COMP 110/L Lecture 5

Kyle Dewey

Outlines

- Methods
  - Defining methods
  - Calling methods

Methods

Motivation

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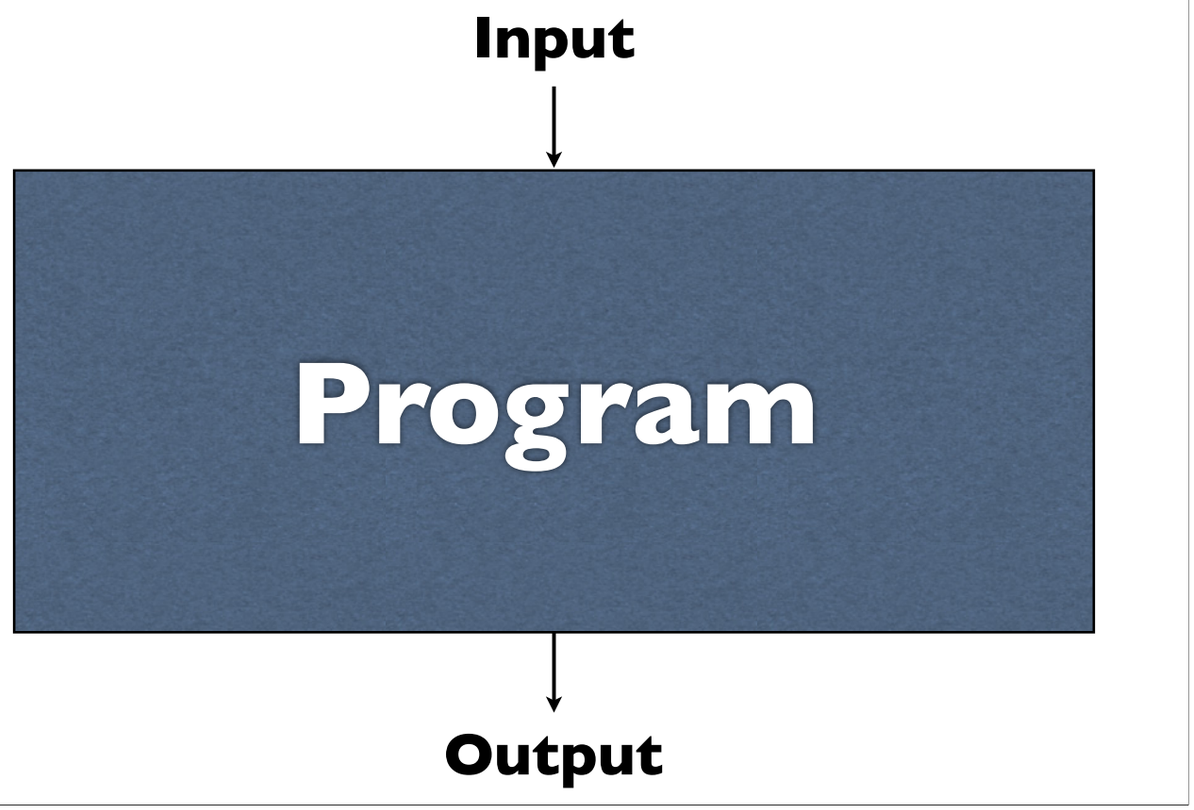
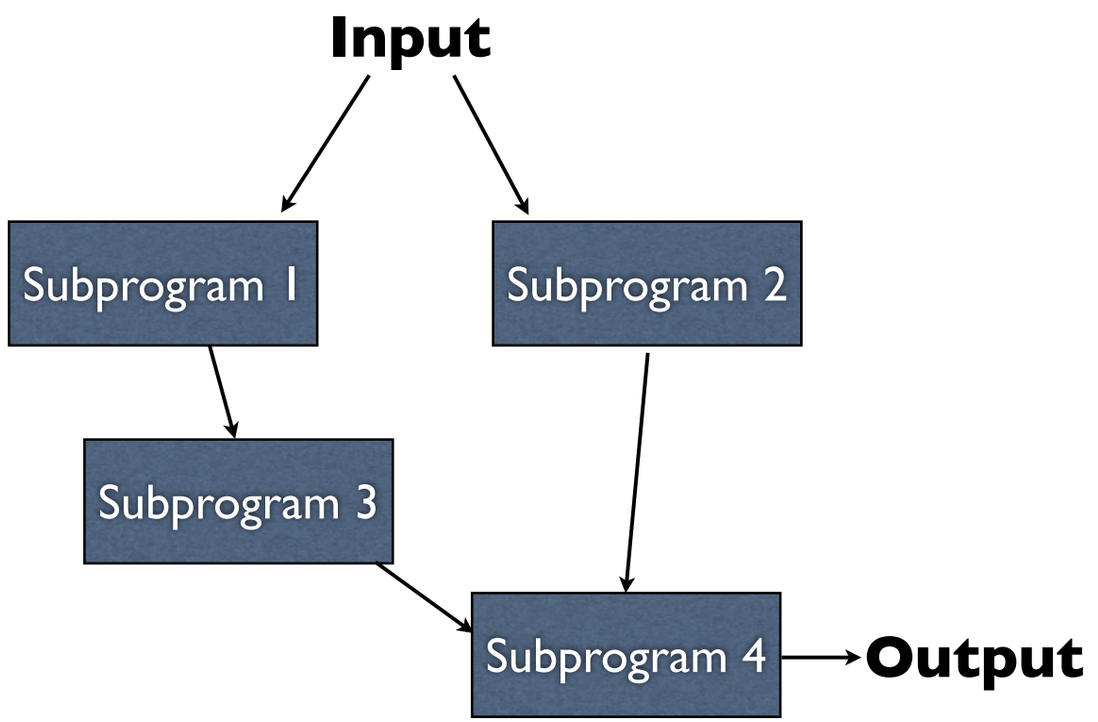


