COE 212 – Engineering Programming

Welcome to Exam I
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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 **110 minutes** to complete the 6 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!!

Problem 1: Multiple choice questions (**20 minutes)** [15 points]

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

1) Which of the following statements are **invalid**?
   a. `Double d = 423.5f;`
   b. `float f = 423.5;`
   c. `int a = 46/5;`
   d. All of the above
2) Consider a Java program that includes: `import java.util.*;` as its only import declaration statement. Which of the following statements would result in a **compile-time error**, when included in this program?
   a. `DecimalFormat fmt = new DecimalFormat("0.###");`
   b. `Scanner scan = new Scanner(system.in);`
   c. Both of the above
   d. None of the above
3) Which of the following represent a **valid constructor header** for a class called `Triangle`?
   a. `public void Triangle()`
   b. `public Triangle(double s1, s2, s3)`
   c. `public Triangle(double s1)`
   d. Both (b) and (c)
   e. None of the above
4) Which of the following statements **outputs**: `12`?
   a. `System.out.println("1" + 1 + 1);`
   b. `System.out.println('1' + '2');`
   c. `System.out.println(1 + "" + (1 + 1));`
   d. Both (b) and (c)
   e. None of the above
5) What **value will z have** after we execute the following statement?
   `double z = (double) (-20%-3 + 4/5);`
   a. `-1.2`
   b. `2.8`
   c. `2.0`
   d. `-2.0`
   e. None of the above
6) Let `str` be a `String` object reference variable. The **value returned** by: `Double.parseDouble(str)` can be stored without casting in which of the following types of variables?
   a. A `Long` variable
   b. A `float` variable
   c. A `String` variable
   d. A `Double` Variable
   e. None of the above
7) If `gen` is a `Random` variable, which of the following are **possible values** for `x` after the following statement is executed?
   `int x = (1+gen.nextInt(5)*2) – 4*gen.nextInt(4);`
   a. `-16`
   b. `11`
   c. `-3`
   d. All of the above
   e. None of the above

8) Which of the following classes **does not require** the use of an import declaration statement?
   a. `String`
   b. `Integer`
   c. `Character`
   d. All of the above
   e. Both (a) and (b)

9) Which of the following correctly computes the sine of a **45 degrees angle**?
   a. `Math.sin(45)`
   b. `Math.sin(Math.PI()/4)`
   c. `Math.tan(Math.PI()/4) * Math.cos(Math.PI()/4)`
   d. Both (b) and (c)
   e. None of the above

10) Which of the following is **not static**?
   a. `ceil`
   b. `abs`
   c. `parseInt`
   d. `floatValue`
   e. Both (a) and (d)

11) Which of the following is an appropriate way of computing **the square root** of an `int` variable `x`?
   a. `double y = Math.abs(Math.sqrt(x));`
   b. `double y = Math.sqrt(Math.abs(x));`
   c. `Math  m = new Math(); double y = M.sqrt(x);`
   d. `double y = Math.pow(Math.abs(x), 1/2);`
   e. Both (b) and (d)

12) Assuming that `rnd` is a `Random` object, which of the following can be used to generate a random integer value **between `-1` (inclusive) and `9` (inclusive)**?
   a. `Math.floor(rnd.nextFloat()*10 – 1);`
   b. `Math.floor(rnd.nextFloat()*10) – 1;`
   c. `Math.ceil(rnd.nextFloat()*10 – 2);`
   d. All of the above
   e. None of the above

13) Which of the following can be used to print **3 forward slash characters** out?
   a. `System.out.println("///");`
   b. `System.out.println("\/\/\/");`
   c. `System.out.println("//////");`
   d. All of the above
   e. Both (a) and (b)

14) Which of the following is part of the `java.lang` package?
   a. `System`
   b. `Long`
   c. `float`
   d. All of the above
   e. Both (a) and (b)

15) Which of the following statements is valid?
   a. `Integer a = Integer.parseInt("26");`
   b. `int a = new Integer(26);`
   c. `float a = (float) Double.parseDouble("26");`
   d. All of the above
   e. None of the above

Problem 2: True or false questions (**10 minutes)** [10 points]

1. A conversion from `byte` to `float` is a widening conversion

Answer: **True** False

2. The following assignment statement is a valid Java statement:
```
String Void = 'String Void';
```
Answer: True **False**

3. The output of the program segment given below is: `8`
```
String str = "3";
System.out.print(Math.pow(2, Integer.parseInt(str));
```
Answer: True **False**

4. The output of the program segment below is:`Absolutely whatever you say!`
```
String will = "you "; String No = "Absolutely ";
String I = "say "; String way = "whatever ";
System.out.print(No + way + will + I + "!");
```
Answer: True **False**

5. The output of the following code segment is: `Length of "seven" is: 5`
```
String str = "seven";
System.out.print("Length of \"seven\" is: "+str.size());
```
Answer: True **False**

6. Consider a `String` variable called `str`. The following Java statement: `str.substring(1, length());` would return a substring composed of all the characters in `str` except the first and last characters.

