LEC 13

CSE 121

Reference Semantics

BEFORE WE START

Talk to your neighbors:

What do you do to destress?

Music: ♣ CSE 121 25su Lecture Tunes ♣

Instructor: Hannah Swoffer

TAs: Abby, Hannah, Julia, Merav, Trey

Questions during Class?

Raise hand or send here

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Agenda

- **Announcements, Reminders** ⟵
- PCM Review
- Sandbox Example!

Announcements, Reminders

- C3 released, due ***Wednesday, August 13th***, one day extension
  - *Please still allocate enough time for quiz prep*
- R5 released, due **Tuesday, August 12th**
  - Eligible: **P1**, C2, P2
- Quiz 2 on **Thursday, August 14th**
  - Conditionals, while loops, User Input (Scanner), Arrays
- Quiz 2 Practice Quizzes released; very helpful resources for the quiz

Announcements, Reminders

- In the future
  - Gumball meetup on **Wednesday, August 20th from 2:30-4:00 PM** near the fountain (specific location TBD)
  - Final exam on **Friday, August 22nd from 12:00-1:00 PM** during lecture

Agenda

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- **PCM Review** ⟵
- Sandbox Example!

Practice: Think

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What would the array a store at the end of this `arrayMystery` method if `{-20, 20, 26, 32, 50, 3}` was passed in?

```
public static void arrayMystery(int[] a) {
  for (int i = a.length - 1; i >= 1; i--) {
    if (a[i] > a[i - 1] + 10) {
      a[i - 1] = a[i - 1] + 5;
    }
  }
}
```

A. `{-20, 20, 26, 32, 50, 3}`

B. `{-15, 25, 31, 37, 55, 8}`

C. `{-15, 25, 31, 37, 50, 3}`

D. `{-15, 20, 26, 37, 50, 3}`

Practice: Pair

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What would the array a store at the end of this `arrayMystery` method if `{-20, 20, 26, 32, 50, 3}` was passed in?

```
public static void arrayMystery(int[] a) {
  for (int i = a.length - 1; i >= 1; i--) {
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      a[i - 1] = a[i - 1] + 5;
    }
  }
}
```