-Start off with some high-level motivation
-You write your program, and it's one giant block
-This is difficult to reason about

Motivation



-Simpler approach: write a bunch of smaller programs, and stitch them together
-Each program is a lot easier to reason about than the one big program
-If we're careful about how these different pieces interact with each other, then we only ever have to think about the small programs

Code Reuse

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```
System.out.println(...)
```

-You’re already familiar with these

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```
System.out.println(...)
nextInt()
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Code Reuse

`System.out.println(...)`

`nextInt()`
`nextLong()`

`nextDouble()`

You have used all of these multiple times.

-You’re already familiar with these, and you’ve used them a bunch of times

Code Reuse

`System.out.println(...)`

`nextInt()`
`nextLong()`

`nextDouble()`

You have used all of these multiple times.
These are all *methods*.

-You're already familiar with these, and you've used them a bunch of times

Methods

Distinct subprograms.

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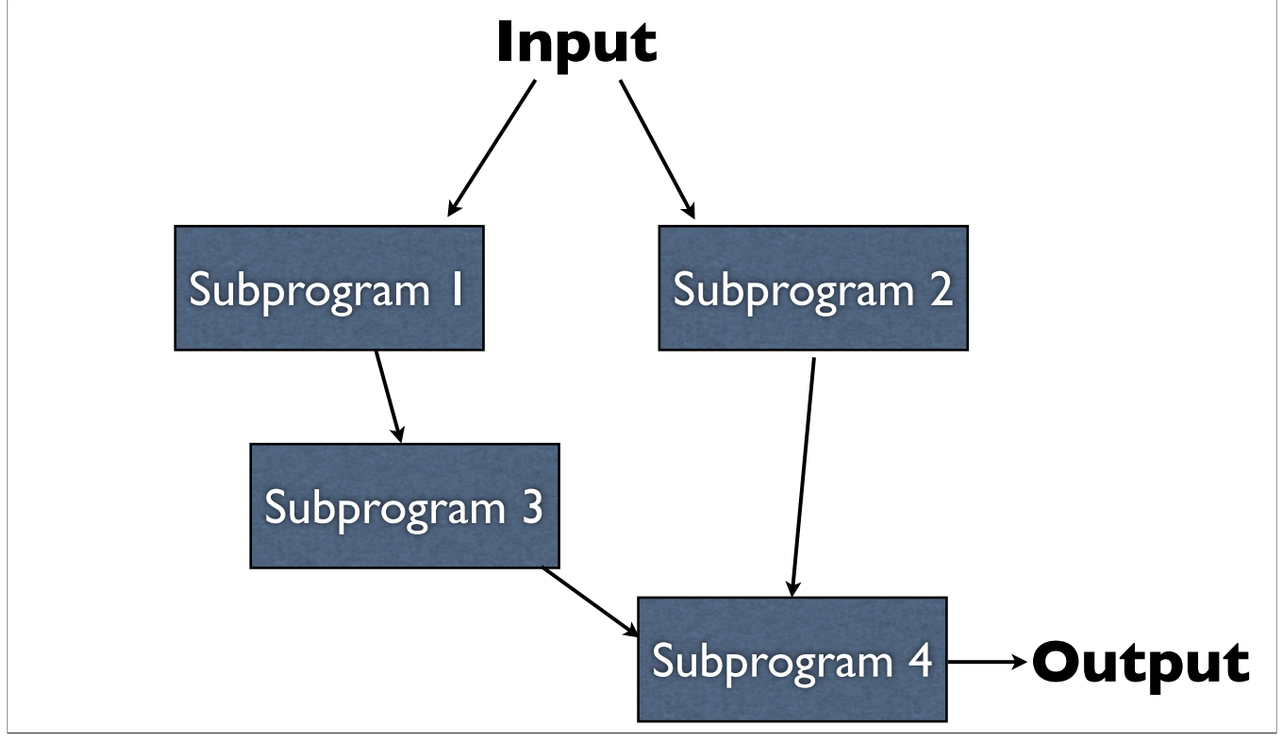
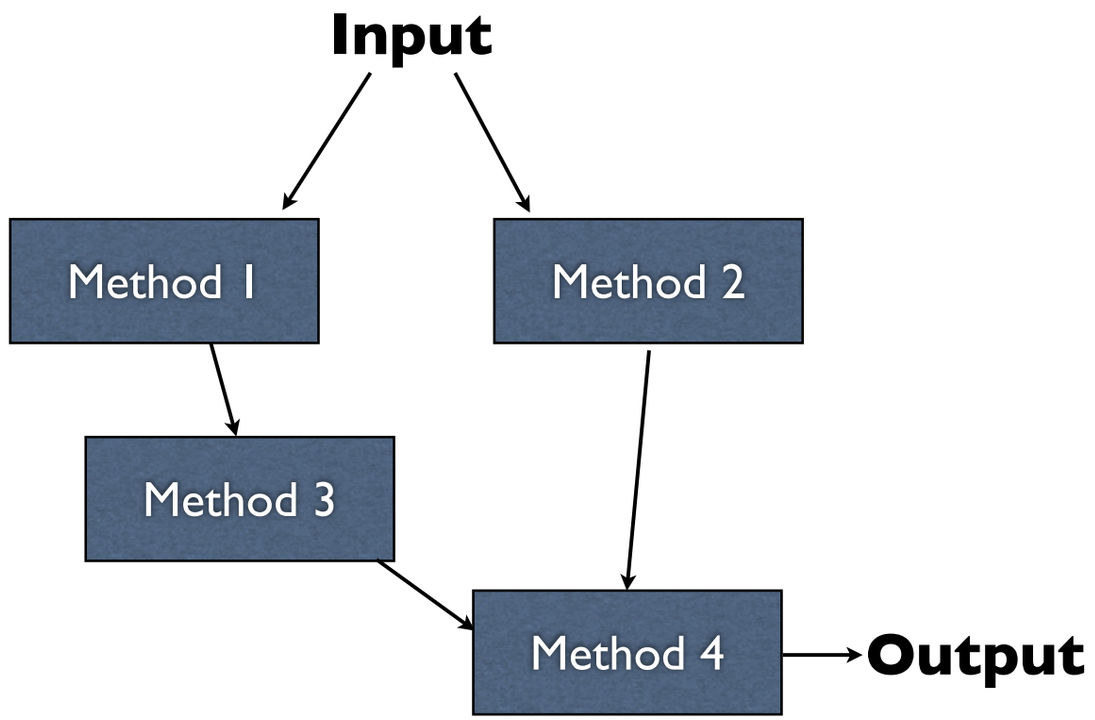


-Taking that illustration from before...

Methods

Distinct subprograms.



-...each one of those subprograms is a method

Method Terminology

- We can *define* a method
  - Make it available to the rest of the program
- We can *call* a method
  - Execute the subprogram

Method Anatomy

Methods take some number of inputs (can be 0).

Methods may produce an output.

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Methods take some number of inputs (can be 0).

Methods may produce an output.


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```

One input, no outputs (cannot assign to a variable).

