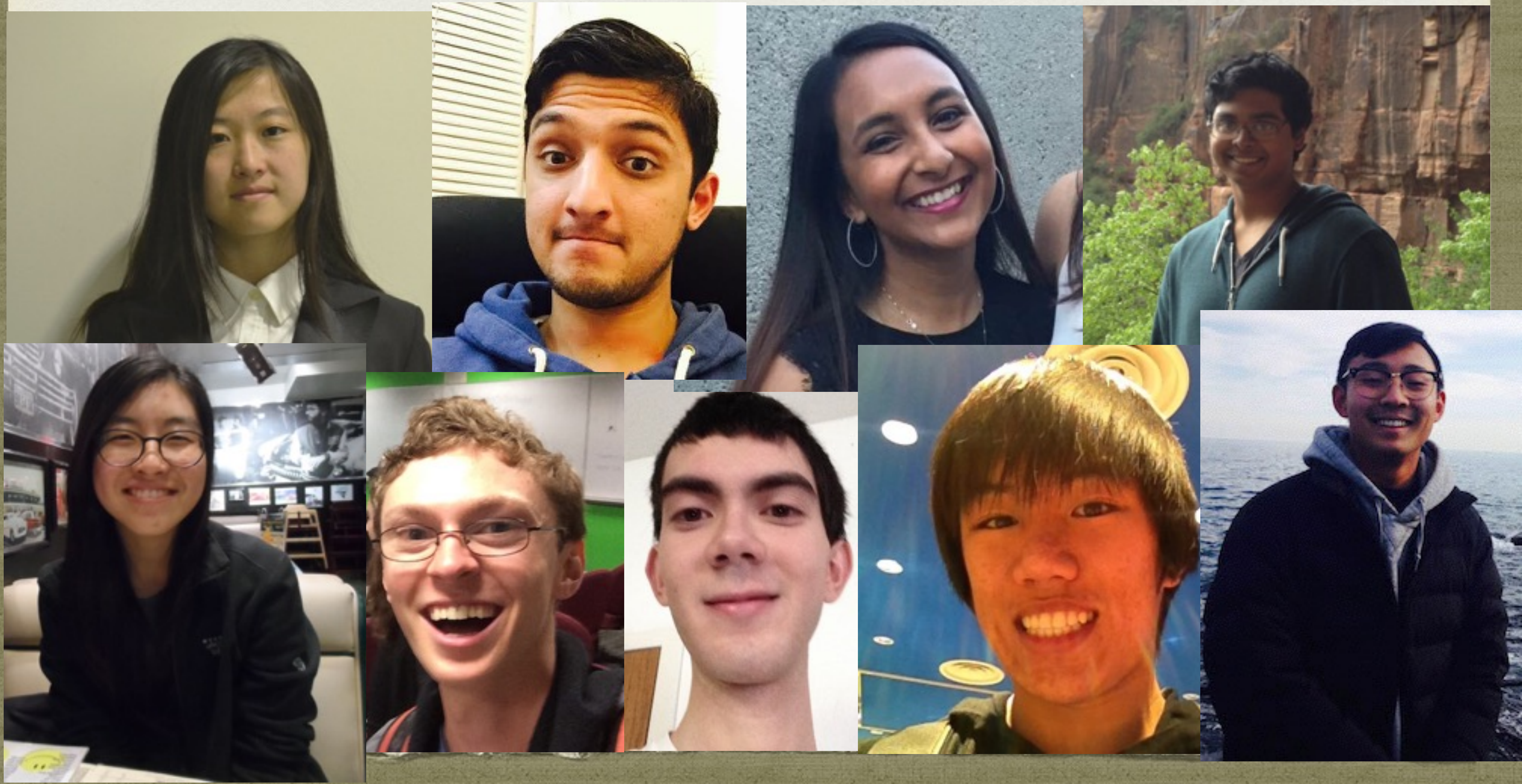
Welcome to CS 61BL!

Quote of the week: "Speak casually, but never think casually."

Let’s introduce the staff

- Your TAs! Say hello to them if you see them around!



Let's introduce the staff

- Me...
- NOT a professor. A Berkeley alumnus.
- Call me Joseph, or Joe, or Joey...
- Technical interests: NLP, machine learning, AI
- Office hours: **M** 4-6, **Tu** 2-4, **W** 12-2 in **329 Soda**

What is this class?

- A lab-based course
- The sequel to CS 61A
- A class about **data structures** and **programming methodology**

A lab-based course

- Learn by doing!
- Lecture isn’t very useful…
- Collaboration over competition

The sequel to CS 61A

- 61A (or some equivalent) is a *required prereq*
- Not just how to program, but how to program *well*
- Expect more work than CS 61A
- Homework now graded on correctness. But no more autograders...
- For other course policies (grading, etc.) please see the course webpage

What you know about Java

- All code appears in a *class*

```
public class Counter {
    // Code goes here
}
```

What you know about Java

- Here, we define a *method* (function) inside the class

```
public class Counter {

    public void printOne() {
        System.out.println(1);
    }
}
```

What you know about Java

- The equivalent Python. Talk to your partner. What does this code do if we were to run it?

```python
class Counter:

    def print_one(self):
        print(1)
```

```java
public class Counter {

    public void printOne() {
        System.out.println(1);
    }
}
```

What you know about Java

- Code outside a definition tells Python to actually do something

```
class Counter:

    def print_one(self):
        print(1)

c = Counter()
c.print_one()
```

What you know about Java

- `main` tells Java to actually do something

```python
class Counter:

    def print_one(self):
        print(1)

c = Counter()
c.print_one()
```

```java
public class Counter {

    public void printOne() {
        System.out.println(1);
    }

    public static void main(String[] args) {
        Counter c = new Counter();
        c.printOne();
    }
}
```