A. {-20, 20, 26, 32, 50, 3}

B. {-15, 25, 31, 37, 55, 8}

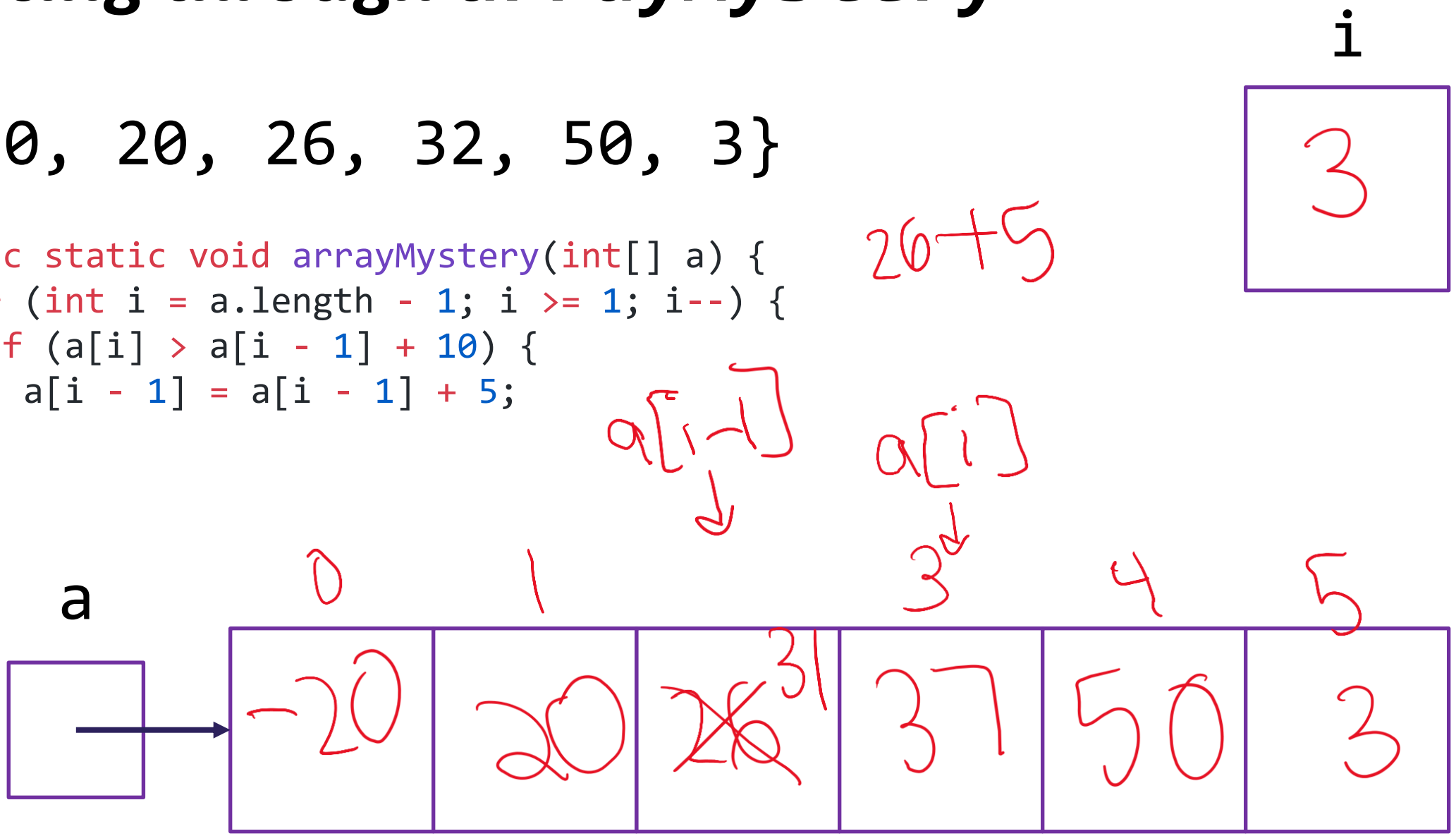
C. {-15, 25, 31, 37, 50, 3}

D. {-15, 20, 26, 37, 50, 3}

Tracing through arrayMystery

{-20, 20, 26, 32, 50, 3}

```
public static void arrayMystery(int[] a) {
  for (int i = a.length - 1; i >= 1; i--) {
    if (a[i] > a[i - 1] + 10) {
      a[i - 1] = a[i - 1] + 5;
    }
  }
}
```

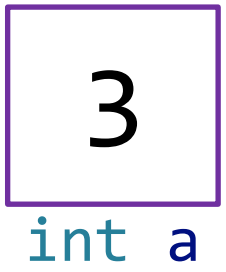


PCM Review: Value Semantics vs. Reference Semantics

Value Semantics

- Applies when working with primitive types
- Variables/parameters hold a *copy* of the actual value

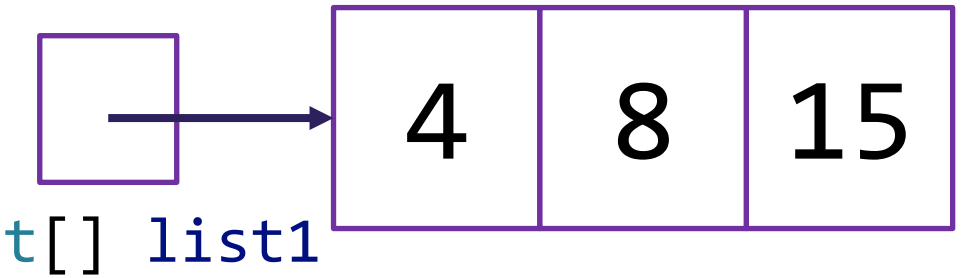
```
int a = 3;
```



Reference Semantics

- Applies when working with objects
- Variables/parameters hold a *reference* to the object

