CS 61B Fall 2022

Scope, Pass-by-Value, Static

Discussion 2: August 29th, 2022

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)

```
1  public class Foo {
2      public int x, y;
3
4      public Foo (int x, int y) {
5          this.x = x;
6          this.y = y;
7      }
8      public static void switcheroo (Foo a, Foo b) {
9          Foo temp = a;
10         a = b;
11         b = temp;
12     }
13     public static void fliperoo (Foo a, Foo b) {
14         Foo temp = new Foo(a.x, a.y);
15         a.x = b.x;
16         a.y = b.y;
17         b.x = temp.x;
18         b.y = temp.y;
19     }
20     public static void swaperoo (Foo a, Foo b) {
21         Foo temp = a;
22         a.x = b.x;
23         a.y = b.y;
24         b.x = temp.x;
25         b.y = temp.y;
26     }
27     public static void main (String[] args) {
28         Foo foobar = new Foo(10, 20);
29         Foo baz = new Foo(30, 40);
30         switcheroo(foobar, baz);    foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
31         fliperoo(foobar, baz);      foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
32         swaperoo(foobar, baz);      foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
33     }
34 }
```

Solution:

```
line 30: foobar.x: 10 foobar.y: 20 baz.x: 30 baz.y: 40
line 31: foobar.x: 30 foobar.y: 40 baz.x: 10 baz.y: 20
line 32: foobar.x: 10 foobar.y: 20 baz.x: 10 baz.y: 20
```

2 Quik Maths

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

```
1  public class QuikMaths {
2      public static void mulitplyBy3(int[] A) {
3          for (int x: A) {
4              x = x * 3;
5          }
6      }
7      public static void multiplyBy2(int[] A) {
8          int[] B = A;
9          for (int i = 0; i < B.length; i+= 1) {
10             B[i] *= 2;
11         }
12     }
13     public static void swap (int A, int B ) {
14         int temp = B;
15         B = A;
16         A = temp;
17     }
18     public static void main(String[] args) {
19         int[] arr;
20         arr = new int[]{2, 3, 3, 4};
21         multiplyBy3(arr);
22
23         /* Value of arr: {_____________________} */
24
25         arr = new int[]{2, 3, 3, 4};
26         multiplyBy2(arr);
27
28         /* Value of arr: {_____________________} */
29
30         int a = 6;
31         int b = 7;
32         swap(a, b);
33
34         /* Value of a: _______  Value of b: _______ */
35     }
36 }
```

Solution:

line 23: /* Value of arr: {2, 3, 3, 4} */
line 28: /* Value of arr: {4, 6, 6, 8} */
line 34: /* Value of a: 6 Value of b: 7 */

3 Static Books

Suppose we have the following `Book` and `Library` classes.

```
class Book {
    public String title;
    public Library library;
    public static Book last = null;

    public Book(String name) {
        title = name;
        last = this;
        library = null;
    }

    public static String lastBookTitle() {
        return last.title;
    }
    public String getTitle() {
        return title;
    }
}
```

```
class Library {
    public Book[] books;
    public int index;
    public static int totalBooks = 0;

    public Library(int size) {
        books = new Book[size];
        index = 0;
    }

    public void addBook(Book book) {
        books[index] = book;
        index++;
        totalBooks++;
        book.library = this;
    }
}
```

(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**

Solution:

1. Compile
2. Compile
3. Error
4. Error
5. Compile

(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.

```
1  public class Main {
2      public static void main(String[] args) {
3          System.out.println(Library.totalBooks);                  _____________________
4          System.out.println(Book.lastBookTitle());                _____________________
5          System.out.println(Book.getTitle());                     _____________________
6
7          Book goneGirl = new Book("Gone Girl");
8          Book fightClub = new Book("Fight Club");
9
10         System.out.println(goneGirl.title);                      _____________________
11         System.out.println(Book.lastBookTitle());                _____________________
12         System.out.println(fightClub.lastBookTitle());           _____________________
13         System.out.println(goneGirl.last.title);                 _____________________
14
15         Library libraryA = new Library(1);
16         Library libraryB = new Library(2);
17         libraryA.addBook(goneGirl);
18
19         System.out.println(libraryA.index);                      _____________________
20         System.out.println(libraryA.totalBooks);                 _____________________
21
22         libraryA.totalBooks = 0;
23         libraryB.addBook(fightClub);
24         libraryB.addBook(goneGirl);
25
26         System.out.println(libraryB.index);                      _____________________
27         System.out.println(Library.totalBooks);                  _____________________
28         System.out.println(goneGirl.library.books[0].title);     _____________________
29     }
30 }
```

Solution:

```
1  public class Main {
2      public static void main(String[] args) {
3          System.out.println(Library.totalBooks);                  0
4          System.out.println(Book.lastBookTitle());                Error, NullPointerException
5          System.out.println(Book.getTitle());                     Error, does not compile
6
7          Book goneGirl = new Book("Gone Girl");
8          Book fightClub = new Book("Fight Club");
9
10         System.out.println(goneGirl.title);                      Gone Girl
11         System.out.println(Book.lastBookTitle());                Fight Club
```

```
12          System.out.println(fightClub.lastBookTitle());          Fight Club
13          System.out.println(goneGirl.last.title);                Fight Club
14
15          Library libraryA = new Library(1);
16          Library libraryB = new Library(2);
17          libraryA.addBook(goneGirl);
18
19          System.out.println(libraryA.index);                     1
20          System.out.println(libraryA.totalBooks);                1
21
22          libraryA.totalBooks = 0;
23          libraryB.addBook(fightClub);
24          libraryB.addBook(goneGirl);
25
26          System.out.println(libraryB.index);                     2
27          System.out.println(Library.totalBooks);                 2
28          System.out.println(goneGirl.library.books[0].title);    Fight Club
29      }
30  }
```