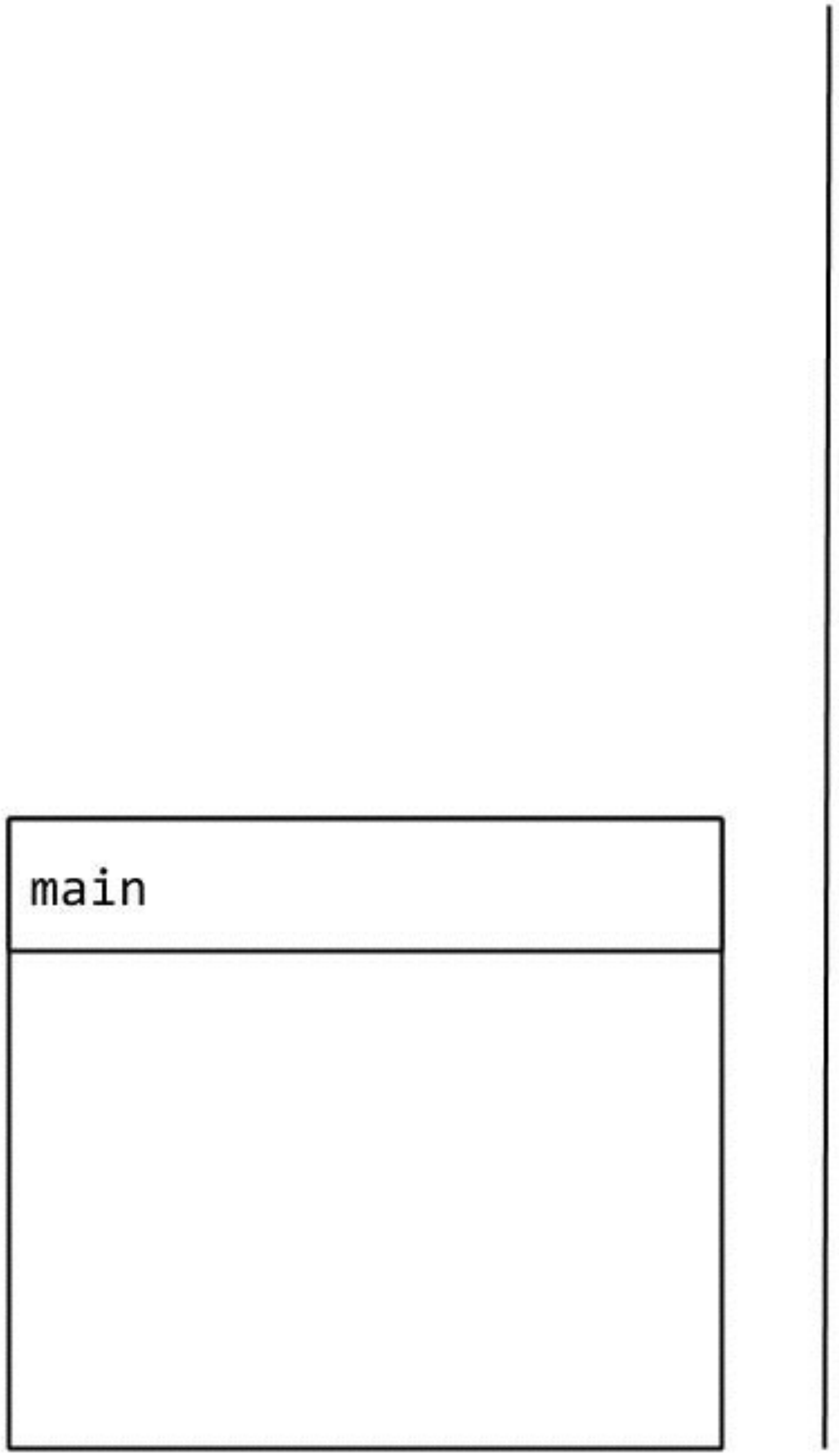
Drawing Java

- To understand our Java programs, it will be helpful to draw them

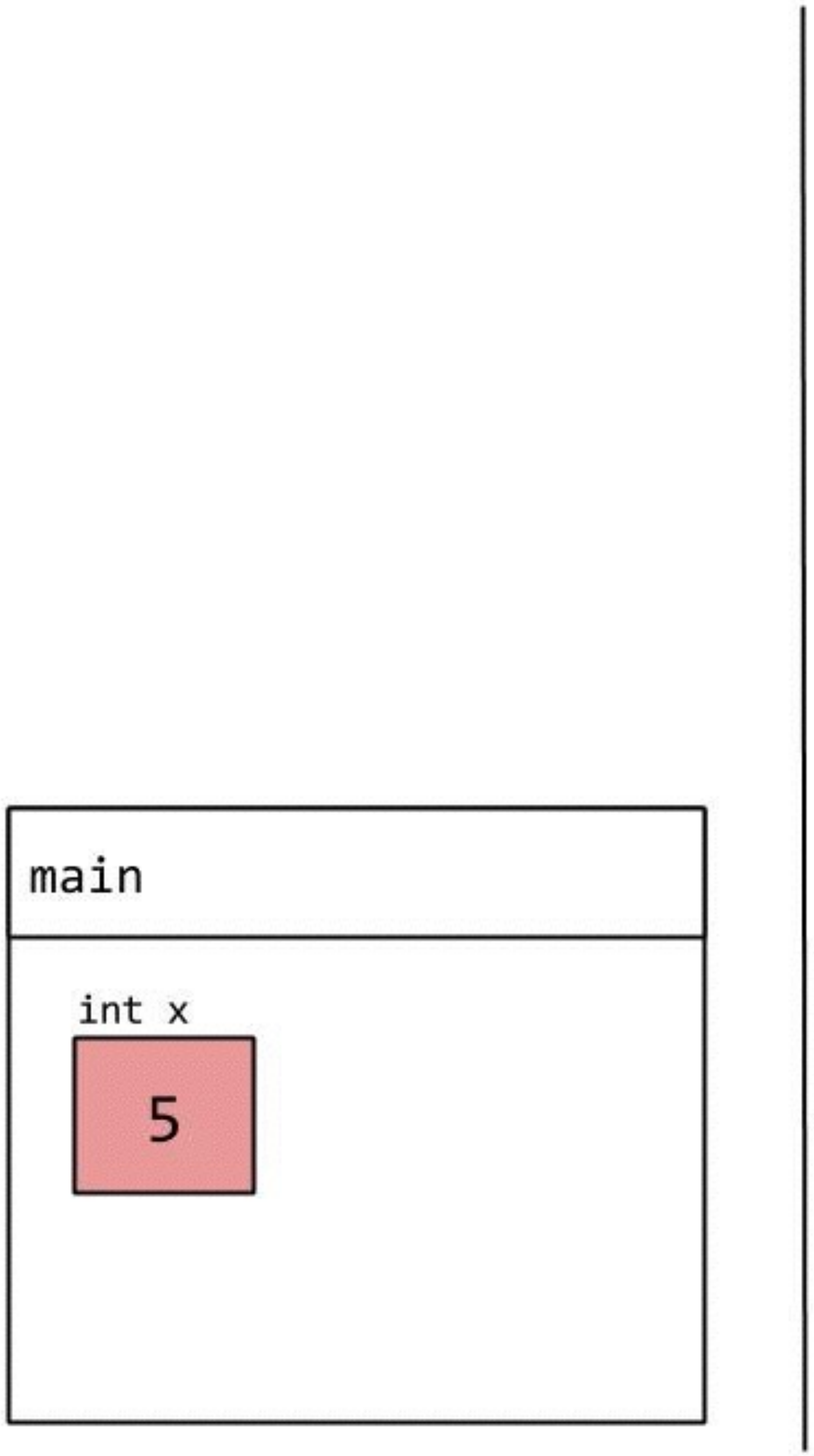
Drawing Java

- The code we’ll be drawing

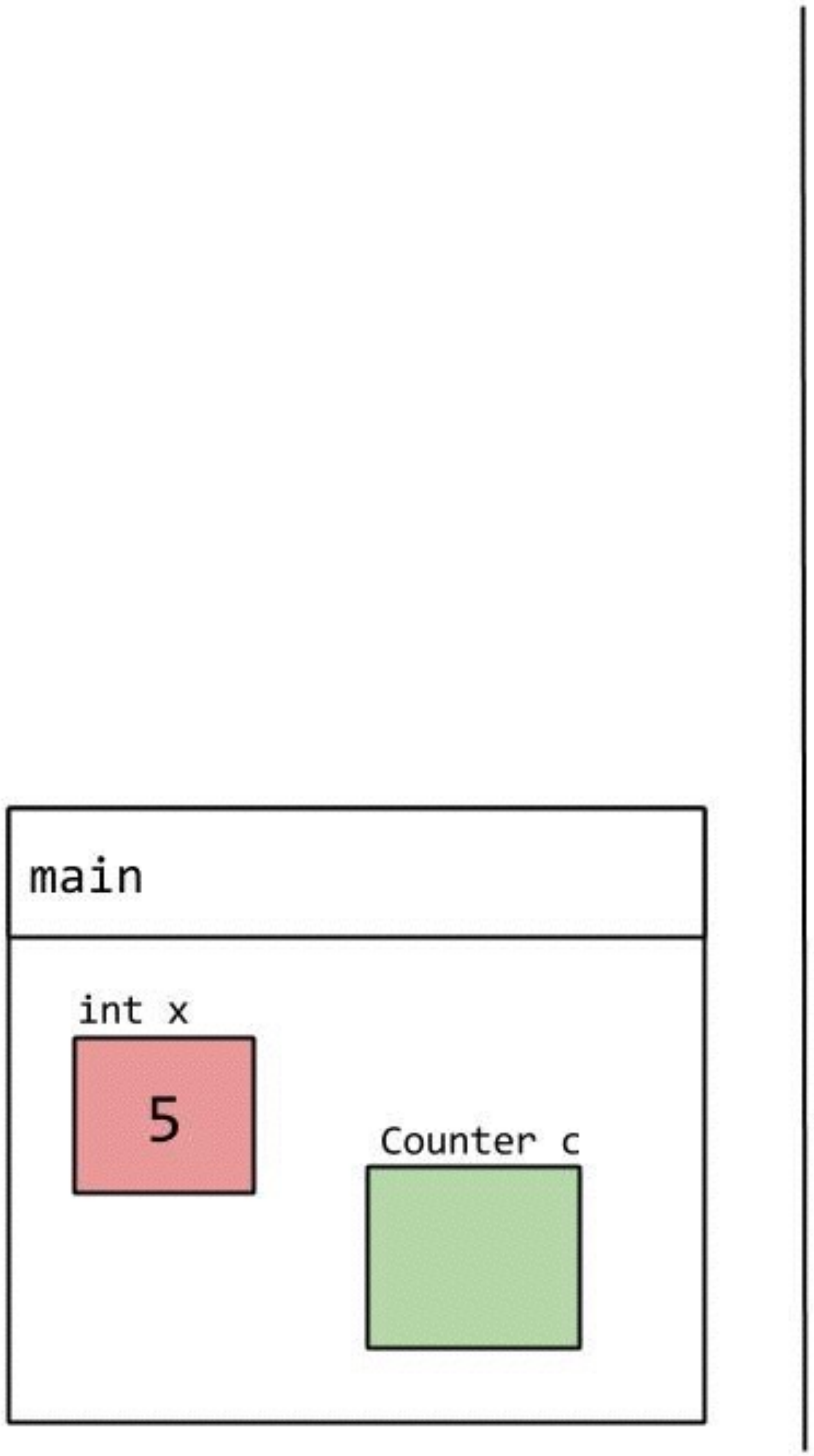
```
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.printNumber(x);
    }
}
```

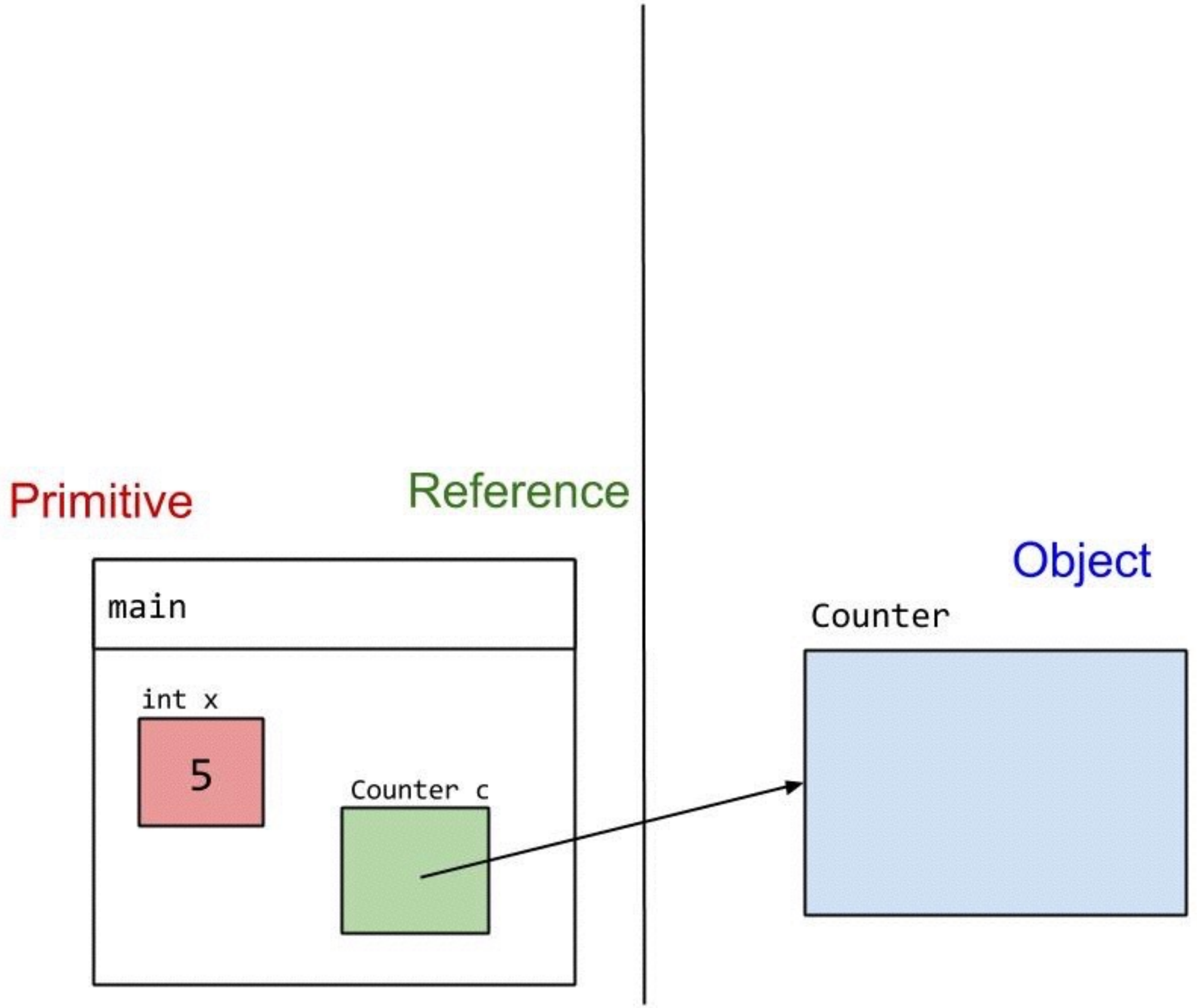

main

```
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.printNumber(x);
    }
}
```

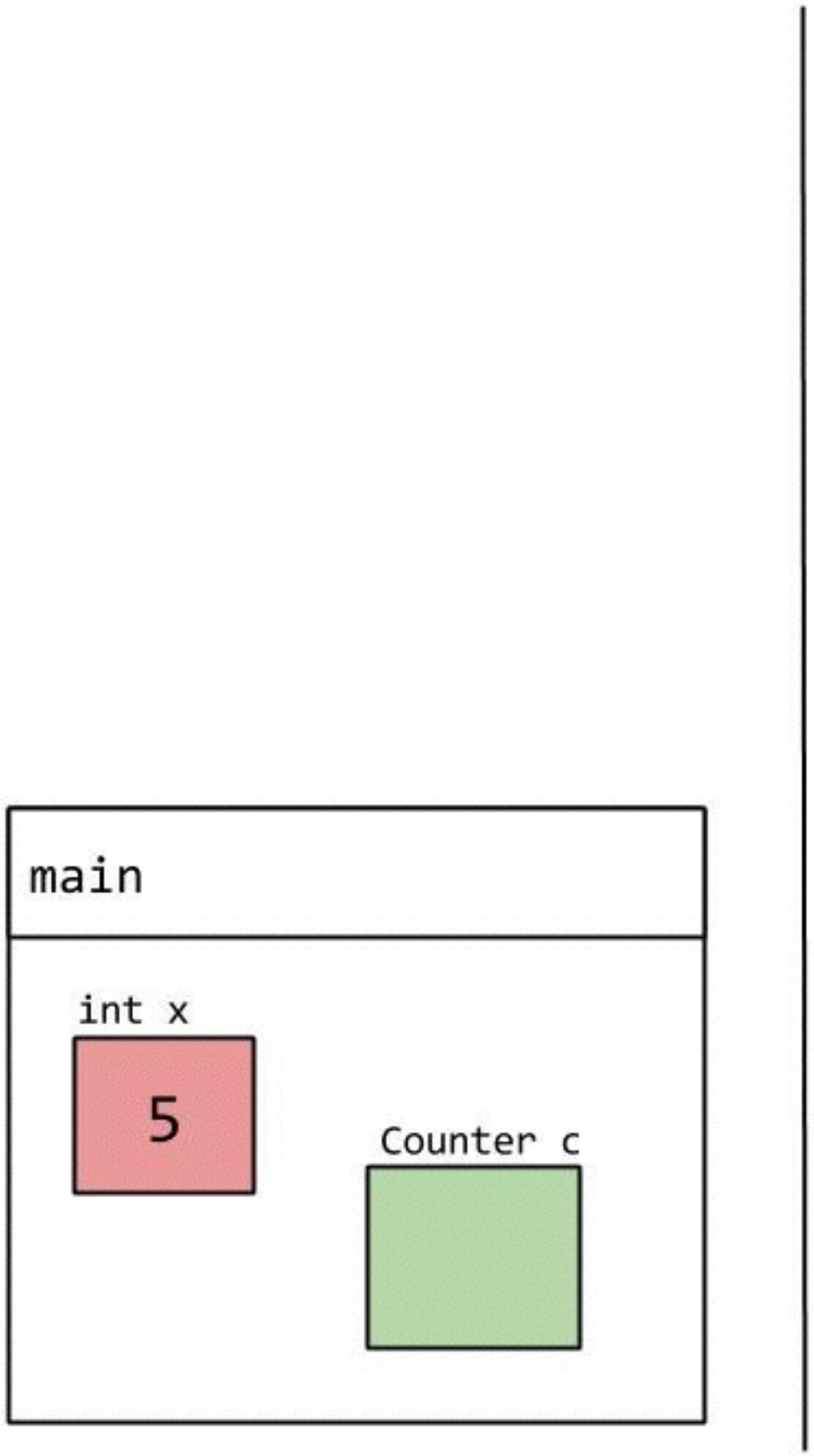

main
int x
5

```java
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.printNumber(x);
    }
}
```

