

COMP 110/L Lecture 5

Kyle Dewey

Outlines

- Methods
 - Defining methods
 - Calling methods

Methods

Motivation

Motivation

Input



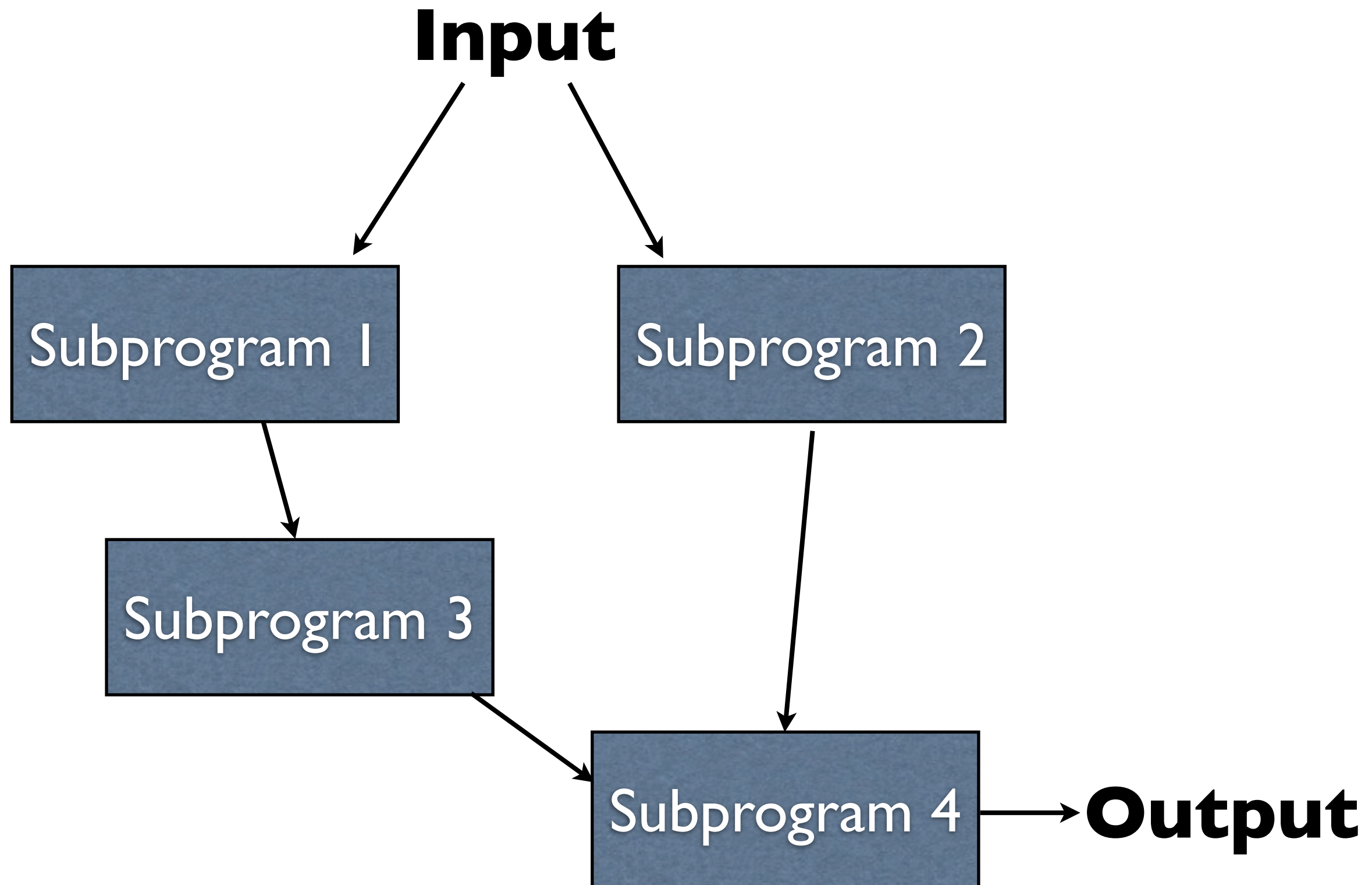
Program



Output

- 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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System.out.println(...)  
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System.out.println(...)  
    nextInt()  
    nextLong()  
    nextDouble()
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System.out.println(...)  
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```

