

CS161: Introduction to Computer Science

Homework Assignment 3

due 9/13 by 11:59pm

The purpose of this homework assignment is to give you practice writing and calling methods.

Warm-Up

Create a Java class named `WarmUp` and inside complete the following questions:

- Write a method that takes in three integers and returns their average.
- Write a method that takes in a person's speed (in miles per hour) and the distance to travel (in miles) and returns the time required for the trip.
- Write a method that takes in a person's name, age, and pet's name and prints the following paragraph:

```
Hello, my name is name and I am age years old.  
I'm enjoying my time at Puget Sound, though  
I miss my pet pet's name very much!
```

Call each method inside of `main()`. Add print statements so that when I run your code it is clear what method is being called, what input arguments (if any) are being passed in, and what value (if any) was returned.

Pseudo-Random Numbers

Generating random numbers has many applications – e.g., games (everything from board games to video games), security (e.g. encrypting sensitive information that is sent over the internet), selecting jurors, scientific simulations, etc.

In reality, it is quite difficult to generate a sequence of numbers that is truly random. For many applications, however, it suffices to instead generate *pseudo-random numbers* – that is, a sequence of numbers that appears random.

One of the simplest methods¹ for computing a sequence of pseudo-random numbers uses the following iterative equation:

$$r_i = (a \cdot r_{i-1} + c) \% m$$

where a , c , and m are all integers chosen by the user.

This equation says that to generate the i th random number in the sequence, you take the $(i - 1)$ st random number, multiply it by a , add on c , and then mod the entire result by m . The result will be an integer between 0 and $m - 1$. If you need 50 random numbers, you would repeat this process 50 times.

Notice that we need some initial, starting number which we'll denote as r_0 . This value is often called the "seed" because it seeds the entire process. The seed is also an integer chosen by the user.

¹This method is known as a *linear congruential generator*. It is not the best way to generate pseudo-random numbers particularly for small values of m .

Create a Java class named `Random` and inside write code to generate random integers using the iterative equation above. **Since this homework assignment is about methods, you should use methods as much as possible to cut down on the amount of repetitive code.**

In the `main()` method, complete the following:

- Find a setting of the integers $r_0, a, c,$ and m that produces the same number again and again – e.g., it might produce the sequence $\{1, 1, 1, 1, \dots\}$.
- Find a setting of the integers $r_0, a, c,$ and m that produces a sequence of numbers that repeats – e.g., for some settings of the variables the equation above will cycle through the same 3 or 4 numbers
- Finally, find a setting of the integers r_0, a, c, m that produces 10 unique numbers

Be sure to add enough print statements so that when I run your code it is clear what the values of $r_0, a, c,$ and m are and what numbers are being generated.

Style Guide

Before you submit your assignment, double check the following:

- You have a Javadoc comment at the top of the class with a brief description (written in full English sentences), you and your partner's name, and the date.
- All variable names are lower cased (remember, only classes are capitalized in Java)
- Use `final` when appropriate
- Use inline comments (`//`) to explain any complicated code

Submitting your assignment

Please make sure to rename your folder before zipping. You should rename your folder using both of your first and last names. For example, `hw3_Jane_Doe_John_Doe`.

Submit your zipped folder via Moodle.