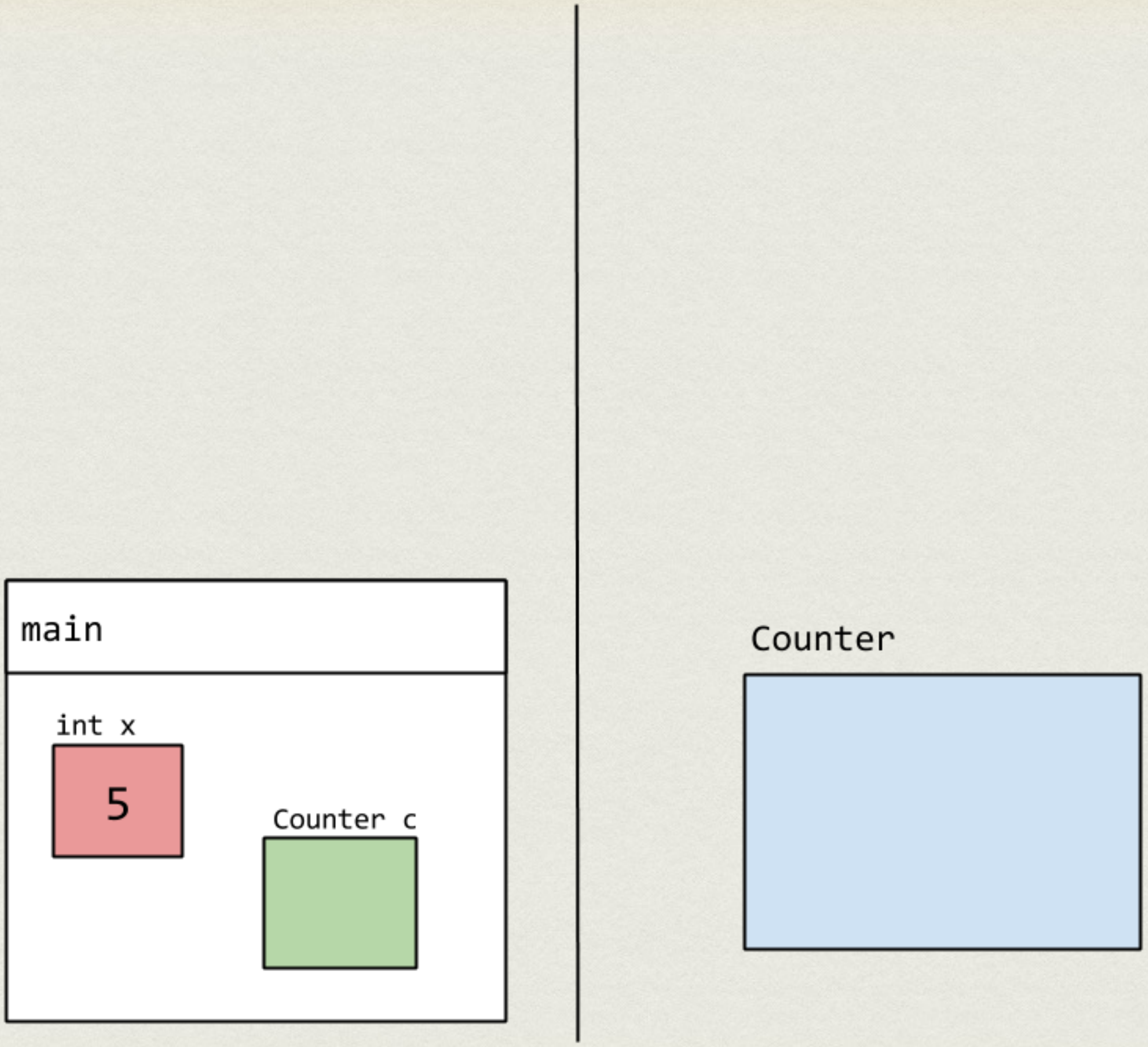

main
int x
5
Counter c


Primitive
Reference
Object
main
int x
5
Counter c
Counter

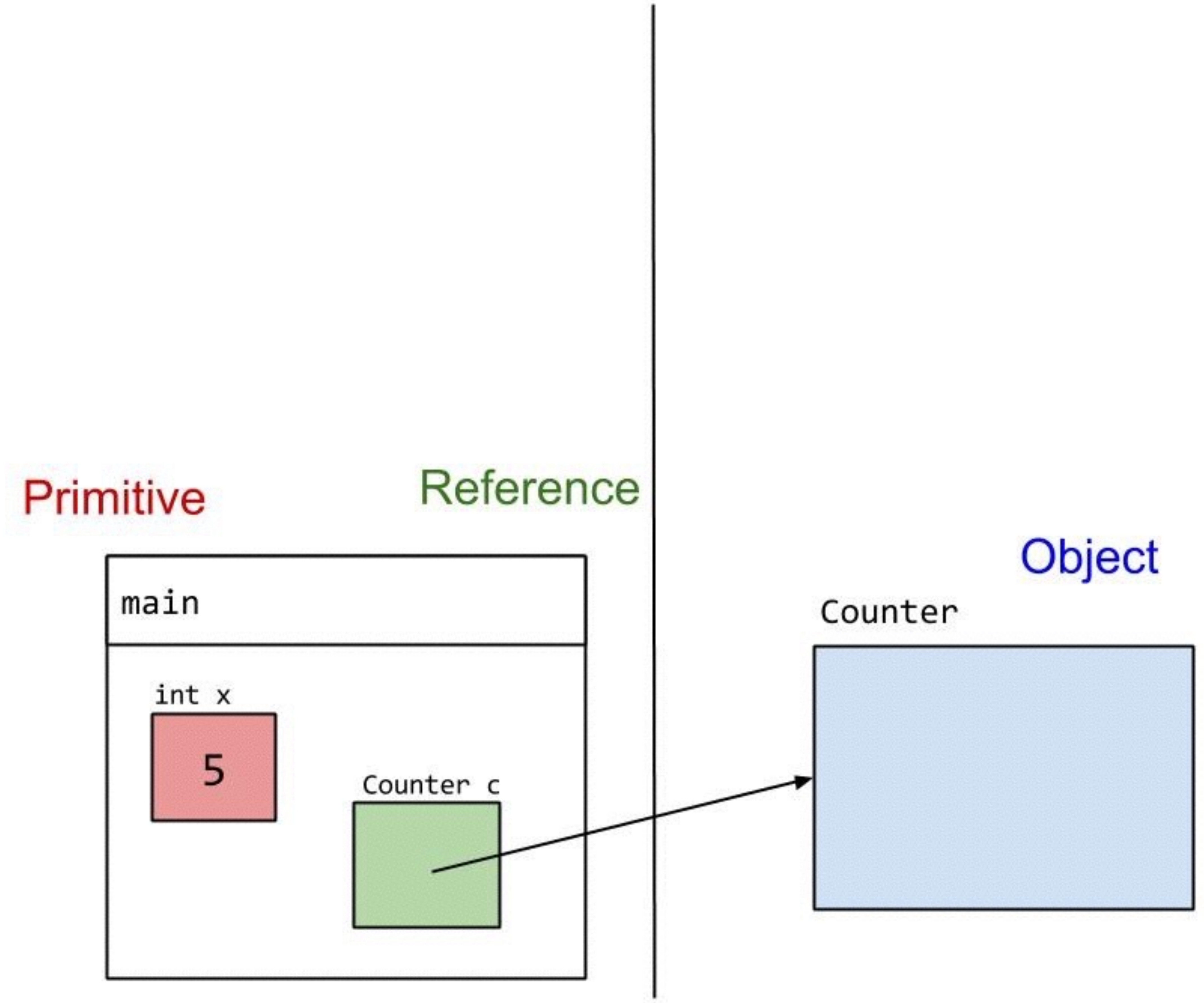
```java
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c;
        new Counter();
        c = new Counter();
        c.printNumber(x);
    }
}
```


main
int x
5
Counter c

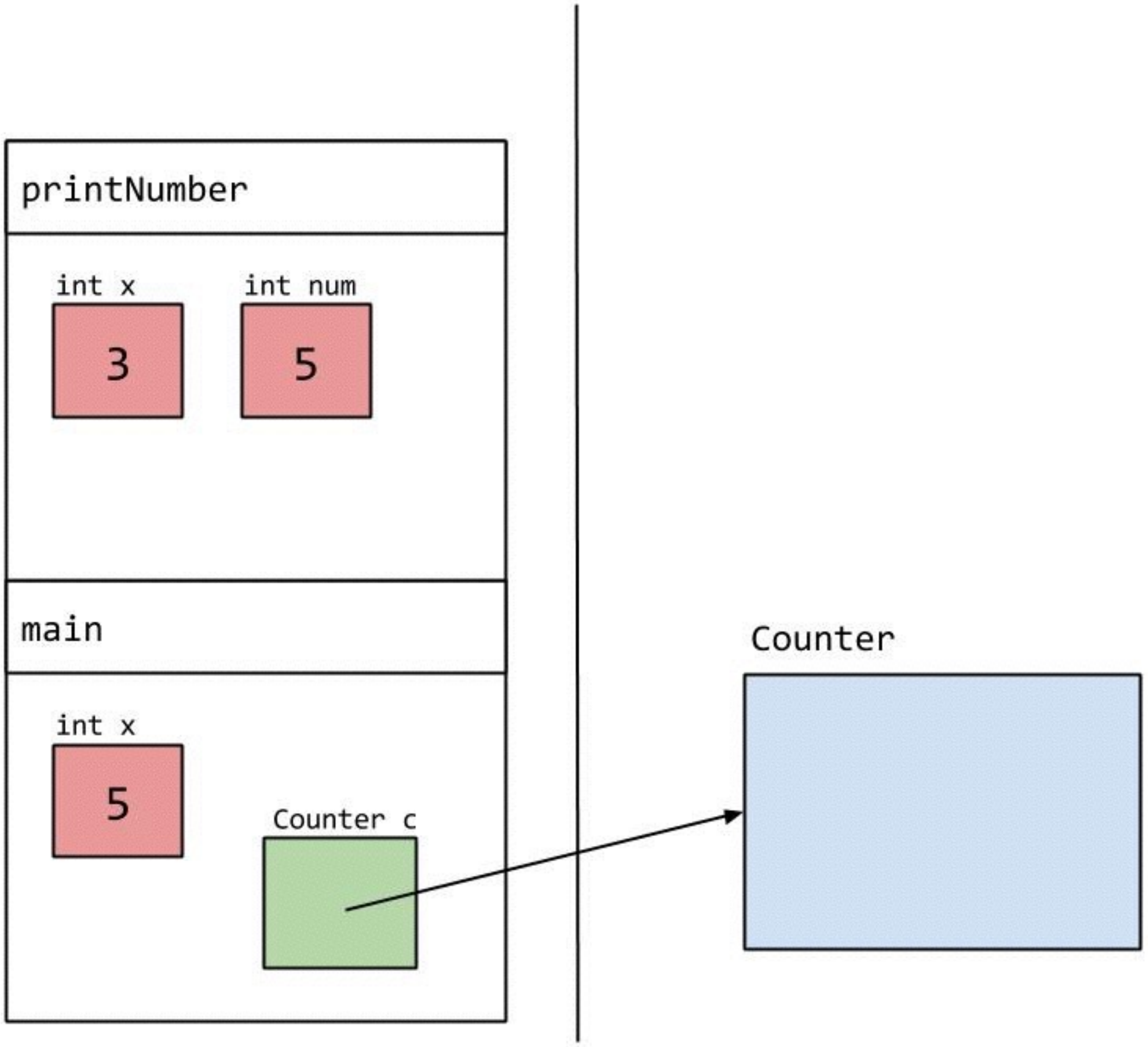
```
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c;
        new Counter();
        c = new Counter();
        c.printNumber(x);
    }
}
```


main
int x
5
Counter c
Counter

```
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c;
        new Counter();
        c = new Counter();
        c.printNumber(x);
    }
}
```