```
Math.pow(2, 3);
```

Two inputs, one output.

```
inputScanner.nextInt();
```

```
inputScanner.nextInt();
```

No inputs, one output.

```
inputScanner.nextInt();
```

No inputs, one output.

```
System.out.print("Goodbye");
```

```
inputScanner.nextInt();
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No inputs, one output.

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One input, no outputs (cannot assign to a variable)

```
inputScanner.nextInt();
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No inputs, one output.

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One input, no outputs (cannot assign to a variable)

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inputScanner.nextLong();
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No inputs, one output.

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One input, no outputs (cannot assign to a variable)

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- The method is executed
- The method returns to wherever it was called from

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-Initially, execution is in method 1

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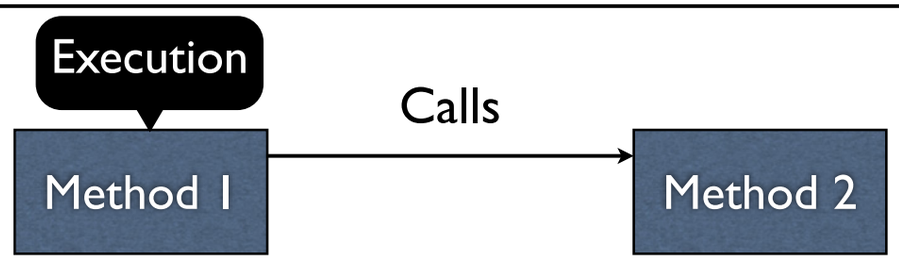
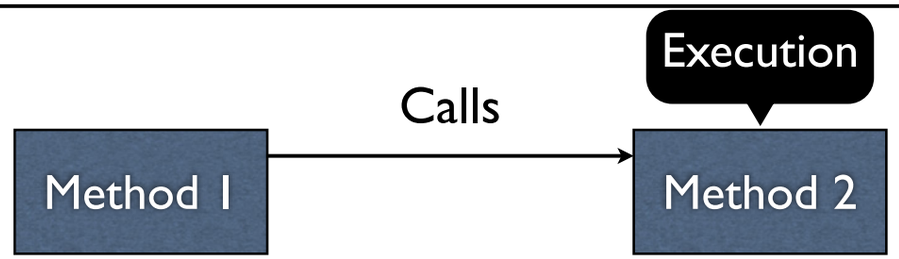


-Method 1 then calls method 2

Calling Methods

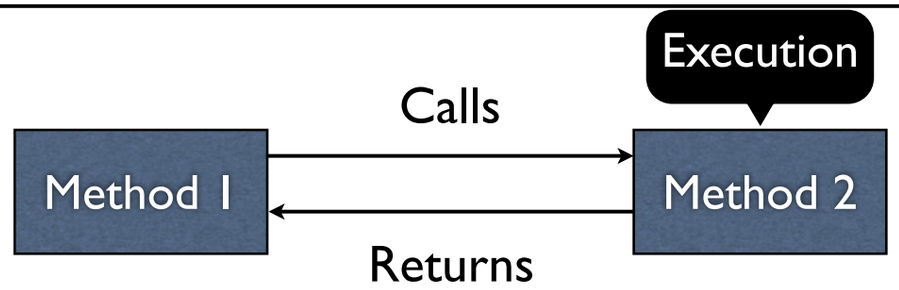
- Execution enters the method calls
- The method is executed
- The method returns to wherever it was called from



-Execution transfers to method 2 as a result of the call

Calling Methods

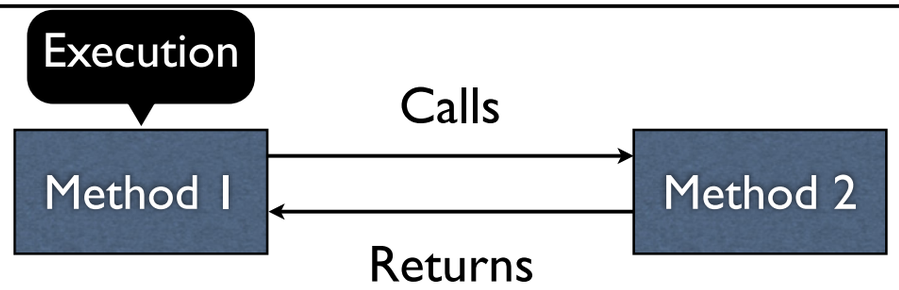
- Execution enters the method calls
- The method is executed
- The method returns to wherever it was called from



-Method 2 eventually completes, returning back to method 1

Calling Methods

- Execution enters the method calls
- The method is executed
- The method returns to wherever it was called from



-Once the return is complete, execution resumes back in method 1 wherever it left off

Defining a Method

Easiest to see with real code.

Example:
`Return42.java`

-The `return` reserved word says that the method should end and return with a given value at this point

Method Parameters

Parameters are *passed* on a call,
copying their values into the called method.

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```
public static int foo(int x) {
  return x + 1;
}
```

