LaurentianUniversity
UniversitéLaurentienne

COSC 1046 FINAL EXAM
Introduction to Programming I (Java)
Friday, Dec 18th 2015, 9:00 a.m.
Instructor: Aaron Langille
Time Allowed: 3 hours
9 pages include this cover page

Name:_____

Student Number:_____

Signature:_____

Instructions:

1. **NO** reference aids including but not limited to, textbooks, handouts, notes, calculators, PDAs, cell phones, pagers, digital cameras or other electronic devices.

2. Read the questions very carefully. Add comments ONLY if specifically requested to so or when they will help you to explain your answer.

3. Do not do any input error checking unless specifically asked to do so.

4. There is a blank page attached to the end of this exam. You may use it for any rough work required. Work on the blank page will **not** be marked.

Section 1: Multiple Choice = 22 marks.
Section 2: Short Answer = 42 marks
Section 3: Programming = 30 marks

Total**:** **/94**

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1. ____ A do-`while` loop is **guaranteed** to run at least _____ time(s):

a) zero b) one c) infinite d) thirteen

2. _____ Consider the following code snippet:

```
public class Vehicle
{
  private String type;
  public String Vehicle(String type)
  {
    . . .
  }
}
```

What is wrong with this code?

a) The class instance variable type must be initialized when it is declared.
b) The constructor must not have any arguments.
c) The constructor must not have a return type declared.
d) The constructor's return type must be void.

3. _____ The process of hiding object data and providing methods for data access is called ____.

a) documentation b) extension c) encapsulation d) initialization

4. _____ Which of the following statements about classes is correct?.

a) A class is an object that can be manipulated by a program.
b) A class describes a set of objects with the same behavior.
c) Class is another name for a method.
d) A class can contain only methods.

5. _____ Consider the following code snippet:

```
Coin coin1 = new Coin("dime", 0.10);
Coin coin2 = new Coin("dime", 0.10);
```

Which of the following statements is correct?

a) coin1 and coin2 contain references to the same object.
b) coin1 and coin2 refer to the same object.
c) coin1 and coin2 contain the same memory location.
d) coin1 and coin2 each have their own set of instance variables.

6. ____ Trying to access an element that is outside of the valid indices of an array generates what type of exception?

a) `NumberFormatException` b) `IShouldHaveStudiedChapter7Exception`
c) `ArrayIndexOutOfBoundsException` d) `IllegalStateException`

7. _____ Consider the statement: `Apple[] cart = new Apple[512];` What *type* is `cart[13]` ?
a) integer b) Apple c) String d) unknown

8. _____ All of the following are methods of the ArrayList class except:
a) length() b) size() c) set() d) get()

9. _____ Which is the correct syntax for placing the string “boat” into an ArrayList named recVehicles in the 4th position for the first time?
a) recVehicles.set(3, “boat”); b) recVehicles.set(“boat”, 3);
c) recVehicles.add(3, “boat”); d) recVehicles.add(“boat”, 3);

10. ____ What is the valid range of indices (index values) for an array of size 5?
a) 0 to 6 b) 1 to 5 c) 1 to 4 d) 0 to 4

11. ____ Which one of the following statements is the correct definition for a two-dimensional array of 2 rows and 20 columns of the type integer?
a) `int[][] num = new int[20][2];` b) `int[][] num = new int[2][20];`
c) `int[][] num = new int[20,2];` d) `int[][] num = new int[2,20];`

12. ____ Consider the following code snippet:

```
int val = arr[0][3];
```

Which value is stored in the `val` variable? The value stored:

a) In the first row and the second column
b) In the first row and the first column
c) In the first row and the fourth column
d) In the third row and the second column

13. ____ How many elements can be stored in a two-dimensional 3 row by 7 column 2D array?

a) 5 b) 6 c) 21 d) 30

14. _____ A method in a class that **modifies** information about an object is called a/an ____ method.
a) void b) accessor c) mutator d) constructor

15. _____ Which of the following statements about constructors is correct?

a) A class can have only one constructor.
b) A constructor should always return a value.
c) A constructor must have the same name as the class.
d) A class must have at least one constructor supplied by the programmer.

16. _____ Which operator should you use to test whether two *references* point to the same object?

a) == b) != c) <= d) ===

17. _____ The new operator:

a) allocates memory for an object
b) is three letters long
c) is used to initialize an object
d) All of the above.

18. _____ In a UML class description, the minus (-) indicates:

a) public access b) protected access c) private access d)package access

19. _____ Most programming languages in use today are:

a) object-oriented b) logic-based c) primitive d) procedural

20. The scope of a `private` instance field is:

a) inside the methods of the same class
b) inside the parentheses of a method header
c) inside the class, but not inside any method
d) the method in which they are defined

21. Two or more methods in a class may have the same name as long as:

a) they have different return types
b) they have different return types, but the same parameter list
c) they have different parameter lists
d) you cannot have two methods with the same name

22. When an object is passed as an argument to a method, what is actually passed into the method?

a) the class name
b) the object's memory address
c) the values for each field
d) the method names

Short answer:

23. (6 marks) Consider the following array: `int[] a = { 1, 2, 3, 0, 3, 2, 1 };`

(1 mark each) What is the value stored in the variable **total** when the followings loops complete?