Primitive
Reference
Object
main
int x
5
Counter c
Counter

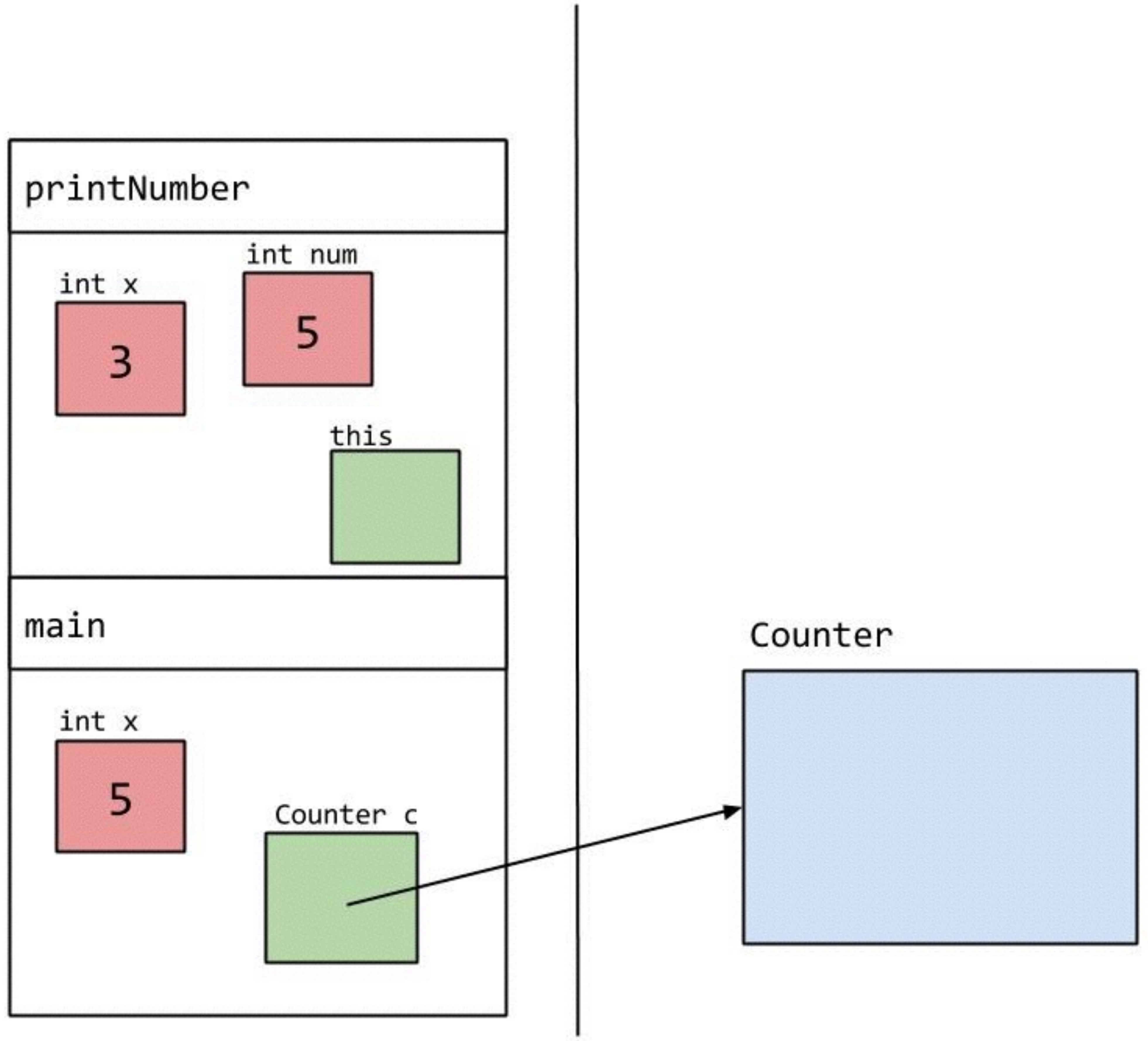
```java
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.printNumber(x);
    }
}
```

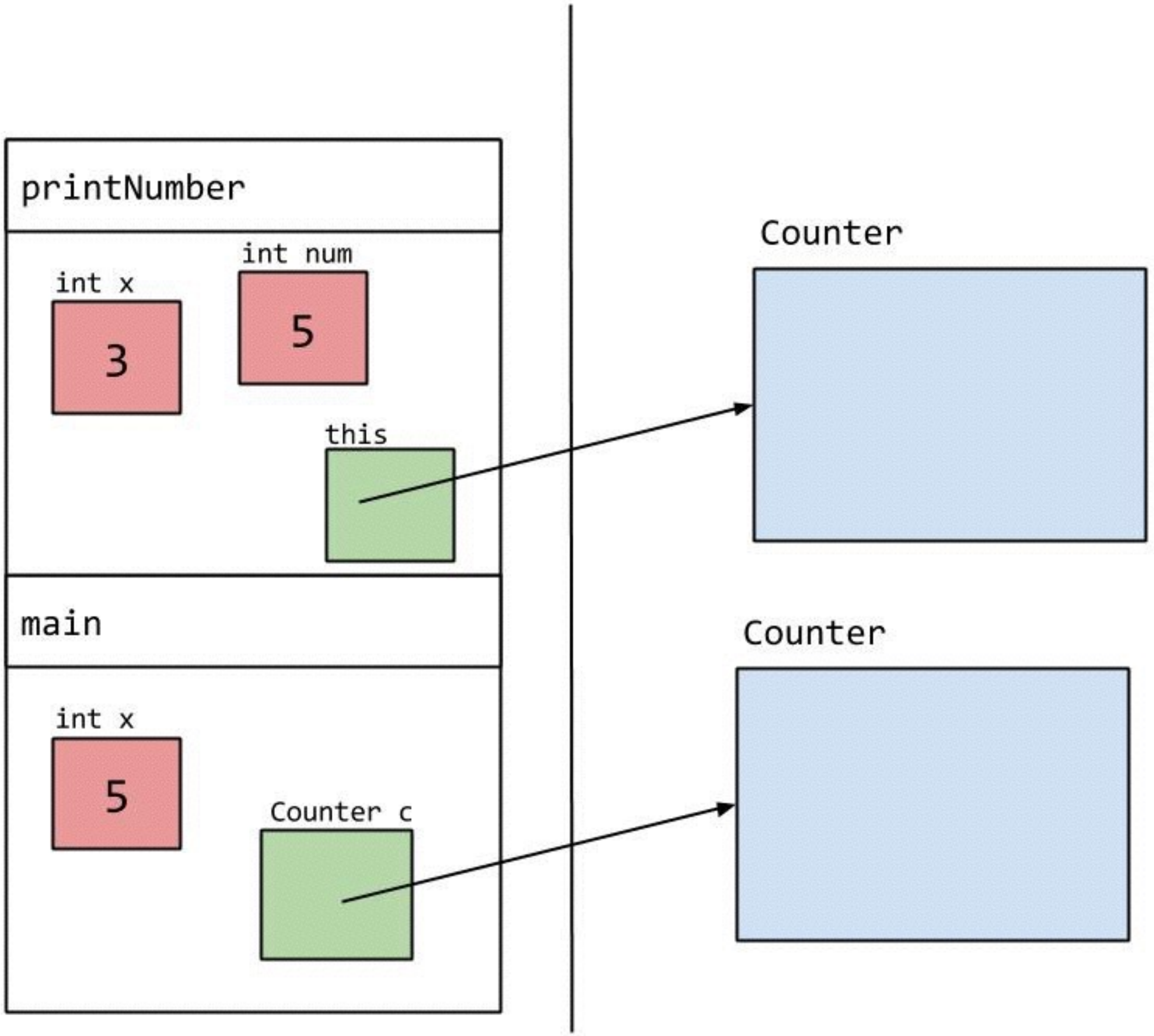

printNumber
int x
3
int num
5
main
int x
5
Counter c
Counter

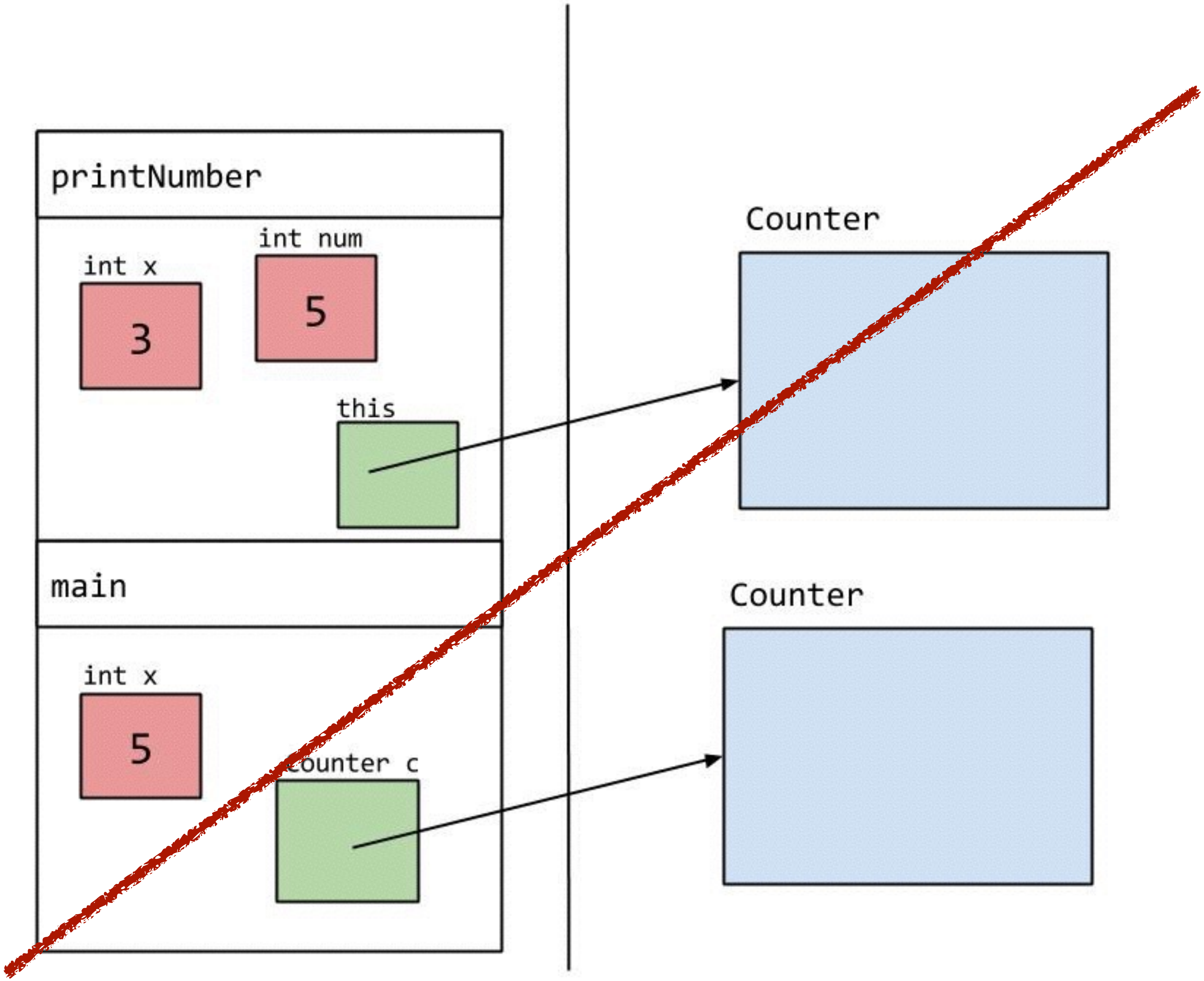
```
public class Counter {

    public void printNumber(int num) {
        int x = 3;
        System.out.println(num);
        System.out.println(this);
        num = 10;
    }

    public static void main(String[] args) {
        int x = 5;

        c.printNumber(x);
    }
}
```