-For example, let's take this method

Method Parameters

Parameters are *passed* on a call,
copying their values into the called method.

```
public static int foo(int x) {
  return x + 1;
}
```

```
int a = foo(7);
```

-We later call this method with parameter 7

Method Parameters

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public static int foo(int x) {
  return x + 1;
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```
int a = foo(7);
```

-Execution then goes into the foo method...

Method Parameters

Parameters are *passed* on a call,
copying their values into the called method.

```
public static int foo(int x) {
  return x + 1;
}
```

x = 7

```
int a = foo(7);
```

-...with x holding the value 7

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Parameters are *passed* on a call,
copying their values into the called method.

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public static int foo(int x) {
  return x + 1;
}
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x = 7

```
int a = foo(7);
```

-From here, x is returned (which still holds 7)...

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public static int foo(int x) {
  return x + 1;
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x = 7

```
int a = foo(7);
```

-...and we return the returned value wherever we were originally called from
-Phrased another way, we resume execution from where the call started

Method Parameters

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  return x + 1;
}
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x = 7

```
int a = foo(7);
```

8

-The whole method call acts as a single expression, and the value of the method call expression is whatever the method returned

Example:

`ReturnParameter.java`

Example:

`MultParameters1.java`

Example:

`MultParameters2.java`

Example:

`MultParameters3.java`

Method Definition General Form

