COE 211/COE 212 – Computer/Engineering Programming

Welcome to
The Midterm Exam I
Wednesday April 04, 2012

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Name: ____________________

Student ID: ________________

Instructions:

1. This exam is **Closed Book**. Please do not forget to write your name and ID on the first page.
2. You have exactly **120 minutes** to complete the 8 required problems.
3. Read each problem carefully. If something appears ambiguous, please write your assumptions.
4. Do not get bogged-down on any one problem, you will have to work fast to complete this exam.
5. Put your answers in the space provided only. No other spaces will be graded or even looked at.

Good Luck!!

<u>Problem 1:</u> comprehension oriented (**15 minutes)** [16 points]

For each question, choose the **single** correct answer.

1) Which of the following is an example of an invalid assignment statement?
   a. double age = 30;
   b. float age = 30.0f;
   c. long age = 30;
   d. None of the above
2) Which of the following statements **properly** references the `PI` member of the `Math` class and stores its value in the **primitive variable** called `value`?
   a. float value = Math.PI;
   b. double value = Math.PI( );
   c. Double value = Math.PI;
   d. None of the above
3) The expression (int) (76.0252175 * 100) / 100 evaluates to
   a. 76
   b. 76.0252175
   c. 76.03
   d. 76.02
4) How many lines of output does the following statement produce?
   System.out.print("1 big bad wolf" + "3 little pigs \\n" + "for dinner tonight");
   a. 1
   b. 2
   c. 3
   d. None of the above
5) Which of the following modifiers should be applied to the data members of a class to enforce encapsulation
   a. static
   b. private
   c. final
   d. None of the above
6) To add `a` to `b` and store the result in `b`, you would write
   a. a = a + b;
   b. b += a;
   c. a += b;
   d. both (a) and (c)
7) Which of the following expressions results in a value of 1?
   a. 2 % 1
   b. 15 % 4
   c. 25 % 6
   d. 18 % 3
8) Information is most likely to be lost in what kind of data conversion?
   a. Narrowing conversion
   b. Conversion via casting
   c. All of the above
   d. None of the above
9) Which of the following would store the last character of the `String` called `word` in the variable called `last`?
   a. char last = word.charAt(length( ) – 1);

b. char last = word.charAt(word.length( ));

c. char last = word.substring(word.length( ) – 1, word.length( ));

d. String last = word.substring(word.length( ) – 1, word.length( ));

10) Which of the following is a predefined class type in Java?

a. Int

b. float

c. double

d. None of the above

11) Which of the following represents the header of a mutator method?

a. public int getAge()

b. public void setAge( )

c. public Person( )

d. none of these are headers for a mutator method

12) What value will `z` have if we execute the following assignment statement?

```
double z = (double) (5 / 10);
```

a. z will equal 0.5

b. z will equal 0.0

c. z will equal 5.0

d. z will equal 0.05

13) The parameters that are used when invoking a method are referred to as

a. formal parameters

b. instance parameters

c. informal parameters

d. actual parameters

14) Which of the following can be used to differentiate between a local variable and an instance variable having the same name

a. dot operator

b. new

c. this

d. None of the above

15) Methods that can be called directly through the class name are called

a. public methods

b. private methods

c. static methods

d. None of the above

16) If a service is so complex that it cannot be reasonably implemented using one method, it is often helpful to decompose the method and make use of **support** methods. These support methods are declared with

a. private visibility

b. public visibility

c. final visibility

d. None of the above

Problem 2: Long true or false questions (**15 minutes)** [12 points]

In the following questions, check **all** the correct answers. There is **at least** one correct answer per question, but **there may be more**.

1. Which of the following are **false**:
   a. **Dividing an `int` by another `int` is an example of a syntax error**
   b. **In Java, all floating point literal values are by default assumed to be of type `float`**
   c. The values of 5.0 / 2 and (double) 5 / 2 are identical.

2. Which of the following are **true**:
   a. Any error detected by the compiler is called a run-time error.
   b. **If a Java program is not syntactically correct, the compiler will not produce an executable version of the program.**
   c. **In the case of a run-time error, the program compiles without complaint.**

3. Which of the following are **false** about methods:
   a. Methods are declared with public visibility.
   b. A return statement is not required at the end of every method.
   c. **Methods define the state of a class.**

4. Which of the following are **true** statements about classes:
   a. **A class is a blueprint for a set of objects.**
   b. All classes must have a main method.
   c. If the programmer does not provide a constructor, the compiler complains.

5. Which of the following are **true**:
   a. Using an un-initialized variable results in a run-time error
   b. **Wrapper classes can be used without an explicit import declaration statement.**
   c. All lines of a Java program must end with a semicolon.

6. Which of the following are **true** about visibility modifiers:
   a. Constructors should be declared with `private` visibility.
   b. `public` visibility must be applied to all the variables of a class.
   c. **A `public` variable can be accessed directly from outside of a class.**

7. Which of the following are **false** about wrapper classes:
   a. **The `Double` wrapper class contains a static method called `parseDouble` that converts a `double` into a `String`.**
   b. **The name of the wrapper class corresponding to the `int` primitive type is "`Int`"**
   c. Each primitive type has a wrapper class associated with it.