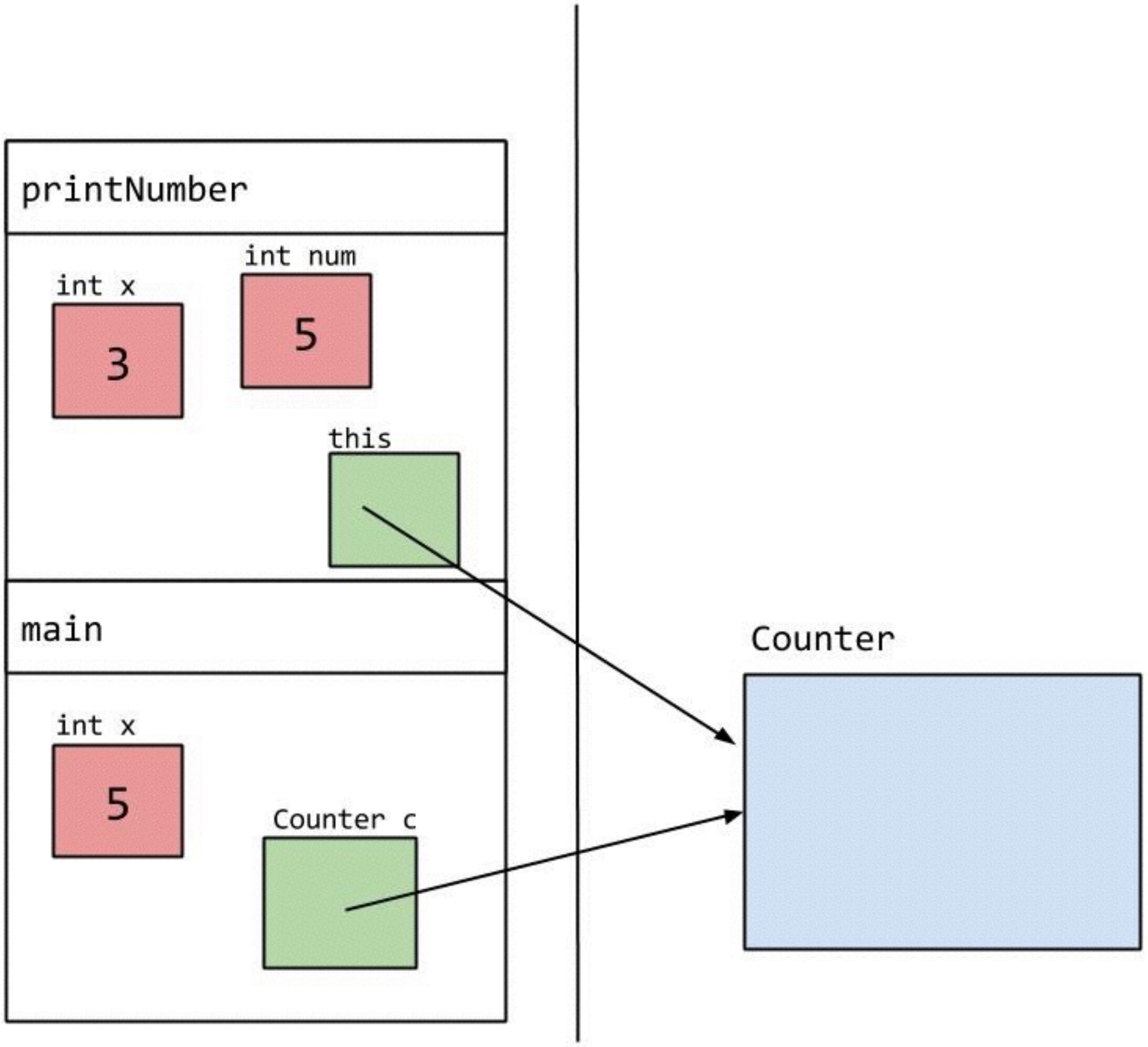
- The equivalent Python has `self` to refer to the object that called the method. Does Java have such a thing?

```
class Counter:

    def print_number(self, num):
        x = 3
        print(num)
        num = 10

x = 5
c = Counter()
c.print_number(x)
```


printNumber
int x
3
int num
5
this
main
int x
5
Counter c
Counter


printNumber
int x
3
int num
5
this
main
int x
5
Counter c
Counter
Counter


printNumber
int x
3
int num
5
this
Counter
main
int x
5
Counter c
Counter


printNumber
int x
3
int num
5
this
main
int x
5
Counter c
Counter

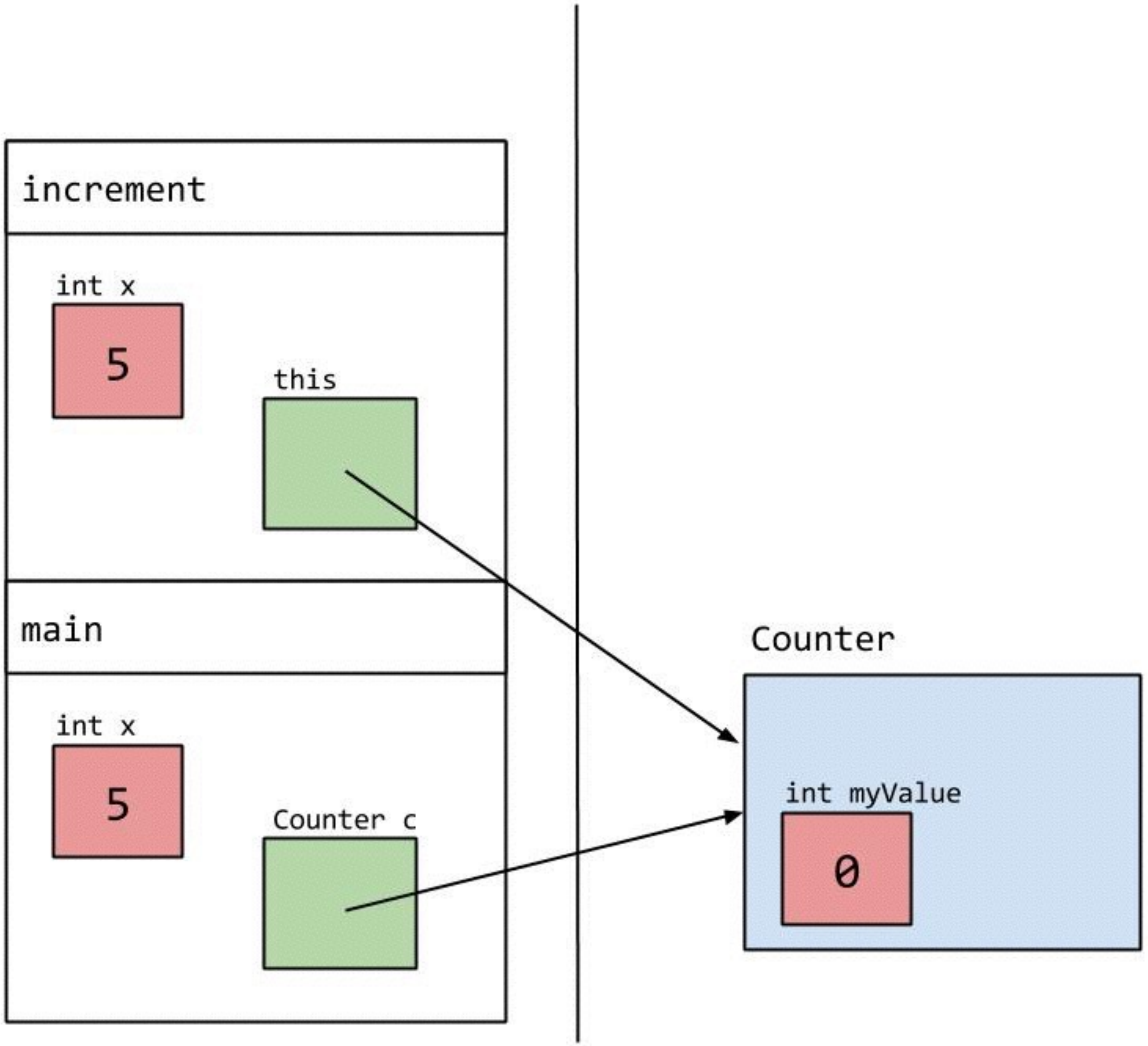
And now…

- A break.
- It’s a long two hours.

Drawing Java

- Objects can have variables inside

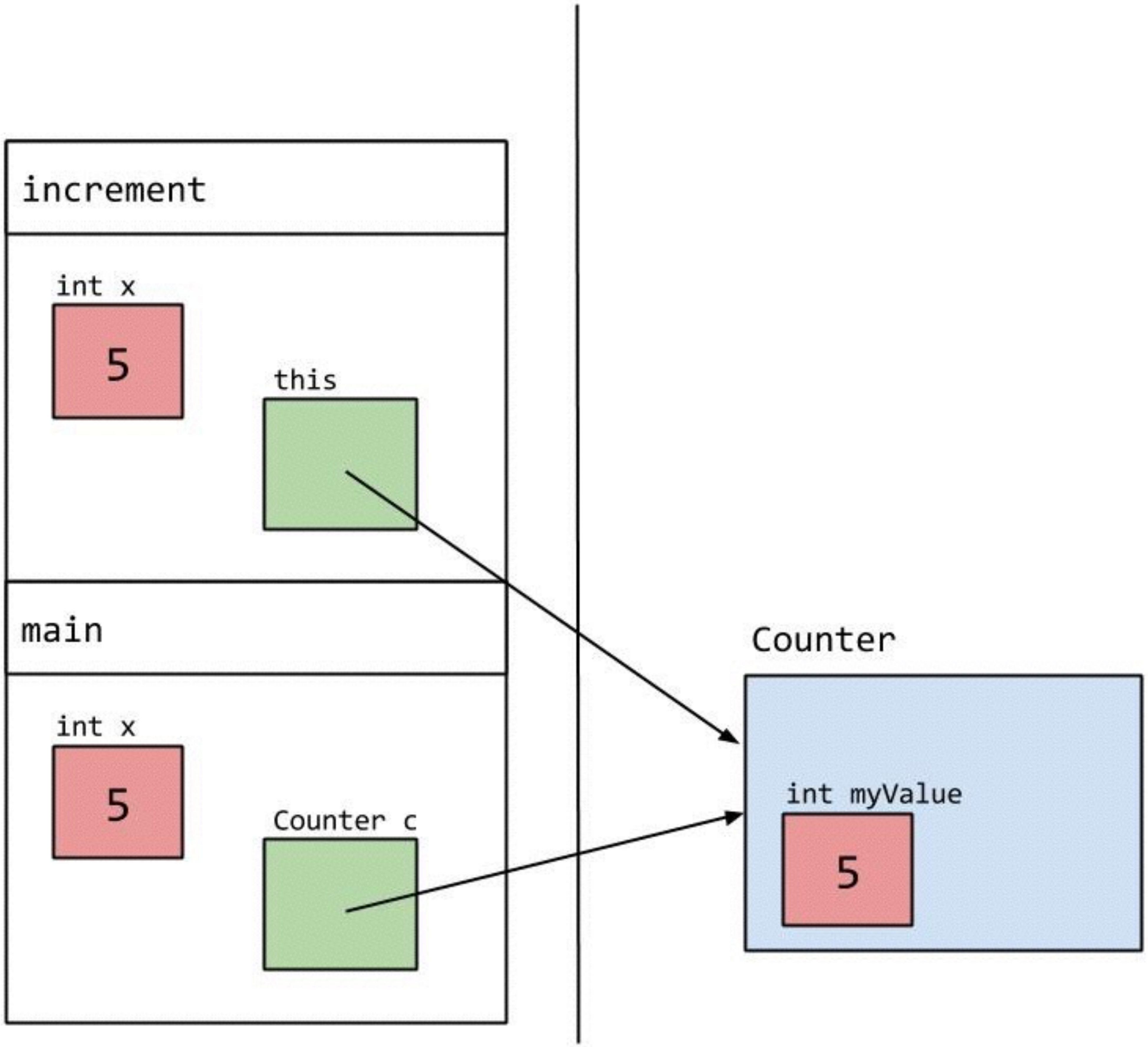
```
public class Counter {
    int myValue = 0;

    public void increment(int x) {
        this.myValue += x;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.increment(x);
        System.out.println(c.myValue);
    }
}
```