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*.**

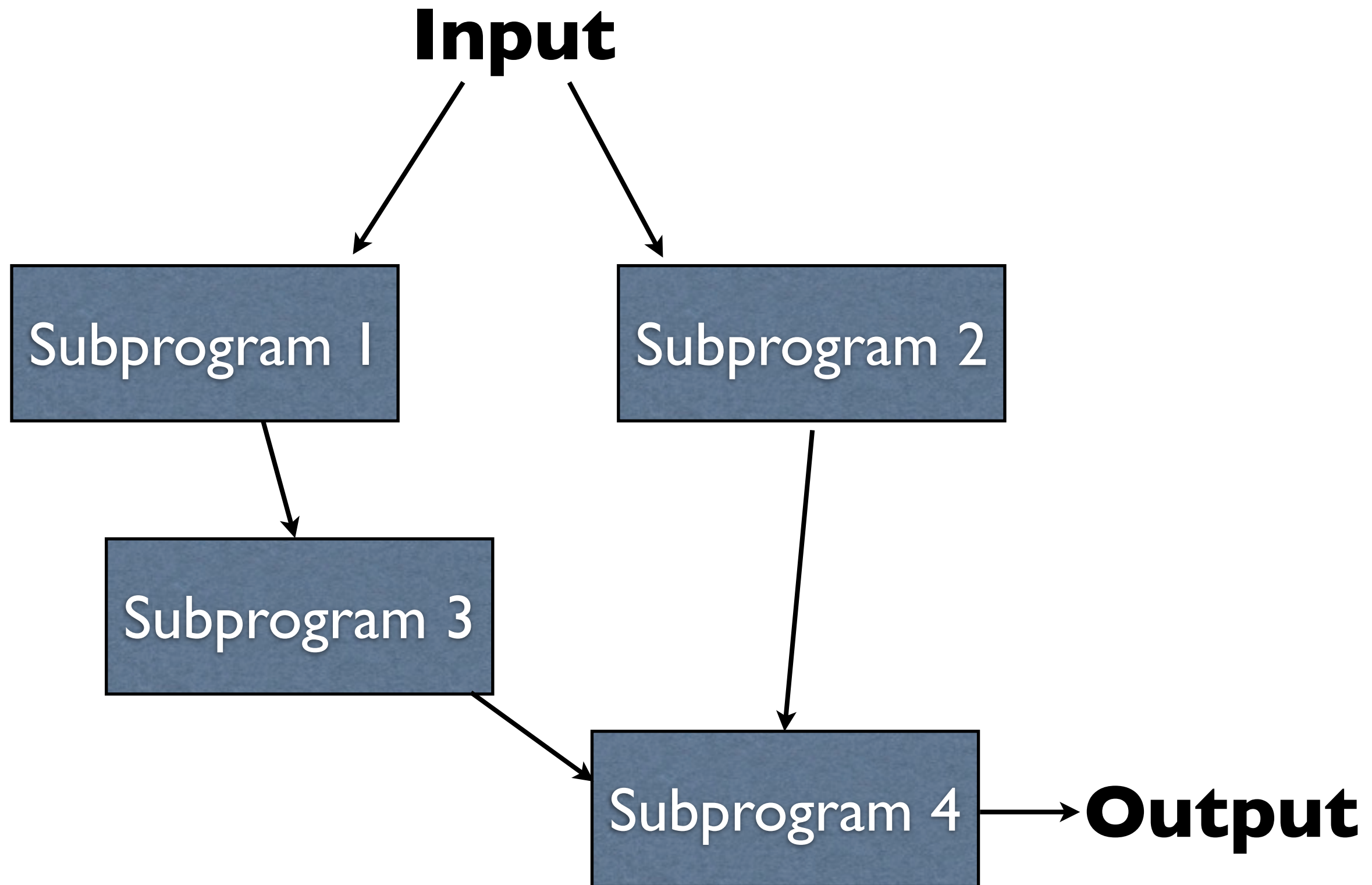
-You're already familiar with these, and you've used them a bunch of times

Methods

Distinct subprograms.

