LEC 14

CSE 121

Reference Semantics

Questions during Class?

Raise hand or send here

sli.do #cse121

BEFORE WE START

Talk to your neighbors:

What's your favorite sport or competition to watch?

Music: ❄ CSE 121 26wi Lecture Tunes ❄

Instructors: Miya Natsuhara

TAs:

Amogh	Hayden	Anum	Sam	Shayna
William	Aki	Abdul	Ethan	Jesse
Johnathan	Spencer	Janvi	Jessica	Minh
Anant	Savannah	Navya	Paul	Cayden
Reese	Tamsyn	Ruslana	Carson	

Announcements, Reminders

- C3 released tonight, due **Tuesday, March 3rd**
- R4 due tomorrow (eligible: **C1**, P1, C2)
  - C1 cycling out of eligibility after R4
- Quiz 2 on **Thursday, March 5th**
  - Conditionals, while loops, User Input (Scanner), Arrays, Reference Semantics
  - can't make it? email Miya before your quiz!

Practice: Think

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

```
public static void arrayMystery(int[] arr) {
  for (int i = arr.length - 1; i >= 1; i--) {
    if (arr[i] > arr[i - 1] + 10) {
      arr[i - 1] = arr[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 `arr` store at the end of this `arrayMystery` method if `{-20, 20, 26, 32, 50, 3}` was passed in?

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```

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

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

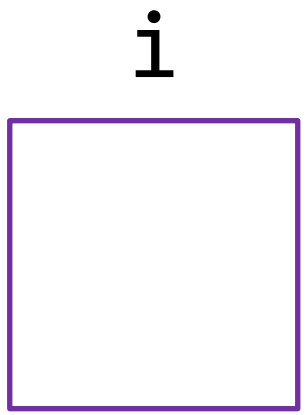
C. `{-15, 25, 31, 37, 50, 3}`

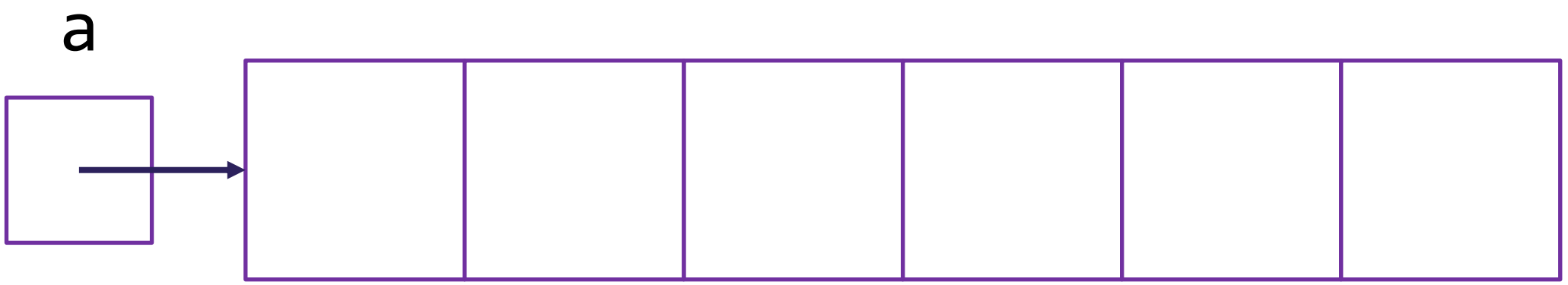
D. `{-15, 20, 26, 37, 50, 3}`

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;
    }
  }
}
```