increment
int x
5
this
main
int x
5
Counter c
Counter
int myValue
0

Drawing Java

- Objects can have variables inside

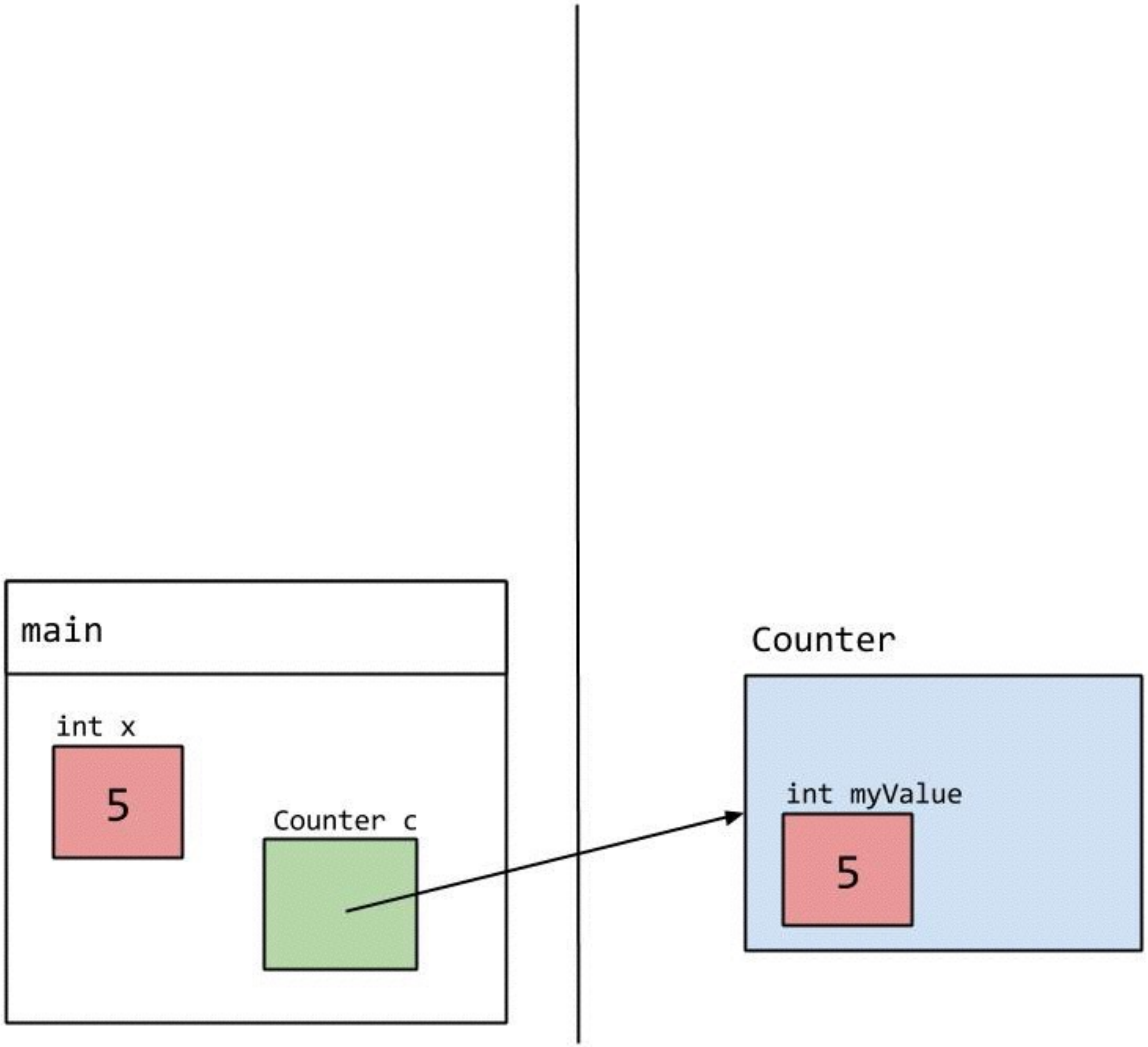
```java
public class Counter {
    int myValue = 0;

    public void increment(int x) {
        this.myValue += x;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.increment(x);
        System.out.println(c.myValue);
    }
}
```


increment
int x
5
this
main
int x
5
Counter c
Counter
int myValue
5

Drawing Java

- Objects can have variables inside

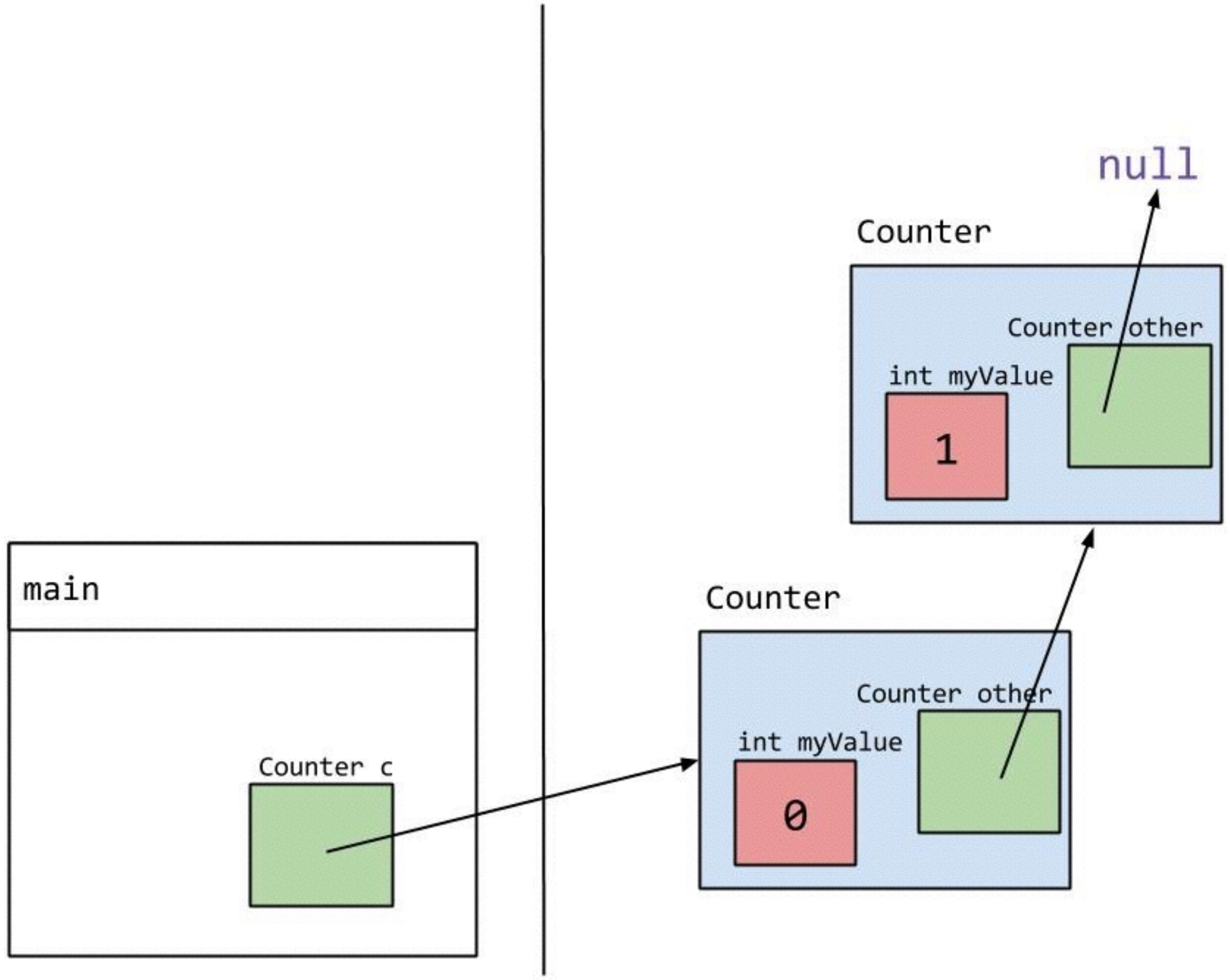
```
public class Counter {
    int myValue = 0;

    public void increment(int x) {
        this.myValue += x;
    }

    public static void main(String[] args) {
        int x = 5;
        Counter c = new Counter();
        c.increment(x);
        System.out.println(c.myValue);
    }
}
```


main
int x
5
Counter c
Counter
int myValue
5

Drawing Java

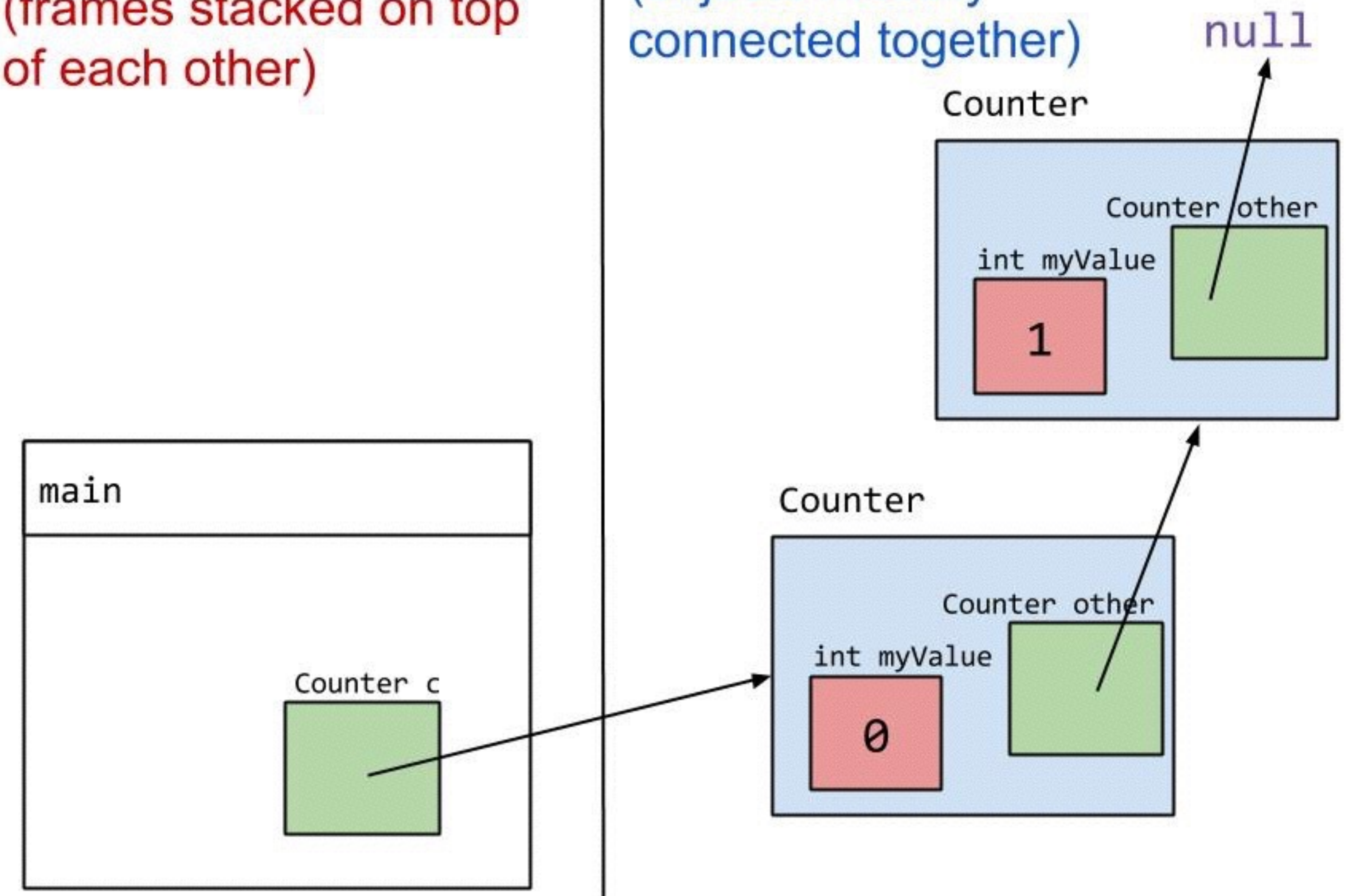
- Objects can have references to other objects inside

```java
public class Counter {
    int myValue = 0;
    Counter other;

    public static void main(String[] args) {

        Counter c = new Counter();
        c.other = new Counter();
        c.other.myValue = 1;
    }
}
```


null
Counter
Counter other
int myValue
1
main
Counter
Counter other
int myValue
Counter c
0