Methods

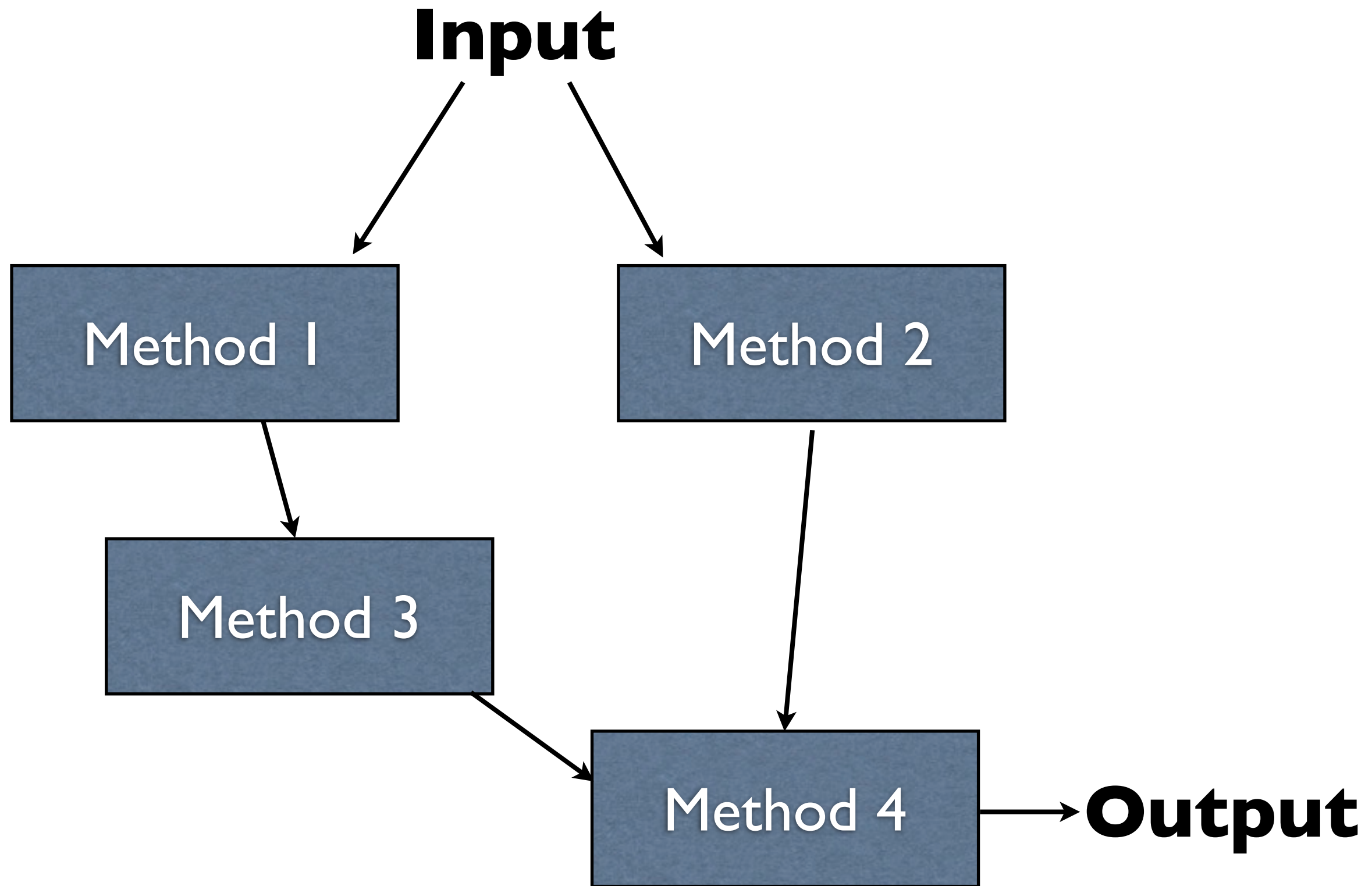
Distinct subprograms.



-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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Math.pow(2, 3);
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Method Anatomy

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

Methods may produce an output.



