

Generating Random Numbers with `Math.random`

The `Math` class contains a class method called `random` that can be used to generate random numbers. Starting with the 2007 AP exam, this is the accepted way to generate random numbers. The method has the following header:

```
static double random ()
```

The `random` method returns a double value between 0.0 (inclusive) and 1.0 (exclusive). That is, its return value is greater than or equal to 0.0 and less than 1.0. Using arithmetic we can get a random number in any range we like. For example, if we want an integer in the range 1 to 10, we can use the following expression:

```
(int)(Math.random() * 10 + 1)
```

This expression multiplies the return value of `random` by 10, resulting in a double value greater than or equal to 0 and less than 10, then adds 1, resulting in a double value greater than or equal to 1 and less than 11. The cast to an integer cuts off any fractional part, giving an integer in the range 1 to 10 inclusive.

Below is a version of the `RandomNumbers` program from Listing 2.10 that uses `Math.random` instead of the `Random` class.

```
/**
 * RandomNumbers.java      Author: Lewis/Loftus/Cocking
 *
 * Demonstrates the creation of pseudo-random numbers
 * using Math.random.
 */
public class RandomNumbers
{
    //-----
    // Generates random numbers in various ranges.
    //-----
    public static void main (String[] args)
    {
        int num1;
        double num2;

        num1 = (int)(Math.random() * 10);
        System.out.println ("From 0 to 9: " + num1);

        num1 = (int)(Math.random() * 10 + 1);
        System.out.println ("From 1 to 10: " + num1);

        num1 = (int)(Math.random() * 15 + 20);
        System.out.println ("From 20 to 34: " + num1);

        num1 = (int)(Math.random() * 20 - 10);
        System.out.println ("From -10 to 9: " + num1);

        num2 = Math.random();
        System.out.println ("A random double [between 0-1]: " + num2);

        num2 = Math.random() * 6; // 0.0 to 5.999999
        num1 = (int) num2 + 1;
        System.out.println ("From 1 to 6: " + num1);
    }
}
```