1   Old Town Code

Next to each line, write out in words what you think the code will do when it is run. Assume the `Singer` class exists and that the code below compiles.

```
1  int x = 7;
2  String chorus = "Thank u, next";
3  Singer queen = new Singer("Ariana");
4
5  while (x > 0) {
6      x -= 1;
7      queen.sing(chorus);
8  }
9
10 String[] phrases = {"love", "patience", "pain", "what does the fox say?"};
11
12 for (int i = 0; i < 3; i += 1) {
13     System.out.println("One taught me " + phrases[i]);
14 }
15
16 System.out.println(phrases[phrases.length - 1]);
```

Hint: For reference, here is an equivalent Python program.

```
1  x = 7
2  chorus = "Thank u, next"
3  queen = Singer("Ariana")
4
5  while (x > 0):
6      x -= 1
7      queen.sing(chorus)
8
9
10 phrases = ["love", "patience", "pain", "what does the fox say?"]
11
12 for i in range(3):
13     print("One taught me " + phrases[i])
14
15
16 print(phrases[len(phrases) - 1])
```

2 Reading Code: A Mystery

Below is a function (or method) called `mystery1`. It takes in two arguments and returns an integer, `answer`. The first argument it takes in is an array of integers called `inputArray`, and the second argument it takes in is an integer, `k`.

```java
public static int mystery1(int[] inputArray, int k) {
    int x = inputArray[k];
    int answer = k;
    int index = k + 1;
    while (index < inputArray.length) {
        if (inputArray[index] < x) {
            x = inputArray[index];
            answer = index;
        }
        index = index + 1;
    }
    return answer;
}
```

Write the return value of `mystery1` if `inputArray` is the array {3, 0, 4, 6, 3} and `k` is 2. What is the significance of the value returned by `mystery1` (what is the significance of `answer`)?

Extra: Below is another function called `mystery2`. It takes a single array of integers called `inputArray` as an argument and returns nothing.

```java
public static void mystery2(int[] inputArray) {
    int index = 0;
    while (index < inputArray.length) {
        int targetIndex = mystery1(inputArray, index);
        int temp = inputArray[targetIndex];
        inputArray[targetIndex] = inputArray[index];
        inputArray[index] = temp;
        index = index + 1;
    }
}
```

Describe what `mystery2` will do and return if `inputArray` is the array {3, 0, 4, 6, 3}. Then, explain in English what the method `mystery2` does.

3 Recursion Practice: Fibonacci

Implement `fib1` recursively. `fib1` takes in an integer `N` and returns an integer representing the
Nth Fibonacci number. The Fibonacci sequence is 0, 1, 1, 2, 3, 5, 8, 13, 21, ..., where 0 is the 0th
Fibonacci number. As a reminder, the Nth Fibonacci number is calculated as follows:

```
fib(N) = fib(N - 1) + fib(N - 2)
```

```java
public static int fib1(int N) {



}
```

Extra: Implement `fib2` in 5 lines or fewer that avoids redundant computation. `fib2` takes in an
integer `N` and helper arguments `k`, `f0`, and `f1` and returns an integer representing the Nth Fibonacci
number. If you're stuck, try implementing `fib1` iteratively and then see how you can transform
your iterative approach to implement `fib2`.

```java
public static int fib2(int N, int k, int f0, int f1) {



}
```

Hint: To compute the Nth fibonacci number, call `fib2(N, 0, 0, 1)`.