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

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");
```

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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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Calling Methods

- Execution enters the method calls
- The method is executed
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Method 1

Method 2

Calling Methods

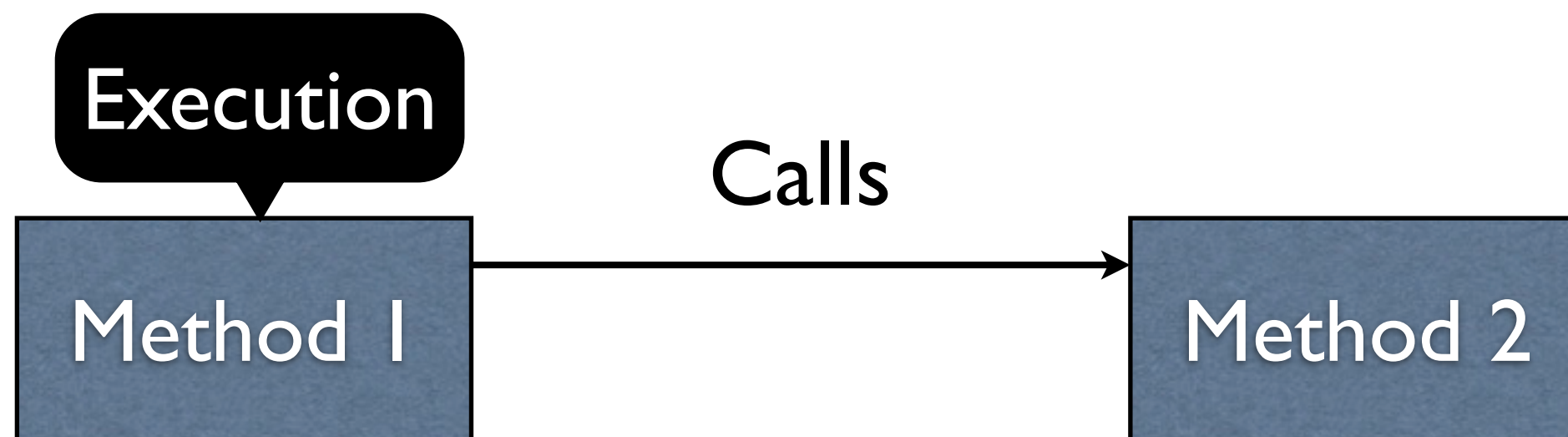
- Execution enters the method calls
- The method is executed
- The method returns to wherever it was called from



-Initially, execution is in method 1

Calling Methods

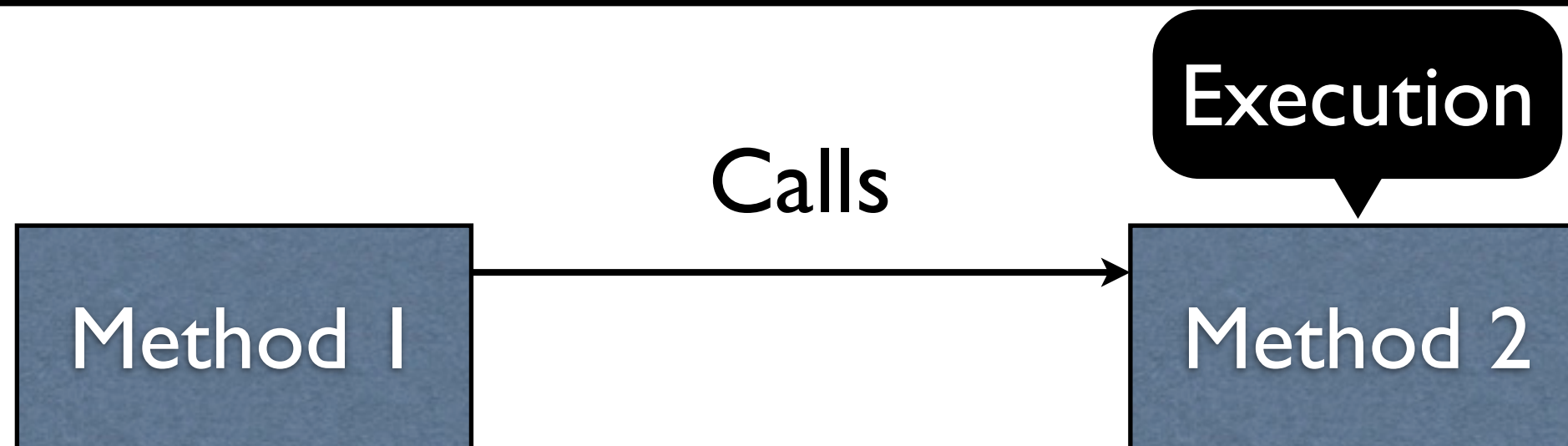