Answer: True **False**

7. Floating point values that appear in a Java program are known as floating point literals and they are of type `float` by default.

Answer: True **False**

8. After running the code shown below, the value stored in variable x is: `3`
```
int x = 3;
x = x + x * x / x - x;
```
Answer: **True** False

9. The output of the following statement is: `3`
```
System.out.print((int) 2 * 3.5 / 2) ;
```
Answer: True **False**

10. The output of the code shown below is: `2`
```
DecimalFormat fmt = new DecimalFormat("000.#");
String str = fmt.format(1.23).substring(0, 3);
System.out.print(str.charAt(str.length()-1));
```
Answer: True **False**

Problem 3: Long true or false question (**10 minutes)** [10 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. **Any variable in Java declared as `final` becomes a Java reserved word.**
   b. **When called with an integer parameter `n`, the `nextInt` method of the `Random` class returns a randomly generated integer between `0` (inclusive) and `n` (inclusive)**
   c. Multiple object reference variables can refer to the same object.
2. Which of the following are **true**:
   a. Any error detected by the interpreter is called a syntax error.
   b. **A Java program that computes the square root of a negative value compiles without complaint.**
   c. Computing the square root of a negative value in a Java program results in a run-time error.
3. Which of the following are **false**:
   a. A `return` statement is not required at the end of every method.
   b. **A value passed to a method inside the driver class is referred to as the formal parameter.**
   c. A mutator method is also known as a setter method.
4. Which of the following are **true**:
   a. Autoboxing allows an `int` variable to hold an `Integer` object.
   b. **An instance variable has a wider scope than a local variable.**
   c. The behavior of a primitive data type is defined through the methods associated with that primitive data type.
5. Which of the following are **false**:
   a. The type of result produced by an arithmetic expression in Java depends on the types of the operands.
   b. **The assignment operator has a lower precedence than the postfix increment operator in the following statement: `y = a++;`**
   c. **Arithmetic expressions in Java are always evaluated from left to right.**
6. Which of the following are **true**:
   a. The cast operator has a lower precedence than the division operator.
   b. The assignment operator does not support widening conversions.
   c. **The letter `L` when appended to the end of an `int` literal value converts it into a long value.**
7. Which of the following are **false**:
   a. **Not including a parameter for a method that accepts one leads to a run-time error.**
   b. The variables of a class define the state of the objects created from that class.
   c. `Math.PI` is a static constant defined in the `Math` class.
8. Which of the following are **false**:
   a. **All the methods of the `Math` class produce a double output value.**
   b. All the methods of the `Math` class can be invoked through the name of the class.
   c. The `random()` method of the `Math` class is functionally equivalent to the `nextDouble()` method of the `Random` class.

Problem 4: Class definition (**15 minutes**) [15 points]

A `RandomWalk` class represents a point travelling in a 2-dimensional space as follows:

- The point starts at some initial position characterized by its x- and y-coordinates
- Every time the point moves, its coordinates change by **random** amounts (i.e., randomly generated step value) between -1.0 (inclusive) and 1.0 (exclusive)

Complete the class definition given below as per the guidelines highlighted in bold.

```
// add import declaration statements below if necessary
import java.util.Random;
public class RandomWalk{
   private double x, y; // x and y coordinates of point
   private Random gen; // Random number generator
   // Constructor initializing all instance variables
   // initX and initY are the initial coordinates for point
   public RandomWalk(int initX, int initY) {
        x = initX;
        y = initY;
        gen = new Random();
   }
   // Update the point's position as specified above
   // i.e. change each coordinate by a random amount
   // between -1.0 (inclusive) and 1.0 (exclusive)
   public void move() {
        x+=gen.nextFloat()*2 – 1;
        y+=gen.nextFloar()*2 – 1;
   }
   // add setter and getter methods for each coordinate
   public double getX() { return x;}
   public double getY() { return y;}
   public void setX(int x) {this.x = x;}
   public void setY(int y) {this.y = y;}

   // add a toString method for the object returning an
   // output in the form: X: value of x; Y: value of y

   public String toString() {
        return "X: " + x + "; Y: " + y;
   }









}
```

Problem 5: Code analysis (**15 minutes**) [10 points]

1) What is the output of the code given in the two columns below when an instance of class `ClassA` is created and used to call the method `startUp()`?

```
public class ClassA {
      private int x, y;
      public ClassA(){
            x=2; y=5;
      }
      public void first(){
            x=y++;
      }
      public void second(int x,int y){
            this.x+=x;
            this.y=++y;
      }
```

```
public void third() {
      int x = this.x;
      setXY(x);
}
public void setXY(int b) {
       second(b, x);
}
public void startUp() {
      first(); second(3, 2);
      third();
      System.out.println(x+y+"");
}
}
```

a. `169`
b. `28`
c. `25`
d. It doesn't compile correctly
e. None of the above

2) Consider the class given below, along with a driver class for it.

```
public class ClassB {
      public String str;
      public ClassB(String val) {
            str = new String(val);
            augmentStr("Funny");
      }
      public void
            augmentStr(String val){
            String str1=
            val.substring(0, 4);
            str =
            str.concat(" ").concat(str1);
      }
}
```

```
public class ClassBDriver {
      public static void
      main(String[] args) {
        ClassB b=
            new ClassB("Exam");

        String str = b.str;
        String output=
        str.replace(' ', ',');
        System.out.println(
            output);
      }
}
```

