COL106: Solutions for Quiz-1

(October 1, 2020)

Code for Questions 1-4. Consider the following method of class MyClass:

```
public static void makeCopy(MyClass x) /* Statement S1 */
{
    MyClass y = x;          /* Statement S2 */
    y = new MyClass();      /* Statement S3 */
    x = y;                  /* Statement S4 */
}
```

Before we address the questions related to this code, we note that x and y are references. Let's analyze the statements of this code.

Analysis of Statement $S1$: In Java, all parameters are passed by value. It's important to understand that the parameter to *makeCopy* is a reference (to an object) and not the object itself. Thus in statement $S1$, a copy of the reference is created and not of the object it refers to.

Analysis of Statement $S2$: In statement $S2$, a new reference y is defined and it is initialized to x. It's important to note that initializing the reference y with x here means that now y will reference the same object as x; the object will not be copied.

Analysis of Statement $S3$: In statement $S3$, a new object that is an instance of the class MyClass is being created and the reference y is assigned to refer to this object. It's important to note that y will no longer reference the object it was referring to before this assignment. If no other reference variables refer to that object (pointed to by y earlier), then that object will eventually be garbage collected (i.e., it's memory will be reclaimed by the system). If you have not read about garbage collection, you can ignore this for now. In this particular code x also refers to the same object that y was pointing to earlier.

Analysis of Statement $S4$: In statement $S4$, x is assigned the reference y. Therefore x now refers to the same object that was created in statement $S3$. It's important to understand at this point that though the value of x has changed, this does not change the value of the reference parameter that was passed to this function.

Question 1. In which all statements is a new object being created?

(A) S1 and S3

(B) S1, S2 and S3

(C) S1, S2, S3 and S4

(D) Only S3

Answer: (D). Read the analysis above and note that a new object is only being created in Statement $S3$. In all other statements, only references are being copied/assigned.

Question 2. Suppose there is no instance of class $MyClass$ before this function is invoked. Also suppose that x is passed as *null* in this function, then how many instances of $MyClass$ will exist at the end of execution of Statement $S4$ (before the method returns).

(A) None

(B) One

(C) Two

(D) Three

Answer: (B). Read the analysis above and note that a new instance of $MyClass$ is only being created in Statement $S3$. As there are no other instances before this instance is created, the total number of instances is 1.

Question 3. Suppose that the method makeCopy is invoked by a caller as follows:

$$MyClass.makeCopy(z);$$

Then what can be said about the following statement:
"The caller will be able to access the new object created in the *makeCopy* method at the completion of the call to makeCopy using the variable z."

(A) The statement is always true

(B) The statement is always false

(C) The statement is only true when z is not passed as *null*

(D) The statement is only true when z is passed as *null*

Answer: (B). Read the analysis of statement $S1$ and $S4$. Since a copy of the passed parameter z is made in reference x, modifying reference x does not modify z. Moreover, this has nothing to do with whether or not z is passed as *null*.

Question 4. Which of the following statements is true when method makeCopy is invoked?

(A) A copy of the reference x is made

(B) A copy of the object referred to by x is made

(C) A copy of both the reference x as well as the object referred to by x is made

(D) No copies are made.

Answer: (A). All parameters are passed by value. As the passed parameter is a reference in this case, a copy of this passed parameter will be made in x.

Question 5. Consider the if statement:

$$If\ ((x > 0)\ \&\&\ isPrime(x))$$

(A) isPrime(x) will be invoked only if x ¿ 0

(B) isPrime(x) will be invoked irrespective of whether or not x ¿ 0

Answer: (A). In Java conditional statements, if an earlier expression determines the outcome of the conditional statement then the subsequent expressions are not evaluated.

Question 6. Which of the following string formations involve an implicit cast:
String s1 = "I like " + "apples."
String s2 = "I like " + 2 + " apples."
String s3 = "I like " + "2" + " apples."
String s4 = "I like " + Integer.toString(2) + " apples."

(A) Only s2

(B) s2 and s4

(C) s2, s3 and s4

(D) s1, s2, s3 and s4

Answer: (A). For $s1$ and $s3$, only strings are being concatenated, hence no casting is required. For $s4$, the cast is explicitly specified by the programmer. For $s2$, the programmer has specified an integer to be added to the strings - this will be implicitly cast by Java.