- Execution enters the method calls
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-Method 1 then calls method 2

Calling Methods

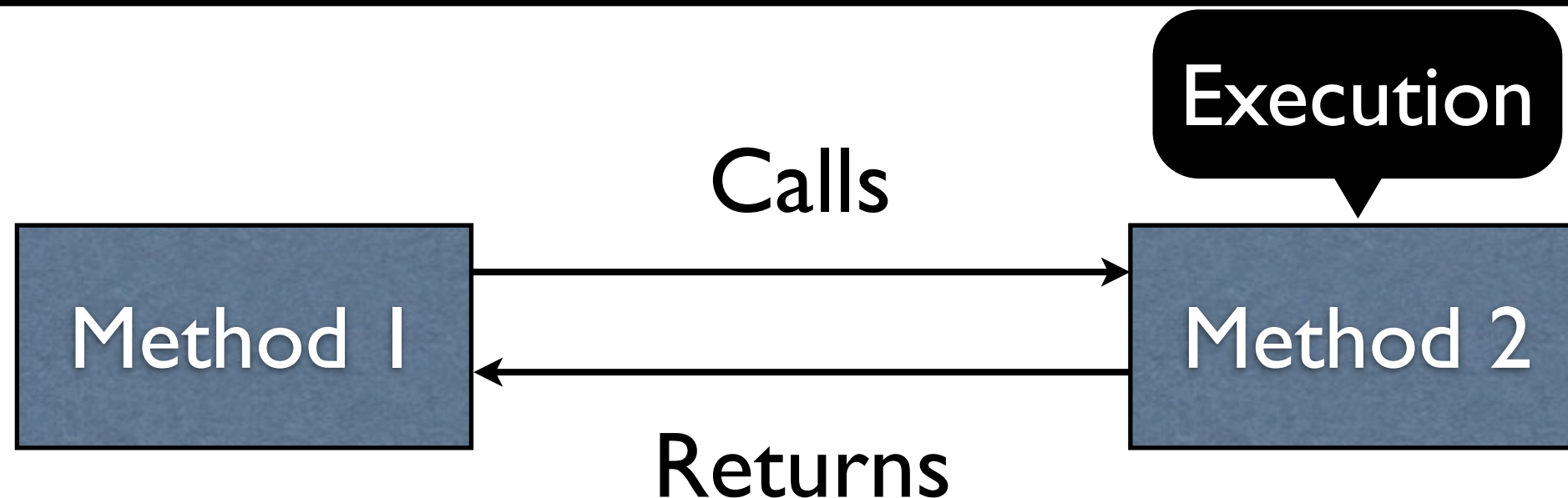
- Execution enters the method calls
- The method is executed
- The method returns to wherever it was called from



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

Calling Methods

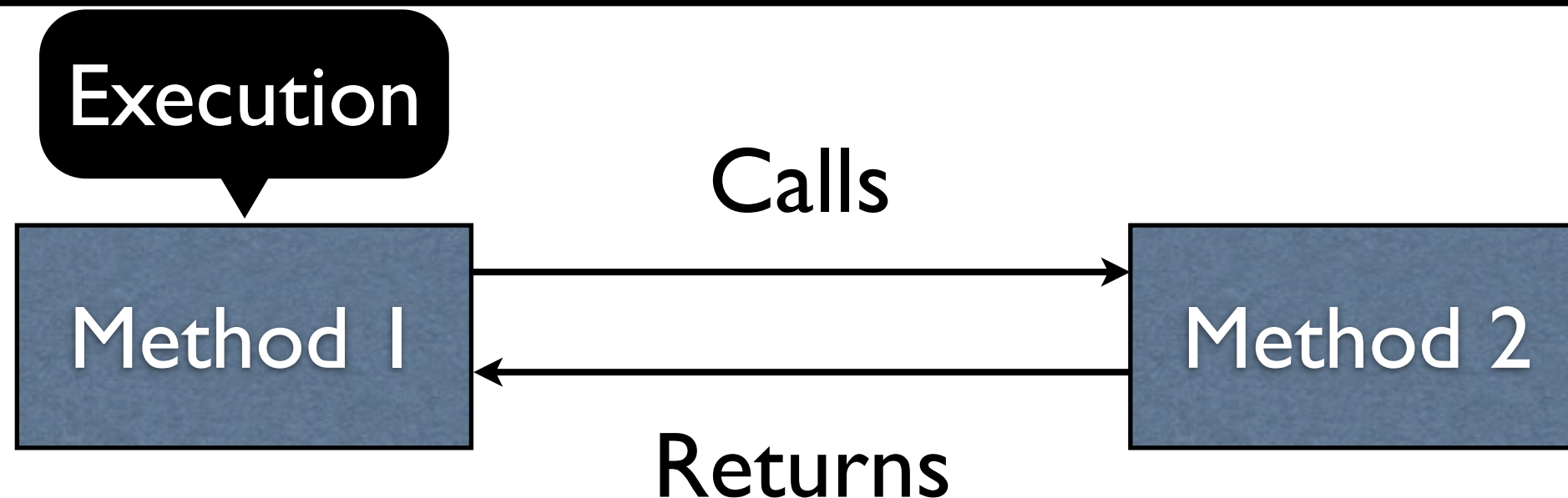
- Execution enters the method calls
- The method is executed
- The method returns to wherever it was called from



-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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copying their values into the called method.

