RANDOM NUMBERS

zyBook 2.21

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WHEN USE RANDOM NUMBERS?

- Games
  - Typing games
  - Shuffle cards, roll dice…
  - Flashcards
- Statistical sampling
- Cryptography

RANDOM NUMBER IN JAVA

Pseudorandom: numbers that, although they are derived from predictable and well-defined algorithms, mimic the properties of numbers chosen at random

- Math.random() method
- Random Objects (java.util.*)

MATH.RANDOM()

- Returns a random number between [0.0, 1.0)
- Can use multiplication to extend range
- Example:

```
double random = Math.random();
```

RANDOM OBJECTS

- Must import java.util.*
- Since it is an object, you must construct it

```
Random rand = new Random();
```

Return	Method	Description	Example
int	nextInt()	Random int between -2^{31} and $(2^{31} - 1)$	int x = r.nextInt();
int	nextInt(max)	Random int between [0, (max – 1)]	int y = r.nextInt(10);
double	nextDouble()	Random real # between [0.0, 1.0)	double z = r.nextDouble();
boolean	nextBoolean()	Random logical value of true or false	boolean b = r.nextBoolean();

EXAMPLE – WHAT'S WRONG?

```
1  import java.util.Random;
2
3  /**
4   * Generate random value using Random object
5   * and use in multiple places
6   *
7   * @author Jessica Young Schmidt
8   */
9  public class RandomSingleValue {
10     /**
11      * Starts the program.
12      *
13      * @param args command line arguments
14      */
15     public static void main(String[] args) {
16         Random r = new Random();
17
18         System.out.println("My random value is: "
19             + (r.nextInt(101)));
20
21         System.out.println("My random value plus 1: "
22             + (r.nextInt(101) + 1));
23
24         System.out.println("My random value times 5: "
25             + (r.nextInt(101) * 5));
26
27     }
28
29 }
```

```
$ javac -d bin -cp bin src/RandomSingleValue.java

$ java -cp bin RandomSingleValue
My random value is: 43
My random value plus 1: 74
My random value times 5: 470

$ java -cp bin RandomSingleValue
My random value is: 9
My random value plus 1: 51
My random value times 5: 385

$ java -cp bin RandomSingleValue
My random value is: 28
My random value plus 1: 32
My random value times 5: 420

$ java -cp bin RandomSingleValue
My random value is: 96
My random value plus 1: 56
My random value times 5: 255
```

EXAMPLE – CORRECTED CODE

```java
import java.util.Random;

/**
 * Generate random value using Random object
 * and use in multiple places
 *
 * @author Jessica Young Schmidt
 */
public class RandomSingleValue {
    /**
     * Starts the program.
     *
     * @param args command line arguments
     */
    public static void main(String[] args) {
        Random r = new Random();

        int val = r.nextInt(101);

        System.out.println("My random value is: "
            + (val));

        System.out.println("My random value plus 1: "
            + (val + 1));

        System.out.println("My random value times 5: "
            + (val * 5));

    }

}
```

```
$ javac -d bin -cp bin src/RandomSingleValue.java

$ java -cp bin RandomSingleValue
My random value is: 63
My random value plus 1: 64
My random value times 5: 315

$ java -cp bin RandomSingleValue
My random value is: 74
My random value plus 1: 75
My random value times 5: 370

$ java -cp bin RandomSingleValue
My random value is: 84
My random value plus 1: 85
My random value times 5: 420

$ java -cp bin RandomSingleValue
My random value is: 76
My random value plus 1: 77
My random value times 5: 380
```