CSE 121 Lesson 15:

Arrays and Reference Semantics

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sli.do #cse121-15

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Today’s playlist:
CSE 121 lecture beats 24sp

Reminders & Announcements

- C3 released Wednesday, due Tuesday May 21
- R5 released yesterday, due Thursday May 23rd (last chance for P1)
- Quiz 2 next Thursday, May 23rd
  - topics: everything up until Arrays on Wednesday (i.e. not today's material)
  - see: Ed post on practice resources!
- In the future: Final Exam (Wednesday June 5th from 2:30 – 4:20 PM)
  - more logistical details coming soon!

Poll in with your answer!

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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}

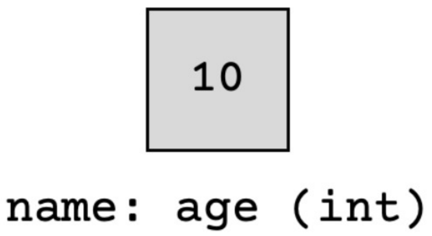
C. {-15, 25, 31, 37, 50, 3}

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

(PCM) Value Semantics vs. Reference Semantics

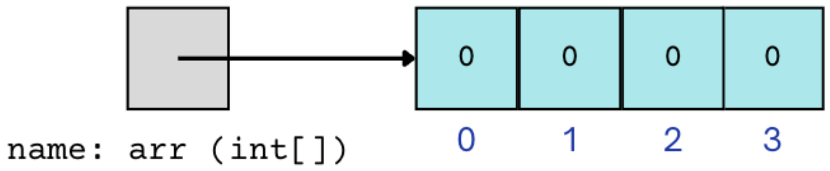
- Applies when working with primitive types
- Variables/parameters hold a *copy* of the actual value

```
age = 10;
```



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

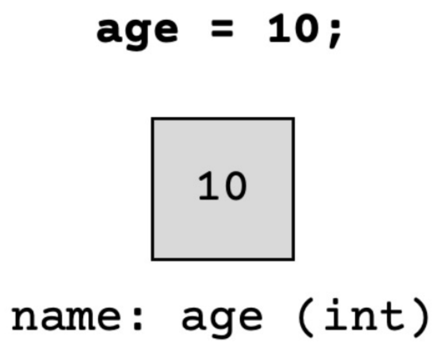
```
int[] arr = new int[4];
```



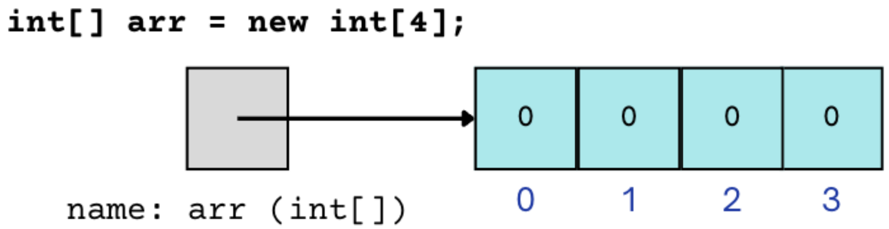
(PCM) Value Semantics vs. Reference Semantics

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

```
int[] list1 = {4, 8, 15, 16, 23};
int[] list2 = list1;
list1[1] = 99;
```



```
age = 10;
```



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

Poll in with your answer!

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Without knowing what someMethod does, what are the possible values of num?

```
int num = 42;
someMethod(num);
System.out.println(num);
```

A. anything!

B. just 42

Poll in with your answer!

Without knowing what anotherMethod does, what are the possible values of nums[0]?

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```
int[] nums = {42, 43, 44};
anotherMethod(nums);
System.out.println(nums[0]);
```

A. anything!

B. just 42

(PCM) Value Semantics vs. Reference Semantics

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

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

(PCM) `null`

The *absence* of a reference!

- Sort of like a "zero-equivalent" for references!
- Default value for “object types” (e.g. Random, Turtle, Scanner…)

`NullPointerException`s are an error that happen when you ask `null` to “do something”

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

`null`: the “billion dollar mistake”

From Sir Tony Hoare (“inventor” of `null`, Turing award winner):

“I call it my billion-dollar mistake… […]

But I couldn’t resist the temptation to put in a null reference, simply because it was so easy to implement. This has led to innumerable errors, vulnerabilities, and system crashes, which have probably caused a billion dollars of pain and damage in the last forty years.” (quote from 2009 talk)

(PCM) avoiding NullPointerException

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