When running the `ClassBDriver` class, what output is produced?

a. `Exam,Funny`
b. `Exam Fun`
c. `Exam,Fun`
d. `Exam Funny`
e. None of the above

Problem 6: Coding (**40 minutes**) [40 points]

1. Write a Java program called `RandomAverage` that reads an integer n from the user. Your program should then generate 3 random integers denoted by `a`, `b`, and `c` between 1 (inclusive) and n (inclusive) before displaying all 3 numbers along with their average on the screen.

Sample run:
Enter an int: 4
a: 1, b: 3, c: 2
Average: 2.0

```
import java.util.Scanner;
import java.util.Random;
public class RandomAverage {
     public static void main(String[] args) {
          int n, a, b, c;
          double average;
          Scanner scan = new Scanner(System.in);
          Random rnd = new Random();

          System.out.println("Enter an int:");
          n = scan.nextInt();
          a = rnd.nextInt(n) + 1;
          b = rnd.nextInt(n) + 1;
          c = rnd.nextInt(n) + 1;
          average = (a+b+c)/3.0;

          System.out.println("a:"+a+", b:"+b+", c:"+c);
          System.out.println("Average:"+average);
     }
}
```

2. Write a program called `PhoneNumbers` that randomly generates a phone number between `000000` and `999999` and prints it to the screen. Note that the output phone number must be composed of **exactly 6 digits**.

Sample run:
Randomly generated phone number: 000486

```
import java.util.Random;
import java.text.DecimalFormat;
public class RandomAverage {
     public static void main(String[] args) {
          Random rnd = new Random();
          DecimalFormat fmt = new DecimalFormat("000000");
          int phoneNumber;

          phoneNumber = rnd.nextInt(1000000);

          System.out.println("Randomly generated number:"+
               fmt.format(phoneNumber));
     }
}
```

3. We wish to pack `n` eggs into `nb` boxes that can accommodate 12 eggs each. Write a Java program called `Packaging` that reads from the user the number of eggs `n` and the price of each box expressed in Lebanese Pounds (L.P.) and denoted by `price`. Your program should then determine and print out the following:
    a. The number of boxes `nb` (completely full and ready to seal),
    b. The number of remaining unpackaged eggs (i.e., the eggs that are not enough to fill a whole box),
    c. as well as the total price of all `nb` (completely full) egg boxes, expressed in dollars. We consider that `1$=1500 L.P.`

Sample run:

Enter the number of eggs: 13
Enter the price per box (in LP): 6000
Number of boxes: 1
Remaining number of free eggs: 1
Total price: $ 4.00

```
import java.util.Scanner;
public class Packaging {
     public static void main(String[] args) {
          int n, nb, remaining;
          double price, totalPrice;
          Scanner scan = new Scanner(System.in);

          System.out.println("Enter number of eggs:");
          n = scan.nextInt();
          System.out.println("Enter price per box:");
          price = scan.nextDouble();

          nb = n/12;
          remaining = n % 12;
          totalPrice = (price * nb)/1500.0;

          System.out.println("Nb of boxes:"+nb);
          System.out.println("Remaining nb of eggs:"+
               remaining);
          System.out.println("Total price:"+totalPrice);
     }
}
```

4. Write a program called `ComplexNumbers` that reads the polar coordinates of a complex number that we denote by r and θ. The program should then display on the screen the complex number using algebraic notation as `x + iy`, where:

$$\mathbf{x = r \times \cos\theta}$$
$$\mathbf{y = r \times \sin\theta}$$

Note that `x` and `y` should be formatted to **2 significant digits** and that they should be placed between parentheses as illustrated in the sample run given below.

Sample output

Enter value of r: 5
Enter value of angle: 53.13
Algebraic notation: (4) + i (3)

```
import java.util.Scanner;
import java.text.DecimalFormat;
public class ComplexNumbers {
     public static void main(String[] args) {
          double r, theta, x, y;
          Scanner scan = new Scanner(System.in);
          DecimalFormat fmt = new DecimalFormat("0.##");

          System.out.println("Enter r:");
          r=scan.nextDouble();
          System.out.println("Enter angle in radians:");
          theta = scan.nextDouble();

          x = r * Math.cos(theta);
          y = r * Math.sin(theta);

          System.out.println("Algebraic notation:" +
          "("+fmt.format(x)+")"+"+i("+fmt.format(y)+")");
     }
}
```