8. Which of the following are **false**:
   a. **Accessor and getter methods (i.e., getter and setter methods) must be private.**
   b. Code placed inside of comments will not be compiled and therefore will not execute.
   c. **The following Java statement: Math.sqrt(4); would yield an integer value of 2.**

<u>Problem 3:</u> Short true or false questions (**15 minutes)** [12 points]

1. Suppose a = 5. After the statement ++a; executes, the value of “a” would still be 5 because the output of the expression is not saved in another variable.

Answer: True **False**

2. Multiple object reference variables can refer to the same object.

Answer: **True** False

3. A variable that is declared as an object stores the actual value of the object. A variable that is declared as a primitive type stores a pointer to the associated data.

Answer: True **False**

4. The scope of a local variable always ends at the closing brace of the block of code in which it is declared.

Answer: **True** False

5. There are times when it is appropriate to return data from a method of a type that is inconsistent with the return type specified in the method header.

Answer: True **False**

6. In a Java program, computing the square root of a negative value produces a syntax error.

Answer: True **False**

7. The name of each wrapper class is the name of its associated primitive data type, but with an initial capital letter (for example, the name of wrapper class corresponding to float is Float).

Answer: True **False**

8. A method defined in a class can access the class’s instance variables.

Answer: **True** False

9. If the called method and the calling method belong to the same class, then only the method name is needed to invoke the called method.

Answer: **True** False

10. When defining (i.e., creating) a method, you must specify the data type for each parameter that this method accepts.

Answer: **True** False

11. If `String a = “123.45”;` and `String b = “” + 123.45;` then `a.equals(b);` returns false.

Answer: True **False**

12. A variable of type `char` cannot be used to hold a collection of characters.

Answer: **True** False

<u>Problem 4:</u> Evaluating java expressions **(15 minutes)** [8 points]
For each of the following code fragments, what is the value of x after the statements are executed?

(1)
```
String x = “”;
x += 12;
x += 14;
```
Answer: x = “1214”

(2)
```
int y = (int) Math.PI;
double z = Math.ceil(Math.PI);
double x = Math.pow(y, Math.sqrt(z));
```
Answer: x =9.0

(3)
```
DecimalFormat fmt = new DecimalFormat(“000.##”);
double y = 24.567;
String x = fmt.format(y);
```
Answer: x =024.57

(4)
```
int y = 11;
int z = (y++);
int x = ++z - y;
```
Answer: x =1

(5)
```
String sentence = “Hello There”;
int len = sentence.length();
 String mutation=sentence.substring(len-4, len-1);
char x =(mutation.toUpperCase()).charAt(1);
```
Answer: x =E

(6)
```
String str1 = “24.57”;
int index = str1.indexOf(‘.’);
String str2=str1.substring(index, str1.length());
 Str2 = “0” + str2;
double x = Double.parseDouble(str2) –
Double.parseDouble(str1);
```
Answer: x =-24.0

(7)
```
String phrase = “exam is fun”;
 String mutation1 = phrase.replace(‘x’, e’));
 String mutation2 = mutation1.replace(‘e’, ‘x’);
 boolean x = mutation1.equalsIgnoreCase(mutation2);
```
Answer: x =false

(8)
```
int x, y = 1;
 y *= 2; y *= 3;
 double z = 4.58;
  x = y + (int) z;
```
Answer: x =10

Problem 5: Object-oriented code analysis (**10 minutes**) [10 points]

Consider the following class:

```
public class Date{
  private String day, month, year;
  public Date(String d, String m, String y){
        day = d; month = m; year = y;  }
  public String getDay() { return day; }
  public String getMonth() {return month; }
  public String getYear() { return year; }
  public String toString() {
  String output = day + “\\” + month + “\\” + year;
  return output; }}
```

This class is supplemented with the following driver class:

```
public class MultiDates{
  public static void main(String[] args) {
     Date d1 = new Date(“01”, “05”, “1979”);
     Date d2 = new Date(“04”, “04”, “2012”);
     Date d3 = d2;
}}
```

For each of the following statements, indicate the expression that will be printed out. Display the output in the provided boxes.

```
a) System.out.println(d3);
```

04\04\2012

```
b) int b = Integer.parseInt(d1.getYear());
   int c = Integer.parseInt(d2.getYear());
   System.out.println(b - c);
```

-33

```
c) System.out.print(d1.getMonth() +
        “\n” + d3.getMonth());
```

05
04

```
d) String day1 = d1.getDay();
   String day2 = d2.getDay();
   System.out.print(day1.concat(day2));
```

0104

```
e) String str1 = d1.toString();
   String str2 = d2.toString();
String str1_mod = str1.substring(6, str1.length());
String str2_mod =  str2.substring(6, str2.length());
System.out.println(
     Math.abs(Integer.parseInt(str1_mod) –
     Integer.parseInt(str2_mod)));
```

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<u>Problem 6:</u> Writing code segments (**15 minutes**) [8 points]

Write each of the Java code segments as the provided instructions.