a)
```
int total = 0;
for(int i = 0; i<7; i++)
{ total = total + a[i]; }
```

b)
```
int total = 0;
for(int i = 0; i<5; i+=3)
{ total = total + a[i]; }
```

(2 marks each) Again, consider the array above. What are the contents of array `a` after the following loops complete?

c)
```
for(int i = 6; i>1; i--)
{ a[i] = a[i] * 2; }
```

d)
```
for(int i = 0; i < 7; i++)
{ a[i] = 5; }
```

24. (2 marks) Write the statements required to create and initialize the 2D array:

1	5	7	9
2	4	6	8

(2 marks) Write the statements required to **swap** the top-right element with the bottom-left element of the 2D array above. You may hard-code the indexes here.

25. (6 marks) Write a method that takes a 2D array of integers as an argument. The array returns **a new 2D array** of integers of the same size (same number of rows and columns). The values in the returned array are the same as those in the argument array EXCEPT that any negative values are made positive. The header for the method is given below:

```
public static int[][] absoluteArray2D(int[][] in){
```

26. (3 x 2 marks) The following code snippets have either a syntax or logic error. Find and correct the error(s) (you do not need to rewrite all of the code, just make the corrections clear). There is only one error per question and it is in the code that is shown to you.

a)
```
double[] values = new double[3];
values[0] = 1; values[1] = 5; values[2] = 19;
double result = Math.sqrt(values);
```

b)
```
public static int getMax(int a, int b){
   if( a > b ) return a;
   else System.out.println(b);
}
```

c)
```
Die[] dice = new Die[5];
dice[0].roll();
int val = dice[0].sideUp();
```

27. (2 x 3 marks) What is the **output** of the following code snippets? Pay attention to the **bold** lines.

a.
```
public static void main(String[] args){
      double x = 5.0;
      System.out.println(x);
      multiply(x);
      System.out.println(x);
}

public static void multiply(int x){
      x = x * 10;
      System.out.println(x);
}
```

b.
```
public static void main(String[] args){
      int[] x = {3,5,7};
      System.out.println(x[0]);
      multiply(x);
      System.out.println(x[0]);
}

public static void multiply(int[] x){

   for(int i = 0; i<x.length; i++){
            x[i] = x[i] * 10;
   }
      System.out.println(x[0]);
}
```

28. (14 marks) Consider ArrayLists and show the command(s) required to complete the following tasks. Assume the tasks are completed in order. Label each task clearly.

    a. (2 marks) Create a new ArrayList called list that can hold integers.

    b. (2 marks) Add three integers of your choice to the list.

    c. (2 marks) Change the second integer in the list to your student number.

    d. (2 marks) Remove the first occurrence of the value 10 from your list.

    e. (2 marks) Determine and store in a variable the number of elements that are currently in the list.

    f. (4 marks) Using a for loop, determine the largest value in your list (assume there are more values than what you entered in part a.). Print the value AND the index where it occurs. This is not a method/function questions, just write the Java statements to complete the task.

Programming:

29. (10 marks) Consider a simple vending machine class. The machine accepts tokens and dispenses cans of refreshing beverages. Write a complete class (on the next page) as described below:
    - The class has two instance data fields; one to keep track of the number of cans in the machine and one to keep track of the number of tokens (think coins) collected.
    - There should be two constructors. One takes no arguments and starts with 50 cans and zero tokens. The other takes one argument, the initial number of cans in the machine.
    - There should be a method to purchase a drink which adds one token to the machine and subtracts one can – assuming there are still cans in the machine to be purchased.
    - There should be one method to add cans to the machine.
    - There should be separate methods to return the number of cans remaining and the number of tokens collected.
    - Bonus (+2 marks): Write a toString( ) method to allow for easy printing of a vending machine object.
    - For any other assumptions you are making, use comments. Don't write Java Docs

30. (5 marks) Write statements to complete the following tasks

- create two vending machine objects using each of the different constructors.
- use one of the objects and show how you would call and test each of the accessor and mutator methods you have written. Use brief comments to make it clear what you are doing.

There should be output where appropriate – pretend that this is a fully functional tester that will be compiled and run. You can hard code any method arguments – you do NOT need to collect user input.

31. (15 marks) Write a complete program that prompts the user for two filenames and a double. The program reads the input file line-by-line. Each line of the file contains two numbers. These numbers represent the coordinates (x,y) of points in 2D space. Compute the distance of each points from the origin (0,0) using the formula: $Dist = \sqrt{x^2 + y^2}$ where *x* and *y* are given in the file. To the output file print the original coordinates, the computed distance AND the corresponding line number from the original file ***only*** if the distance is greater than the number collected from the user. Assume all of the numbers in the input file are properly formatted and legal.

Possible input file (input file would be arbitrary in length).

```
5.1 6.3
9.9 18.0
1.1 6.2
12.3 3.7
...
```

Resulting output file if user inputs 10 as the threshold value.

```
Line 2: 9.9 18.0 20.5428819789
Line 4: 12.3 3.7 12.8444540561
...
```

***Alternate: For 8 out of 15 marks write a program where the output file is simply a line-by-line copy of the input file.