Discussion 4: Objects

Hi everyone! My name is Adel and I will be your CS 61B TA this semester 🙂

Discussion: Wed 2-3pm 3111 Etcheverry Hall
Lab: Fri 1-3pm 275 Soda Hall
OH: Tues 3-4pm in 109 Morgan Hall

email: asetoodehnia@berkeley.edu
website: asetoodehnia.github.io (or find it through the CS 61B staff webpage)
(I post my discussion materials here if you are interested in referring to them after section)

Announcements!

1. Homework 2 is **due 2/14**
2. Proj 0 is **due 2/18**
3. Lab this week is **Proj 0 OH**
4. Extended Topical Section **Friday 1-3 PM**
5. Proj 0 Party this **Saturday 1-4PM**
6. Fill out the weekly surveys!

Static vs. Instance:

What's wrong with the code?

```
public static int badBalance(Account A) {
    int x = A._balance;   // This is OK
                          // (A tells us whose balance)
    return _balance;      // WRONG! NONSENSE!
}
```

- Reference to `_balance` here equivalent to `this.balance`, but static methods don't have access to `this` as it operates separate from any instance of a given class

Some key points:

- ***static*** methods cannot use ***instance*** variables
- ***instance*** variables/methods are **only** accessible through instances of the object
- ***static*** variables/methods belongs to the class (also accessible through instances)

CS 61B Discussion 4: Objects Spring 2020

1 Objects Refresher

Answer the following questions about the `Avatar` class.

```
1  public class Avatar {
2      public static String electricity; public String fluid;
3
4      public Avatar(String str1, String str2) {
5          Avatar.electricity = str1;
6          this.fluid = str2;
7      }
8
9      public static void main(String[] args) {
10         Avatar foo1 = new Avatar("one ", "two");
11         Avatar foo2 = new Avatar("three ", "four");
12         System.out.println(foo1.electricity + foo1.fluid);
13         foo1.electricity = "I declare ";
14         foo1.fluid = "a thumb war";
15         System.out.println(foo2.electricity + foo2.fluid);
16     }
17 }
```

(a) Determine what would be printed after executing the main method of class `Avatar`.

three two

I declare four

(b) If we changed only line 2 such that `electricity` is an instance variable and `fluid` is a class variable instead, would this code still compile or which other lines would also need to be changed and in what way?

(c) Reverting our changes from part (b) and starting from the original code, will adding the following method to class `Avatar` cause any errors during compilation or execution? Why or why not?

```
public static String getFluid() {
    return fluid;
}
```

2 Reversing an Array

Given an array `A`, reverse its elements in place. Do not create any new arrays; this should be a destructive method.

```
/** Destructively reverses A in place. */
public static void reverse(int[] A) {
    for (int i = 0; i < A.length / 2; i++) {
        int temp = A[A.length - i - 1];
        A[- - -] = A[i];
        A[i] = temp;
    }
}
```

Extra: Given a square 2D array `B`, reverse the elements along a given `diagonal` in place. `reverseDiagonal` is destructive so you should modify `B` directly. A `diagonal` begins at the leftmost column and continues up and to the right. An *N* x *N* array has exactly *N* diagonals.

For example, let the 2D array on the left be `B`. The value contained within `diagonal = 0` is {1}. The values contained within `diagonal = 1` are {2, 5}. The values contained within `diagonal = 2` are {3, 6, 9}. The values contained within `diagonal = 3` are {4, 7, 10, 13}.

Below, the 2D array on the right has the values along `diagonal = 2` reversed.

1	2	**3**	4
5	**6**	7	8
9	10	11	12
13	14	15	16

$\Longrightarrow$

1	2	**9**	4
5	**6**	7	8
3	10	11	12
13	14	15	16

Assume that `B` contains at least one item (N $\geq$ 0) and that `diagonal` is an integer between `0` and `B.length - 1`, inclusive.

```
/** Destructively reverses the items along the diagonal in B. */
public static void reverseDiagonal(int[][] B, int diagonal) {



}
```

3 Circular Buffer

A circular buffer is a data structure whose contents start at an arbitrary index and continue from there, wrapping around to the beginning upon reaching the end of the buffer. In this case, we will be using an array as our buffer.

Write a function that, when given a full circular array `A` whose contents start at index `i`, returns a *new* array whose contents start at index `0` and maintain the same relative ordering with `k` appended to the end. For example, if `A` has length `8`, contains the values `0` through `7` inclusive, and starts at index `6`, then the array returned after calling `overflow(A, 6, 8)` is shown below on the right (the first item in both buffers are **bolded**):

2	3	4	5	6	7	**0**	1

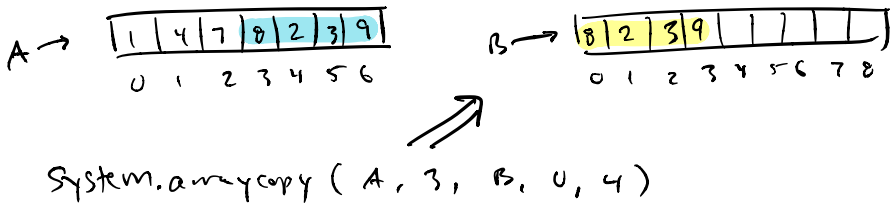
$\Longrightarrow$

0	1	2	3	4	5	6	7	8

After calling `overflow`, `A` should remain unchanged. Use the `arraycopy` method, which is defined below:

```
System.arraycopy(Object src, int srcPos, Object dest, int destPos, int length)
```

```
/** Returns a new array containing the elements of A starting at index 0
 * with k appended to the end. The contents of the returned array should
 * begin at index 0. The new array should have length = A.length + 1*/
public static int[] overflow(int[] A, int i, int k) {
    int[] B = new int[A.length + 1];
    System.arraycopy(A, i, B, 0, A.length-i);
    System.arraycopy(A, 0, B, A.length-i, i);
    B[B.length-1] = k;
    return B;
}
```



4 Transposing a 2D Array

The transpose of a 2D array is a new 2D array whose rows are the columns of the original (and vice versa). For example, let `A` be the 2D array below on the left. The transpose of `A` is the resulting 2D array below on the right.

$$A = \begin{array}{|c|c|c|c|} \hline 1 & 2 & 3 & 4 \\ \hline 5 & 6 & 7 & 8 \\ \hline 9 & 10 & 11 & 12 \\ \hline 13 & 14 & 15 & 16 \\ \hline \end{array} \implies \begin{array}{|c|c|c|c|} \hline 1 & 5 & 9 & 13 \\ \hline 2 & 6 & 10 & 14 \\ \hline 3 & 7 & 11 & 15 \\ \hline 4 & 8 & 12 & 16 \\ \hline \end{array} = transpose(A)$$

Given a square 2D array `A`, destructively transpose `A`.

```
/** Destructively transposes A. Assume that A is square. */
public static void transpose(int[][] A) {
    for (int i = 0; i < A.length; i++){
        for (int j = i; j < A[i].length; j++) {




}
```