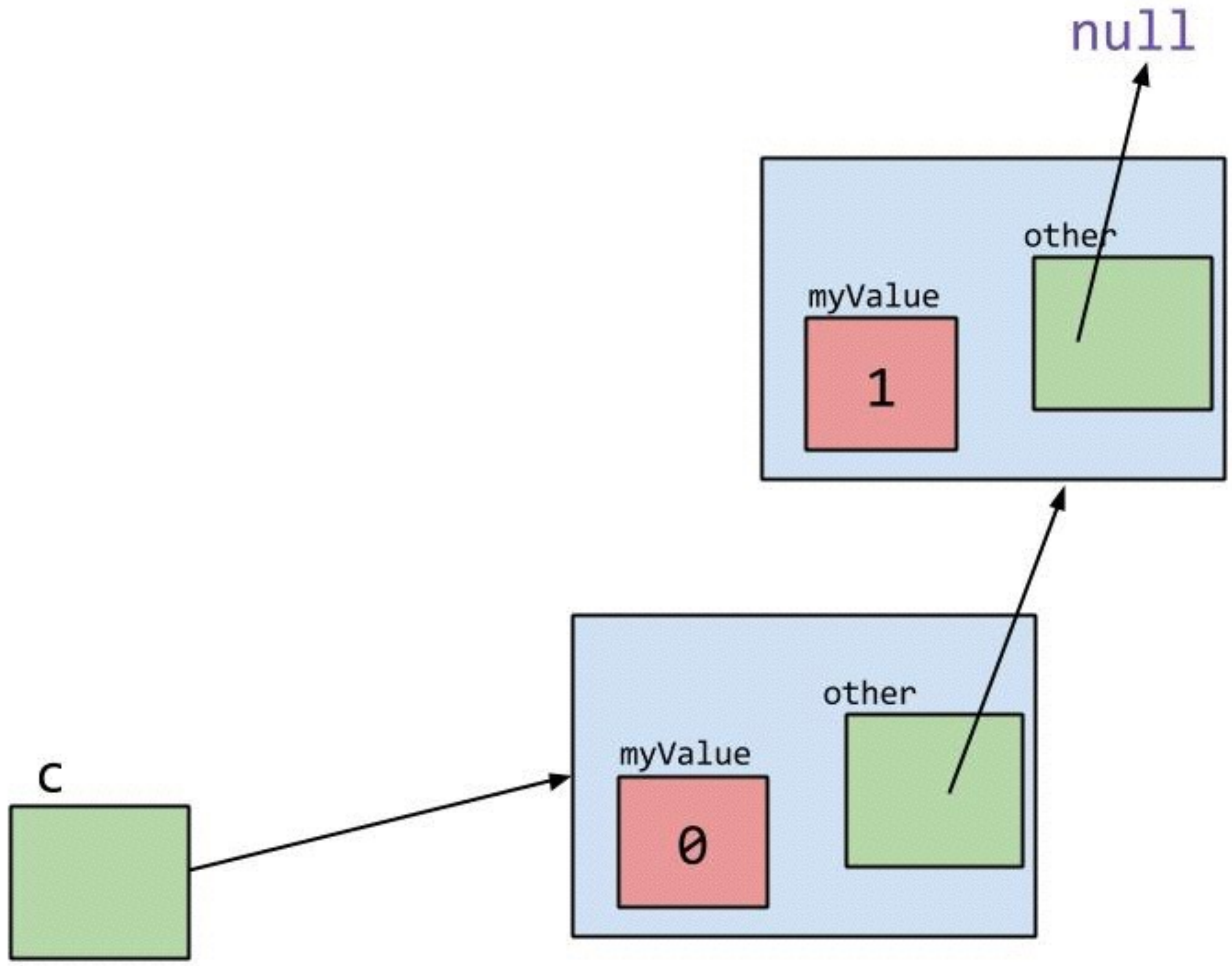
The Stack
(frames stacked on top of each other)

The Heap
(objects messily connected together)



Drawing Java

- Often we abbreviate diagrams


null
other
myValue
1
other
myValue
0
c

Drawing Java

- **Stack and heap diagrams**…
  - Are not literally how your computer's memory works
  - They are useful models for understanding what your program does
- In this class, we are mainly concerned with the heap (leave stack frame craziness for 61A!)

Drawing Java

- Additional points...
    - References do not point to other references, only to objects
    - Objects do not contain other objects, only primitives and references
    - A new object is created *only* if there is a call to `new`

Your turn!

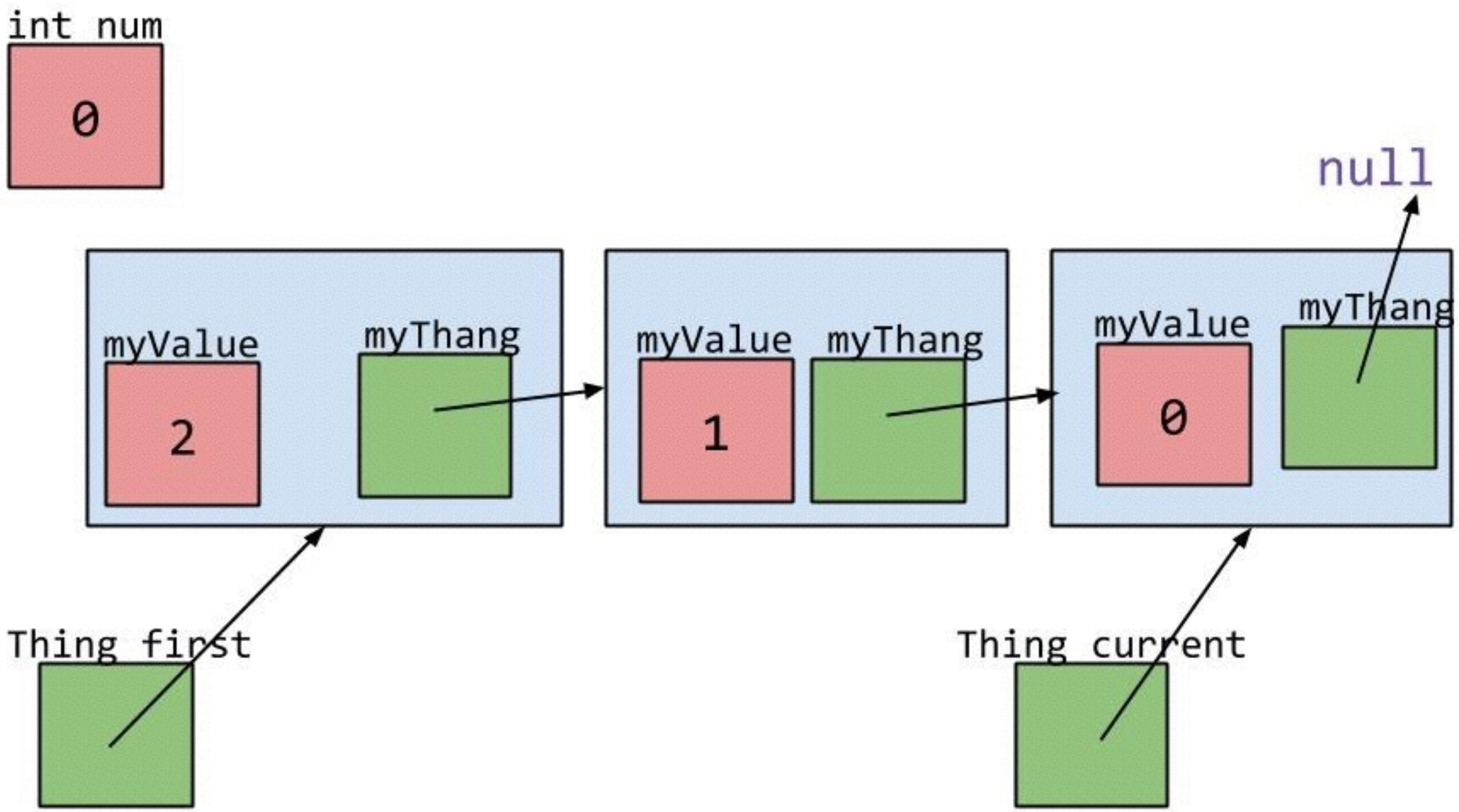
- Quiz time!
- (More quizzes, even in lecture?!)
    - Be chill. It’s worth 1 ec point. And you can work with your partner.
    - One sometime in every lecture...

Your turn!

- Draw everything by the end of the `main` method.

```java
public class Thing {
  int myValue;
  Thing myThang;

    public static void main(String[] args) {
      Thing firstThing = new Thing();
      int num = 2;
      Thing currentThing = firstThing;
      currentThing.myValue = num;
      while (num > 0) {
        num--;
        currentThing.myThang = new Thing();
        currentThing.myThang.myValue = num;
        currentThing = currentThing.myThang;
      }
    }
}
```

```java
public class Thing {
  int myValue;
  Thing myThang;

    public static void main(String[] args) {
      Thing firstThing = new Thing();
      int num = 2;
      Thing currentThing = firstThing;
      currentThing.myValue = num;
      while (num > 0) {
        num--;
        currentThing.myThang = new Thing();
        currentThing.myThang.myValue = num;
        currentThing = currentThing.myThang;
      }
    }
}
```


int num
0
null
myValue
2
myThang
myValue
1
myThang
myValue
0
myThang
Thing first
Thing current

Arrays

- Now that we have primitives, objects, and references, we have almost all of Java
- The next major piece is the **array**

Arrays and lists

- You may remember the **list** from Python
- An array is like a list, but more limited
    - It can only store objects of *one* type!
    - It is a *fixed size*.

Declaring an array

- Declare an int variable like so…
    - `int x = 3;`
- Declare an array of ints like so…

[ ] tells you it's an array type…

    - `int[] arr = new int[4];`

4 indicates the array will hold 4 things

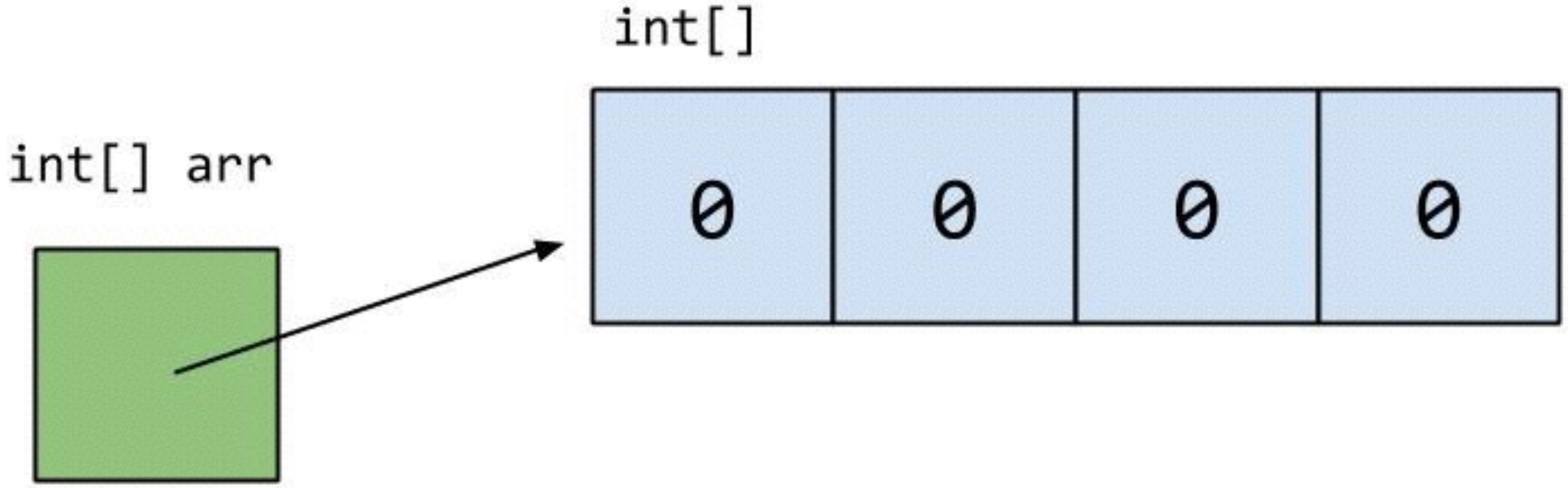
- You can put things in it like so:
    - `arr[2] = 10;`