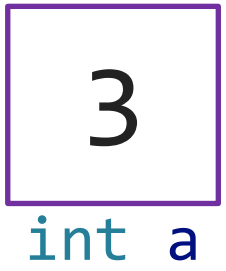


PCM Review: Value Semantics vs. Reference Semantics

Value Semantics

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

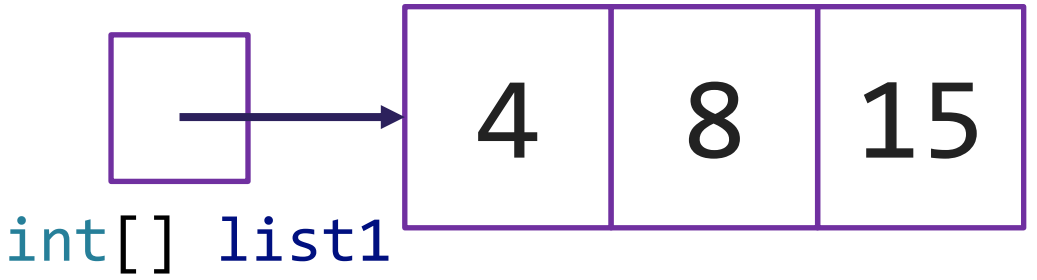
```
int a = 3;
```



Reference Semantics

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

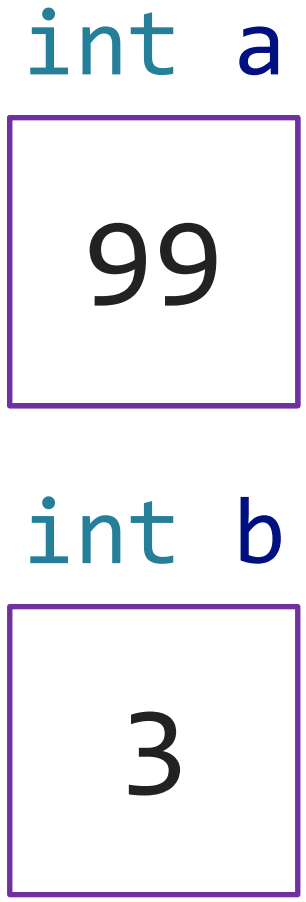
```
int[] list1 = {4, 8, 15};
```



PCM Review: Value Semantics

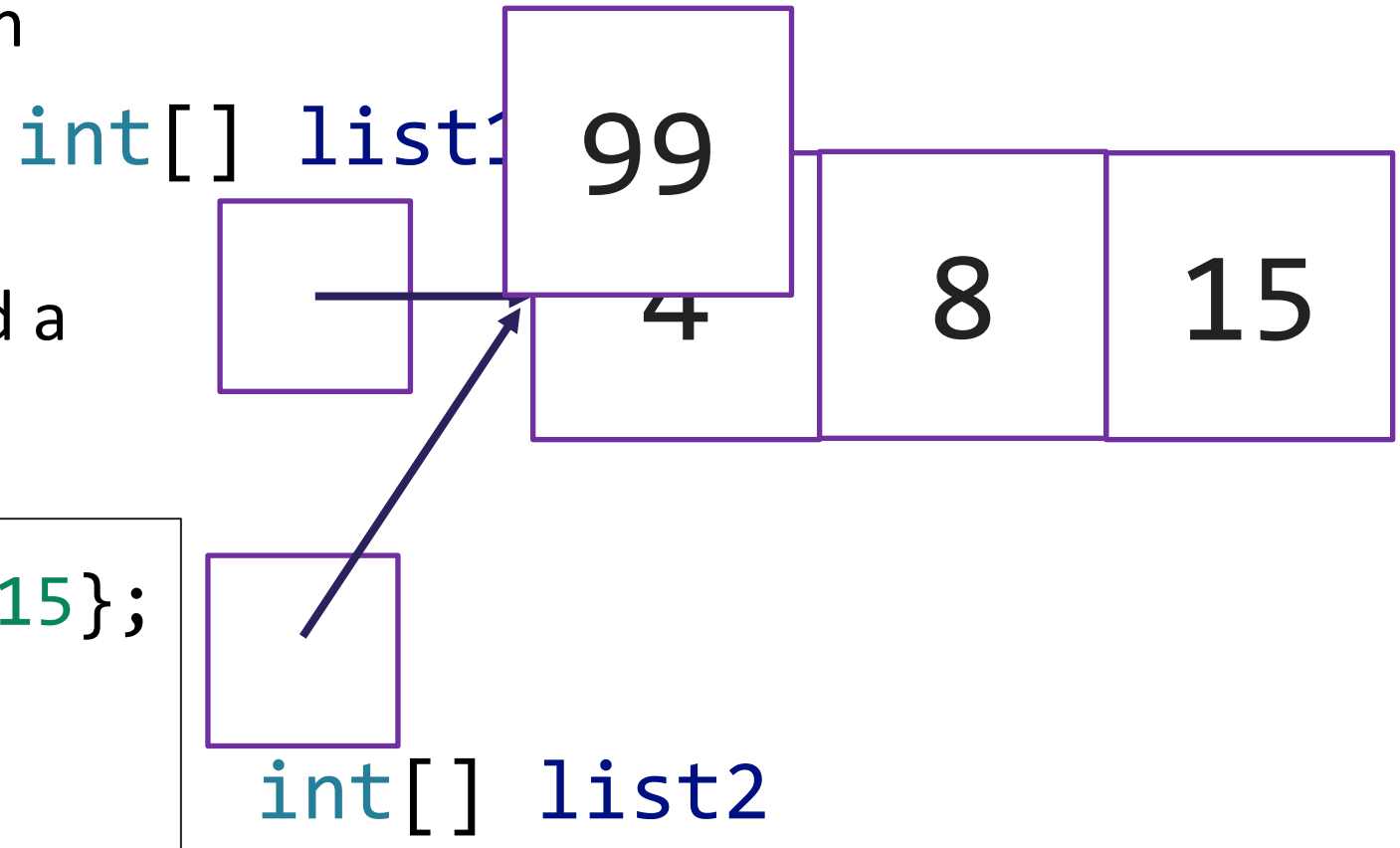
- Applies when working with primitive types
- Variables/parameters hold a *copy* of the actual value

```
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];
  }
}
```

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.");
}
```