## Scope, Pass-by-Value, Static

Exam-Level 01: January 22, 2024

## 1 Give 'em the 'Ol Switcheroo

For each function call in the main method, write out the x and y values of both foobar and baz after executing that line. (Spring '15, MT1)

```
public class Foo {
        public int x, y;
2
        public Foo (int x, int y) {
            this.x = x;
            this.y = y;
        public static void switcheroo (Foo a, Foo b) {
            Foo temp = a;
            a = b;
10
            b = temp;
11
12
        public static void fliperoo (Foo a, Foo b) {
13
            Foo temp = new Foo(a.x, a.y);
14
            a.x = b.x;
15
            a.y = b.y;
            b.x = temp.x;
17
            b.y = temp.y;
18
19
        public static void swaperoo (Foo a, Foo b) {
20
21
            Foo temp = a;
            a.x = b.x;
22
            a.y = b.y;
23
            b.x = temp.x;
24
            b.y = temp.y;
25
26
        public static void main (String[] args) {
27
            Foo foobar = new Foo(10, 20);
28
            Foo baz = new Foo(30, 40);
29
                                          foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
            switcheroo(foobar, baz);
            fliperoo(foobar, baz);
                                          foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
31
            swaperoo(foobar, baz);
                                          foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
        }
33
    }
34
```

## 2 Quik Maths

What would the contents of the array be after being run through these functions in the main method? (Fall '16, MT1)

```
public class QuikMaths {
        public static void mulitplyBy3(int[] A) {
2
            for (int x: A) {
                x = x * 3;
            }
        }
6
        public static void multiplyBy2(int[] A) {
8
            int[] B = A;
            for (int i = 0; i < B.length; i+= 1) {</pre>
10
                B[i] *= 2;
11
12
            }
        }
13
14
        public static void swap (int A, int B) {
15
            int temp = B;
16
           B = A;
17
           A = temp;
18
        }
19
20
        public static void main(String[] args) {
21
            int[] arr;
22
            arr = new int[]{2, 3, 3, 4};
23
           multiplyBy3(arr);
24
25
            /* Value of arr: {_____}} */
26
27
            arr = new int[]{2, 3, 3, 4};
28
           multiplyBy2(arr);
29
30
            /* Value of arr: {_____} */
31
32
            int a = 6;
33
            int b = 7;
34
            swap(a, b);
35
36
            /* Value of a: _____ */
37
        }
38
   }
39
```

## 3 Static Books

Suppose we have the following Book and Library classes.

```
class Book {
                                                 class Library {
    public String title;
                                                     public Book[] books;
    public Library library;
                                                     public int index;
    public static Book last = null;
                                                     public static int totalBooks = 0;
    public Book(String name) {
                                                     public Library(int size) {
        title = name;
                                                          books = new Book[size];
        last = this;
                                                          index = 0;
        library = null;
                                                     }
    }
                                                     public void addBook(Book book) {
    public static String lastBookTitle() {
                                                          books[index] = book;
        return last.title;
                                                          index++;
    }
                                                          totalBooks++;
    public String getTitle() {
                                                          book.library = this;
        return title;
                                                     }
    }
                                                 }
}
```

- (a) For each modification below, determine whether the code of the Library and Book classes will compile or error if we **only** made that modification, i.e. treat each modification independently.
  - 1. Change the totalBooks variable to non static
  - 2. Change the lastBookTitle method to non static
  - 3. Change the addBook method to static
  - 4. Change the last variable to non static
  - 5. Change the library variable to static

- 4 Scope, Pass-by-Value, Static
- (b) Using the Book and Library classes from before, write the output of the main method below. If a line errors, put the precise reason it errors and continue execution.

```
public class Main {
        public static void main(String[] args) {
            System.out.println(Library.totalBooks);
3
            System.out.println(Book.lastBookTitle());
            System.out.println(Book.getTitle());
5
6
            Book goneGirl = new Book("Gone Girl");
            Book fightClub = new Book("Fight Club");
8
            System.out.println(goneGirl.title);
10
            System.out.println(Book.lastBookTitle());
11
            System.out.println(fightClub.lastBookTitle());
12
            System.out.println(goneGirl.last.title);
13
14
            Library libraryA = new Library(1);
15
            Library libraryB = new Library(2);
16
            libraryA.addBook(goneGirl);
17
18
            System.out.println(libraryA.index);
19
            System.out.println(libraryA.totalBooks);
20
21
            libraryA.totalBooks = 0;
22
            libraryB.addBook(fightClub);
23
            libraryB.addBook(goneGirl);
24
25
            System.out.println(libraryB.index);
26
            System.out.println(Library.totalBooks);
27
            System.out.println(goneGirl.library.books[0].title);
28
        }
29
30
    }
```