The third thing in `arr` is now 10

Drawing an array

- An array itself is an object, so it has a reference to it

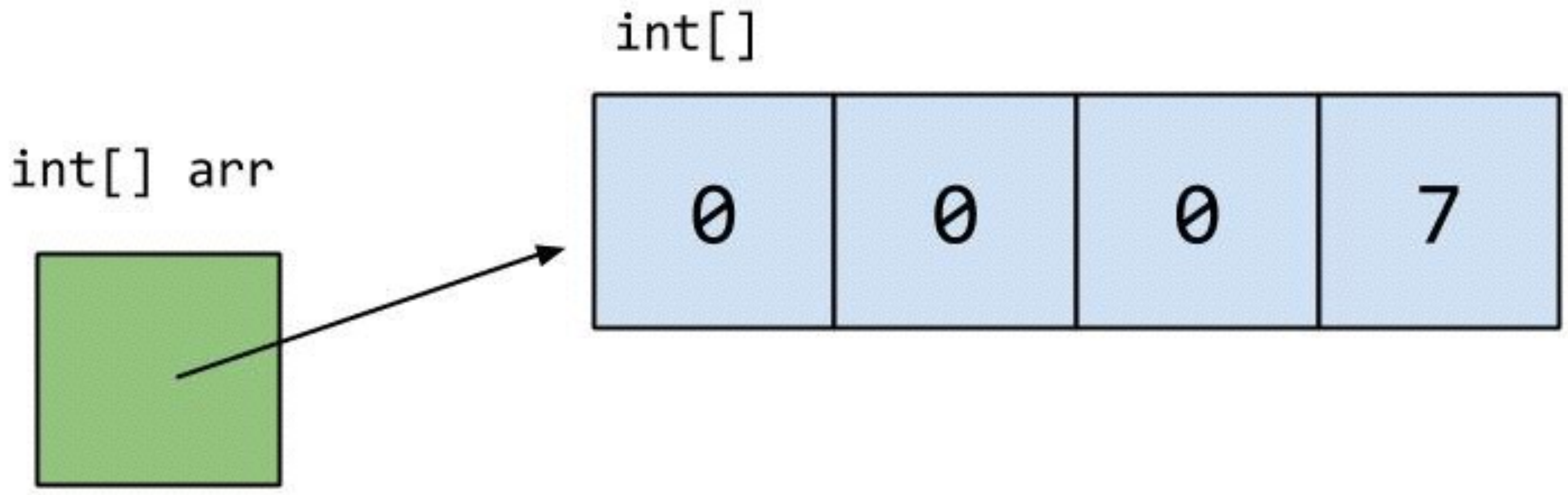
```
int[] arr = new int[4];
```


int[] arr
int[]
0
0
0
0

Drawing an array

- We can change things in the array

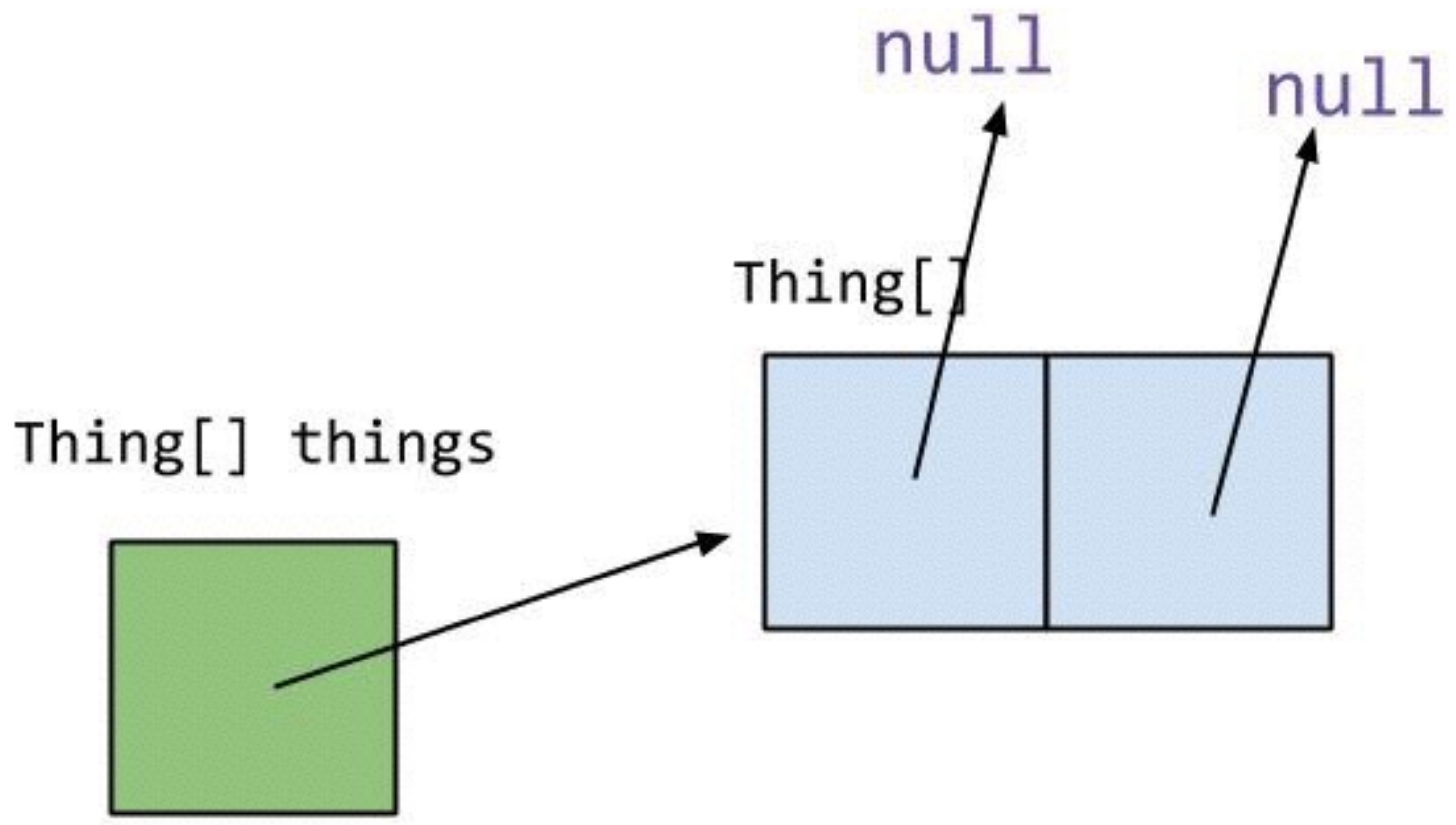
```
int[] arr = new int[4];
arr[3] = 7;
```


int[]
int[] arr
0
0
0
7

Drawing an array

- An array of objects starts out full of null

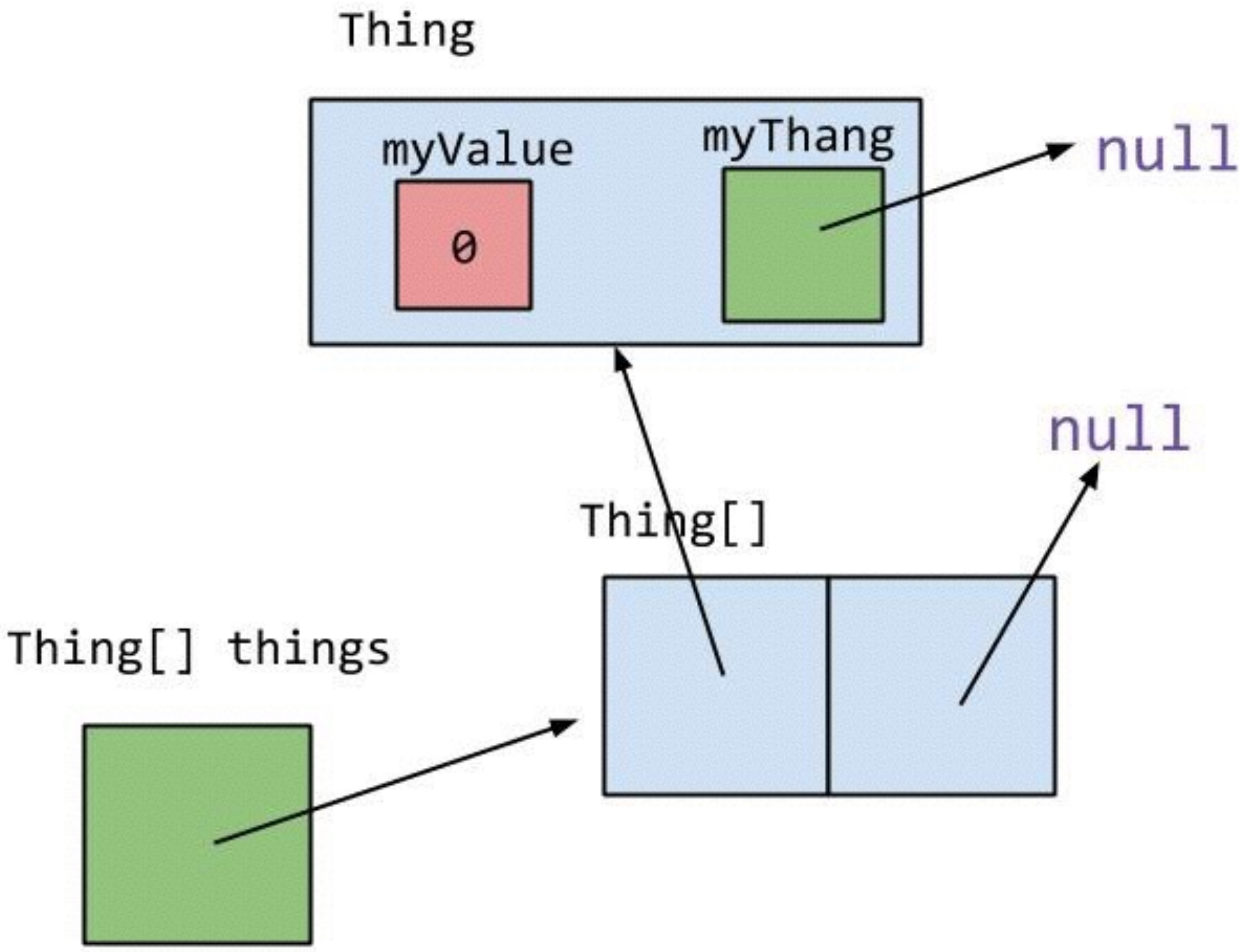
```
Thing[] things = new Thing[2];
```


null
null
Thing[]
Thing[] things

Drawing an array

- When we put objects inside, we just get references to the object

```
Thing[] things = new Thing[2];
things[0] = new Thing();
```


Thing
myValue
myThang
0
null
null
Thing[]
Thing[] things

A nice topic

- Let’s talk about the cheating policy.
- (Sorry)

What constitutes cheating?

- For **in-lab quizzes** and **exams**, the normal policy: you’re totally on your own.
- For **labs** and **group projects**, you can share *everything* within your partnership/group
- For **labs**, high-level collaboration is allowed across-partnership during lab time only. Can discuss ideas, but no direct sharing of code
- For **group projects**, essentially no collaboration is allowed outside your group

What constitutes cheating?

- Do **NOT** host your code publicly online (such as on Github — use BitBucket if you don't have a private)
- Don't look up answers to lab exercises online, but you can look up general how-to Java (in fact, this is encouraged)
- If you get ideas from another partnership, or if you take significant code from online, *please provide a citation as a comment*.

Another nice topic

- The exam times are
  - Friday, 10 July, 7-9 pm
  - Friday, 31 July, 7-9 pm
  - Friday, 14 August 3-6 pm
- If you have conflicts, please email me ***ASAP***. Before the end of this week. If you don’t I cannot guarantee you a make-up.
  - Please provide a reason, and exactly what time it takes up

Project 1 demo

- Introducing the first project! (Released Monday)