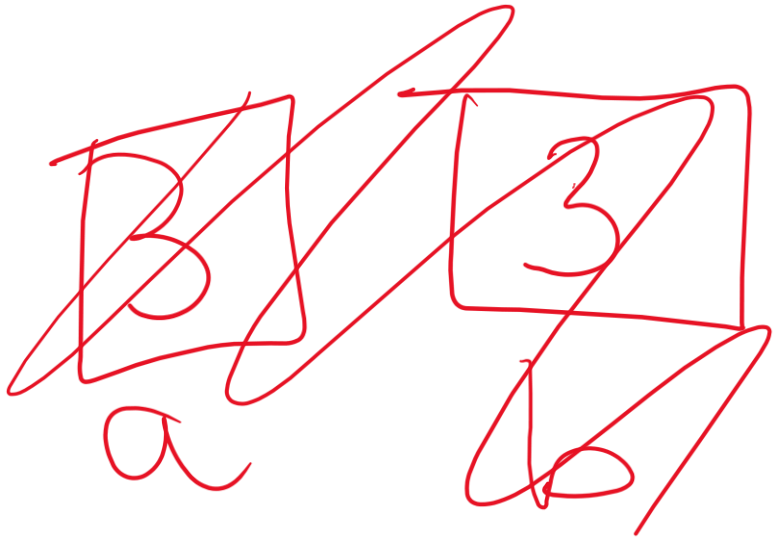
```
int[] list1 = {4, 8, 15};
```

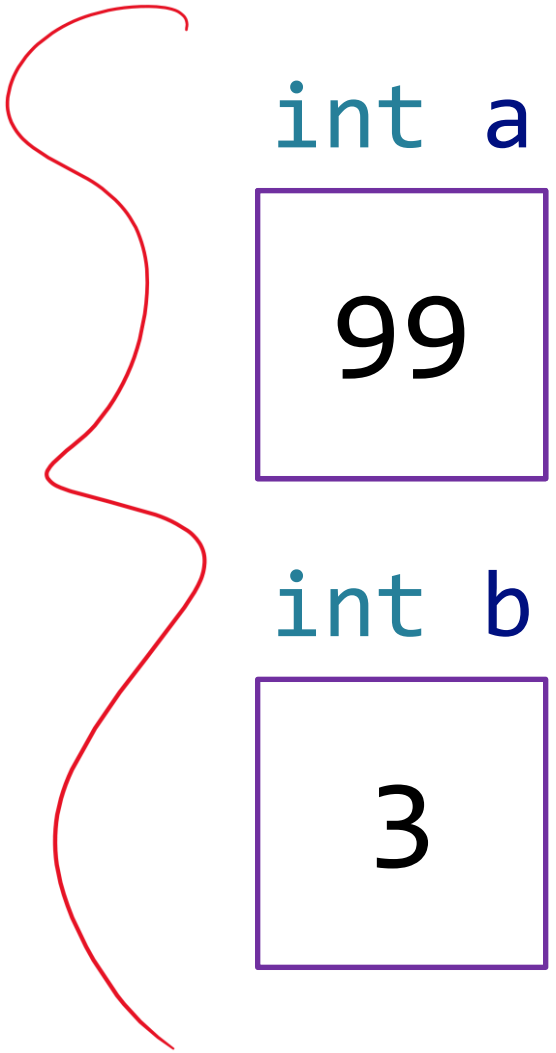


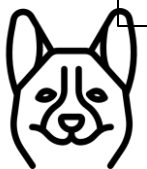
PCM Review: Value Semantics

- Applies when working with primitive types
- Variables/parameters hold a *copy* of the actual value

```
int a = 3;
int b = a;
a = 99;
```