```
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);
```

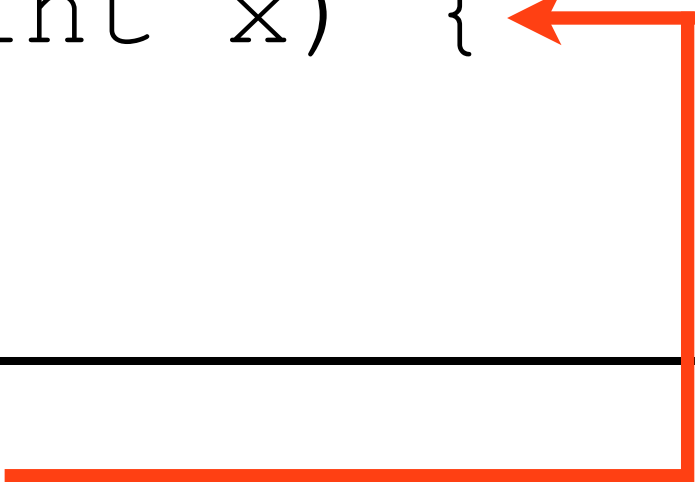
-We later call this method with parameter 7

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public static int foo(int x) {  
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}
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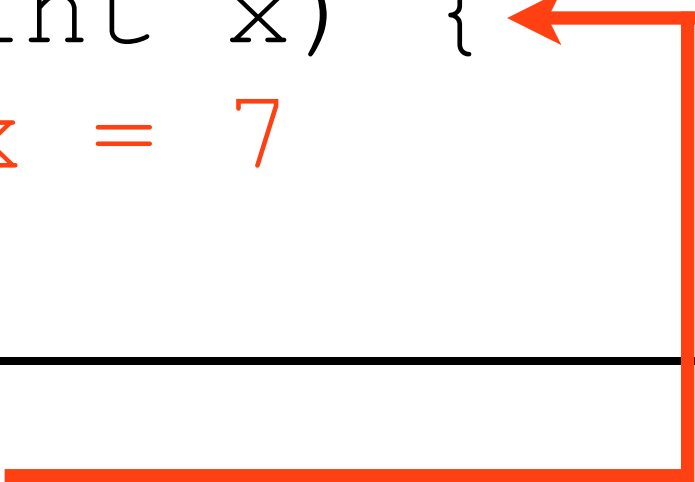
-Execution then goes into the foo method...

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

Method Parameters

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

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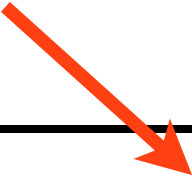
-From here, x is returned (which still holds 7)...

Method Parameters

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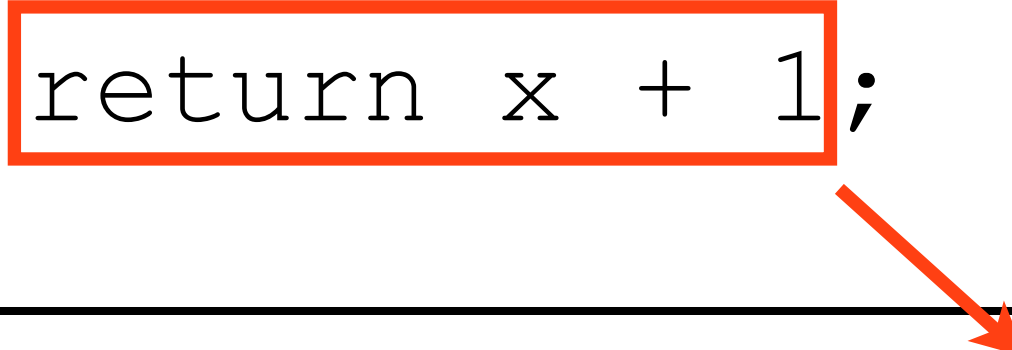
-...and we return the returned value wherever we were originally called from
-Phrased another way, we resume execution from where the call started

Method Parameters

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);  
        8
```

A red arrow points from the boxed return statement 'return x + 1;' in the method definition above to the underlined method call 'foo(7)' in the code below. The number '8' is positioned directly below the underlined 'foo(7)', indicating the result of the method call.

-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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Magic

Type of value produced

Inputs to
method
(int x)

Method ends
here, evaluates
expression, and
produces its result

Name given to
method; same naming
rules as variables

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