString()` – Return a `String` that summarizes the *state* of the brain. In other words, the `String` you return should contain the current thought, the current piece of memory, and whether or not the brain is asleep.

Testing your classes

I have written a tester class for you named `Tester`. This class has a `main()` method at the very bottom. When you finish writing a class, you can uncomment the corresponding line and run the `main()` method. You can use this to test that your classes work correctly.

Extras

After awhile, it would be nice to know how "efficiently" our stomach is working. On average, how much are we digesting every time the `digest()` method is called? This might be a useful piece of information to know. (E.g., if we're digesting a very small amount on average then we might have a blockage in our stomach that needs to be looked at.)

Add the following method to your `Stomach` class: `public double getAverageAmountDigested()`.

This method should return the average amount of food that has been digested. For example, if 10 units of food was digested the first time we called `digest()` and 4 units of food the second time we called `digest()`, then on average, we are digesting $(10 + 4)/2$ units of food each time.

To solve this problem, you'll need to add another instance variable to your class! Can you think of what else you'll need to keep track of in order to compute the average?

Submitting your lab assignment

You should submit your `lab4` folder with the following classes: `Brain`, `Stomach`, and `Tester`. Rename the folder using both of your names. Then zip and submit via Moodle.