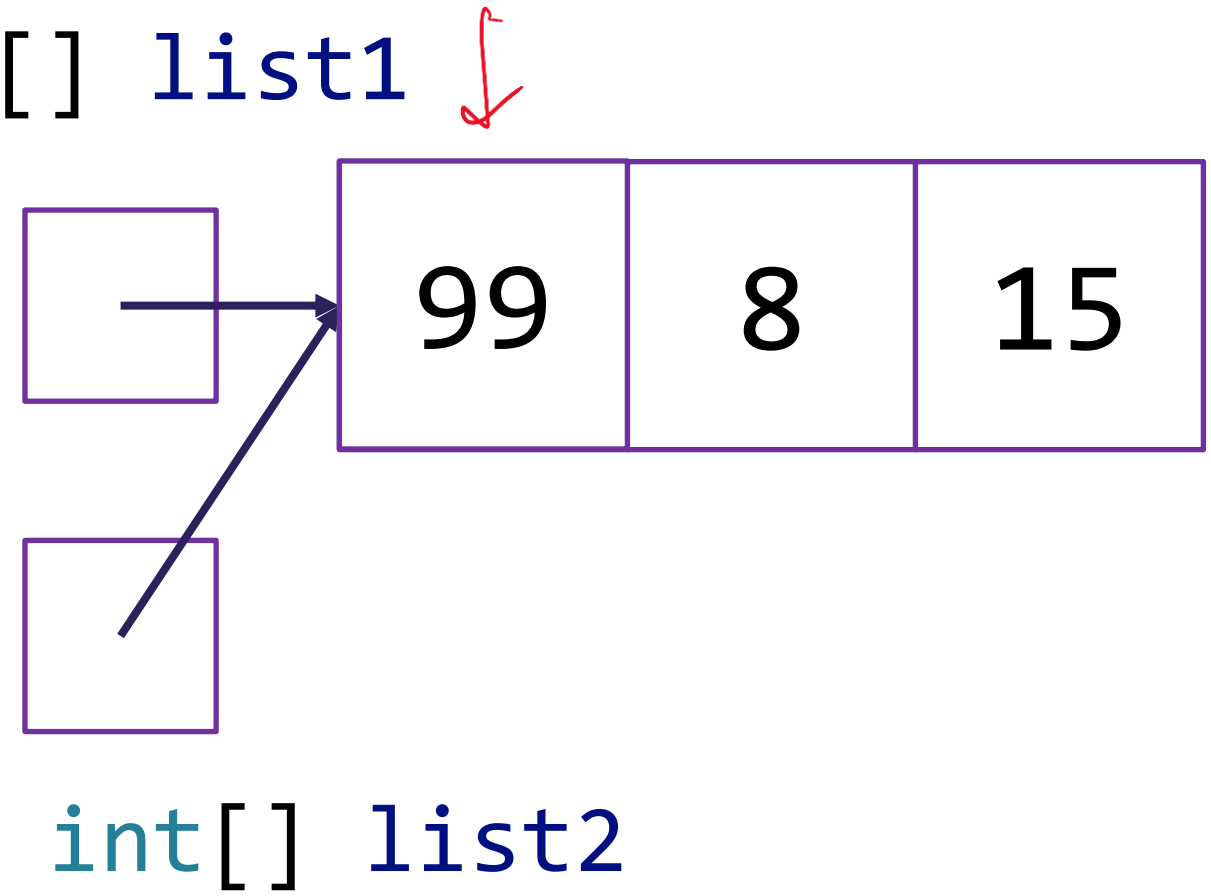




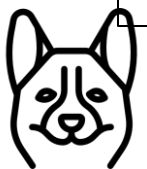


PCM Review: Reference Semantics

- Applies when working with objects
  - Including arrays!
- Variables/parameters hold a *reference* to the object

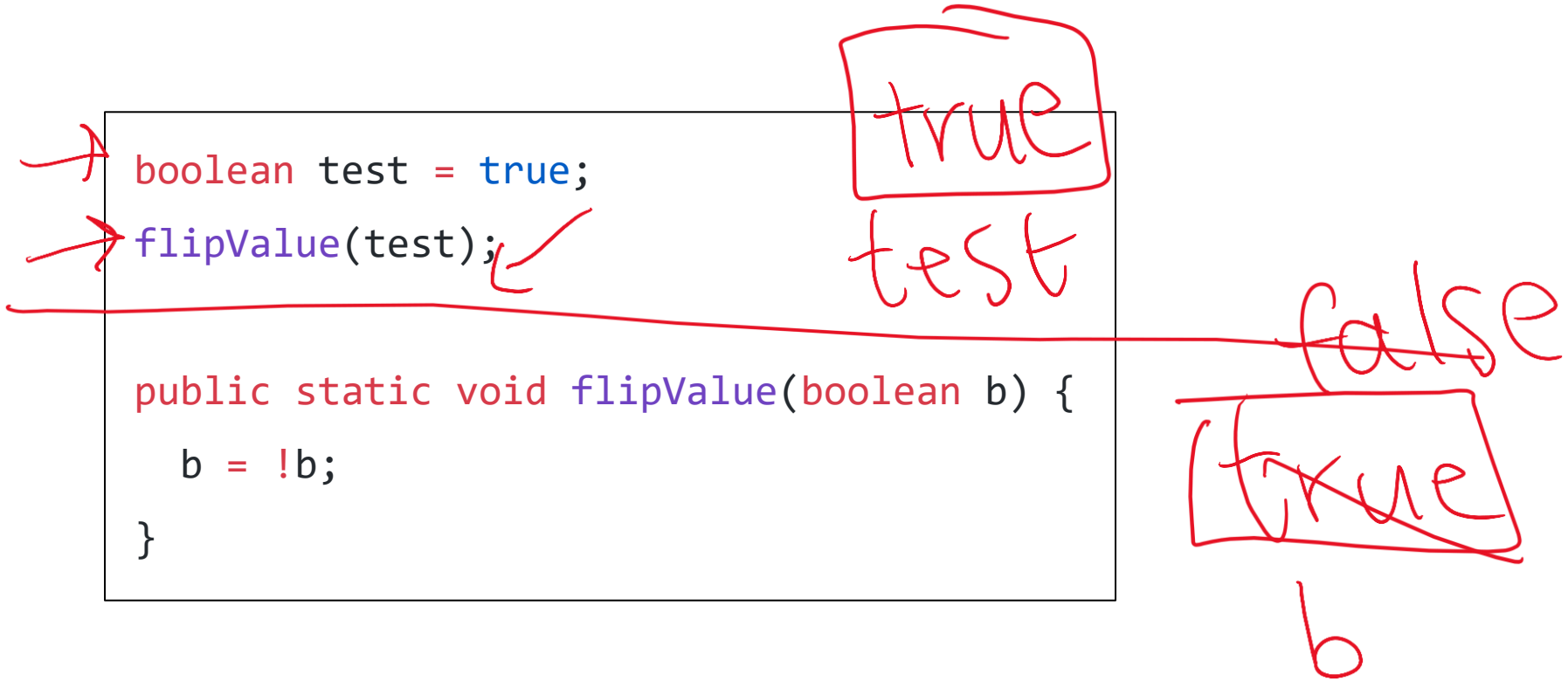



```
int[] list1 = {4, 8, 15};
int[] list2 = list1;
list1[0] = 99;
```