Example: write a **one-line statement** declaring a string storing your name.
Answer: String name = "wissam";

a) Write a **one-line statement** declaring and creating a `Scanner` object called `keyboard`.

Scanner keyboard=new Scanner(System.in)

b) Write a **one-line statement** that uses the `keyboard` object created earlier to read an `int` value and then store it in a variable called `val`.

int val=keyboard.nextInt()

c) Write a **one-line statement** that reads a line of text from the user via the `keyboard` object and stores it in a variable called `str`.

String str=keyboard.readLine()

d) Write a **one-line statement** that generates a random `int` between 0 (inclusive) and `str.length()` (exclusive) before storing the resulting value in a variable called `index`.

*int index=(int)(Math.random()*str.length())*

e) Write a **one-line statement** that uses `index` (from part (d)) to extract at random a character out of `str` (from part (c)). Place the extracted character in a variable called `rnd_char`.

char rnd_char=str.charAt(index)

f) Write a **one-line statement** that generates a new String called `str_mod` that is identical to `str` but with every occurrence of the character `rnd_char` in `str` being replaced with the letter `e` in `str_mod`.

String str_mod=str.replace(rnd_char,'e')

g) Write a **one-line statement** that prints the last two characters in `str_mod` out.

System.out.println(str_mod.substring(str_mod.length()-2))

h) Write a **one-line statement** that prints a capitalized version of `str_mod` out.

System.out.println(str_mod.toUpperCase())

Problem 7: Complete code fragment (**10 minutes**) [9 points]

Given below is the partial definition for the Book class. This class has 2 instance variables called author and period, representing the author and checkout period (a number of days) of the book. Complete this definition by doing the following:

- Introduce the **instance variables** to the class and then add a **constructor** to this class that sets the initial values of the instance variables author and period using two input parameters.
- Add two public **accessor methods** that return the values of the private member variables author and period.
- Add two **mutator methods** that can change the values of the private member variables.
- Finally, add a —**toString**— method that returns a one-line description of the book consisting of the author followed by white space and then period.

```
public class Book {
     // private instance variables would go below
     private String author;
     private int period;
     // constructor for Book: Add code here
     public Book(String s, int p)
     {   author=s;
         period=p; }
     // accessor method for author: Add code here
     public String getAuthor()
     {   return author;}

     // accessor method for period: Add code here
     public int getPeriod()
     {   return period;}

     // mutator method for author: Add code here
     public void setAuthor(String s)
     {   author=s; }


     // mutator method for period: Add code here
     public void setPeriod(int p)
     {   period=p;}
     // toString method: Add code here
     public String toString()
{    return author+” “+period; }}
```

Problem 8: Coding (**25 minutes**) [25 points]

1. The harmonic mean of two numbers is given by

$$H = \frac{2}{\left(\frac{1}{X} + \frac{1}{Y}\right)}$$

Write a program that reads two numbers (as integers) from the keyboard and prints out both the traditional average (i.e., arithmetic mean) and the harmonic mean.

```
import java.util.Scanner;

public class Harmonic {

     public static void main(String[] args) {
          Scanner scan=new Scanner(System.in);
          System.out.print("Enter x: ");
          int x=scan.nextInt();
          System.out.print("Enter y: ");
          int y=scan.nextInt();
          double mean=(x+y)/2.0;
          double harm=2/(1.0/x+1.0/y);
          System.out.println("Arithmetic mean= "+mean);
          System.out.println("Harmonic mean= "+harm);
     }

}
```

2. Design and implement a class called `LightSpeed` whose main method reads the coordinates of 2 points A(x1, y1) and B(x2, y2) as double. Use the obtained coordinates to compute the **distance** between A and B as follows:

$$D = \sqrt{(x1 - y1)^2 + (x2 - y2)^2}$$

Then, use the computed distance to determine the **amount of time in seconds** needed by light to travel from A to B. Assume that the speed of light is equal to **299 792 458 m/s**. Make sure to **round the value of the computed distance to 3 decimal places and the value of time to 8 decimal places**.

<u>Sample run</u>:

```
Enter x1: 10.7
Enter y1: 109.8
Enter x2: 0
Enter y2: 2890.67
The distance between A and B is 2780.891 meters
The time is: 0.00000928 seconds
```

```
import java.text.DecimalFormat;
import java.util.Scanner;


public class LightSpeed {


     public static void main(String[] args) {
          final double celerity=299792458 ;
          DecimalFormat distance=new
DecimalFormat("0.###");
          DecimalFormat time=new
DecimalFormat("0.########");
          Scanner scan=new Scanner(System.in);
          System.out.print("Enter x1: ");
          double x1=scan.nextDouble();
          System.out.print("Enter y1: ");
          double y1=scan.nextDouble();
          System.out.print("Enter x2: ");
          double x2=scan.nextDouble();
          System.out.print("Enter y2: ");
          double y2=scan.nextDouble();
          double dist=Math.sqrt(Math.pow(x1-
x2,2)+Math.pow(y1-y2,2));
          double t=dist/celerity;
          System.out.println("The distance between A and B
is "+distance.format(dist)+" meters");
          System.out.println("The time is:
"+time.format(t));
     }
}
```