`Math.random()`

CSCI 111

Why do we need randomness?

- Generate unique circumstances each time the program is run.
- More accurately represent real life.
- Make things less predictable.

How do we achieve randomness?

```
Math.random()
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Look in Math class (built into Java)

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Look in Math class (built into Java)

Call the method named random.

How do we achieve randomness?

`Math.random()`

Then what happens? link

How do we achieve randomness?

`Math.random()`

Then what happens?

A double is returned whose value is greater than or equal to 0.0 and less than 1.0:

0.888237

0.132

0.0

~~1.0~~

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

Since $0 \leq r < 1$,

How do we achieve randomness?

`Math.random()`

Great, but what if we need a random double between 0 and 10 to simulate how much snow fell?

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

Since $0 \leq r < 1$,

$$10 * 0 \leq 10 * r < 10 * 1$$

Thus, $0 \leq 10 * r < 10$.

How do we achieve randomness?

`Math.random()`

Great, but what if we need a random double between 0 and 10 to simulate how much snow fell?

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

Since $0 \leq r < 1$,

$$10 * 0 \leq 10 * r < 10 * 1$$

Thus, $0 \leq 10 * r < 10$. So set:

```
double r = 10 * Math.random();
```

for a random double between 0 and 10 (not including 10).

How do we achieve randomness?

`Math.random()`

Great, but what if we need a random double between 3 and 10?

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

Since $0 \leq r < 1$,

$7 * 0 \leq 7 * r < 7 * 1$

Thus, $0 \leq 7 * r < 7$

and, $0 + 3 \leq 7 * r + 3 < 7 + 3 \Rightarrow 3 \leq 7 * r + 3 < 10$

So set: `double r = 7 * Math.random() + 3;`

for a random double between 3 and 10 (not including 10).

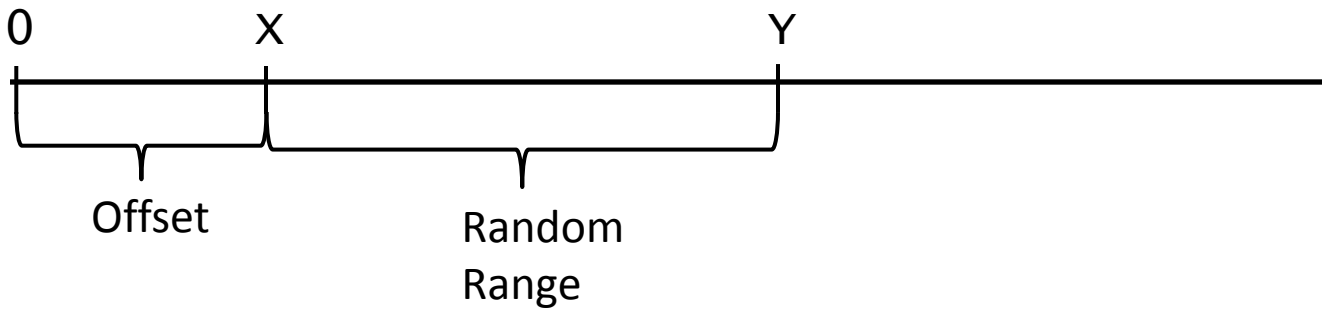
How do we achieve randomness?

In general, if we need a random double between X and Y (including X, but not Y),

```
double r = (Y - X) * Math.random() + X;
```

Random Range

Offset



How do we achieve randomness?

`Math.random()`

What if we need a random **integer** between 3 and 10?

Since $0 \leq$ `Math.random()` < 1,

$3 \leq$ `7 * Math.random() + 3` < 10

How do we achieve randomness?

`Math.random()`

What if we need a random **integer** between 3 and 10?

Since $0 \leq$ `Math.random()` < 1,

$3 \leq 7 *$ `Math.random()` $+ 3 < 10$

$? \leq$ (int) $(7 *$ `Math.random()`$) + 3 \leq ?$

How do we achieve randomness?

`Math.random()`

What if we need a random **integer** between 3 and 10?

Recall that,

```
(int) 1.322 = 1
(int) 7.6894      = 7
(int) 9.9999      = 9
(int) 10.001      = 10
(int) 0.232 = 0
```

So,

```
(int) Math.random() = ?
```

How do we achieve randomness?

`Math.random()`

What if we need a random **integer** between 3 and 10?

Recall that,

```
(int) 1.322 = 1
(int) 7.6894      = 7
(int) 9.9999      = 9
(int) 10.001      = 10
(int) 0.232 = 0
```

So,

```
(int) Math.random() = 0
```

How do we achieve randomness?

`Math.random()`

What if we need a random **integer** between 3 and 10?

Since $0 \leq$ `Math.random()` < 1,

$3 \leq 7 *$ `Math.random()` $+ 3 < 10$

$? \leq$ (int) $(7 *$ `Math.random()`$) + 3 \leq ?$

How do we achieve randomness?

`Math.random()`

What if we need a random **integer** between 3 and 10?

Since $0 \leq$ `Math.random()` < 1,

$3 \leq 7 *$ `Math.random()` $+ 3 < 10$

$3 \leq$ (int) $(7 *$ `Math.random()`$) + 3 \leq 9$

So we need,

$3 \leq$ (int) $(8 *$ `Math.random()`$) + 3 \leq 10$

How do we achieve randomness?

In general, if we need a random int between X and Y (including both X and Y),

```
double r = (int) ((Y - X + 1) * Math.random()) + X;
```

Random Range

Offset