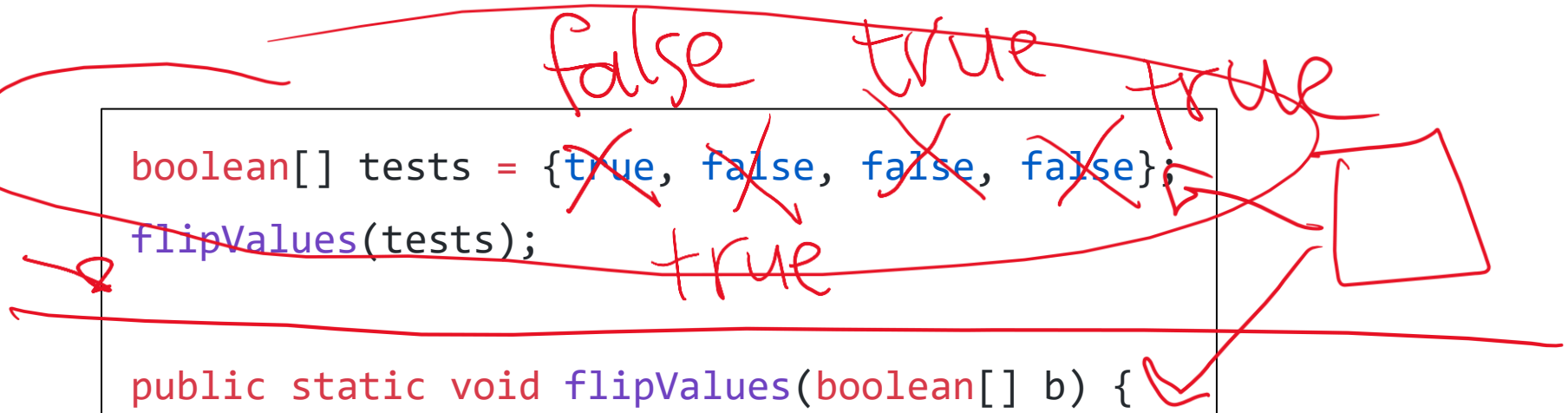
Value Semantics & Methods

```
boolean test = true;
flipValue(test);

public static void flipValue(boolean b) {
  b = !b;
}
```



Reference Semantics & Methods

```
boolean[] tests = {true, false, false, false};
flipValues(tests);

public static void flipValues(boolean[] b) {
  for (int i = 0; i < b.length; i++) {
    b[i] = !b[i];
  }
}
```



boolean[] test2 = new boolean[test.length];

PCM Review: `null`

`null` is the absence of a reference!

- sort of the "zero" for references
- default value for object types (e.g. `Random`, `Scanner`, and `String`)

A **`NullPointerException`** is an error that happens when you ask `null` to "do something", which includes:

- calling `.toUpperCase()` on `null`? **`NullPointerException!`**
- calling `.nextInt()` on `null`? **`NullPointerException!`**
- many, many more

PCM Review: avoiding NullPointerException

```
if (strs[i] != null) {
  System.out.println(strs[i].toUpperCase());
} else {
  System.out.println("element " + i + " is null.");
}
```

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- **Sandbox Example!** ⟵