```
public static
returnType
methodName(parameter_list) {
   ...
   return expression;
}
```

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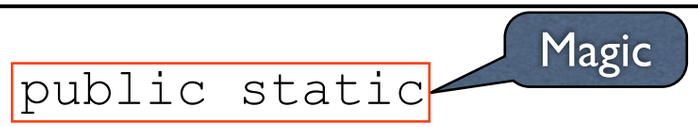


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Type of value produced

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Name given to method; same naming rules as variables

Method Definition General Form

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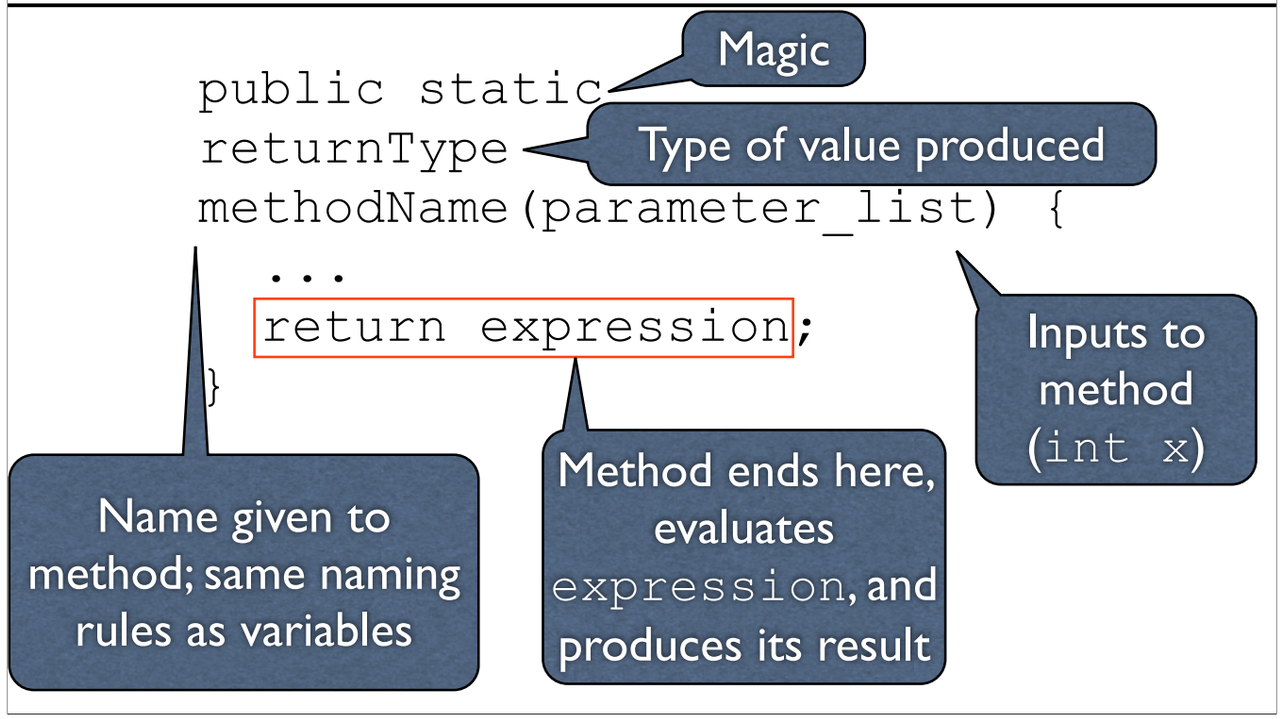
Magic

Type of value produced

Inputs to method (`int x`)

Name given to method; same naming rules as variables

Method Definition General Form



Methods which Produce no Values

Methods which produce no values
have a `void` return type

Example:
`ReturnNothing.java`

Aside: Expressions vs. Statements

- Expressions return values (e.g., `1 + 2`)
- Statements do not return values (e.g., `System.out.println("Hello")`)
- Statements are separated with semicolon (`;`)

```
System.out.println("Hello");
System.out.println("Goodbye");
```

`main` Method

`main` is just another method.

`main` serves as the entry point to your program.

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```
public static
void
main(String[] args) {
   ...
}
```

-main's return type is void - it produces no value (doesn't return anything)
-String[] is actually a type, so args is a parameter
-Later on we'll get into what the type `String[]` is (not the same as just String), along with what this parameter to main holds