

**IE ALGORITHMIQUE & PROGRAMMATION**  
**INSA-LYON- PCC - ASINSA - Novembre 2017**

The answers must be written directly on this document in the dedicated boxes.

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**Duration: 1 hour**

**Documents: None**

- Le barème est indicatif et le sujet est sur 6 pages.
- Les exercices sont indépendants.
- L'indentation des programmes, les commentaires, le choix judicieux des noms de variables seront pris en compte.

15,5

**Exercise 1 : Questions on the lectures (2 pts)**

For each of the following statements, say if it is True or False.

- A - I must save my java source code in a file with an extension .class
- B - The command « javac MyProg.java » execute the program on the Java machine
- C - The compiler is used to translate the source code into a machine code
- D - When a variable is declared with the keyword « final », the its value is fixed in all the program
- E - All the variable of a program must have a type
- F - « a==b » is a logical expression (we assume a and be are of type integer)
- G - « a%b » is a logical expression (we assume a and be are of type integer)
- H - In an interpreted programming language, the errors are detected during the compilation

Question	A	B	C	D	E	F	G	H
Answer	False	True	True	True	True	True	False	True

X

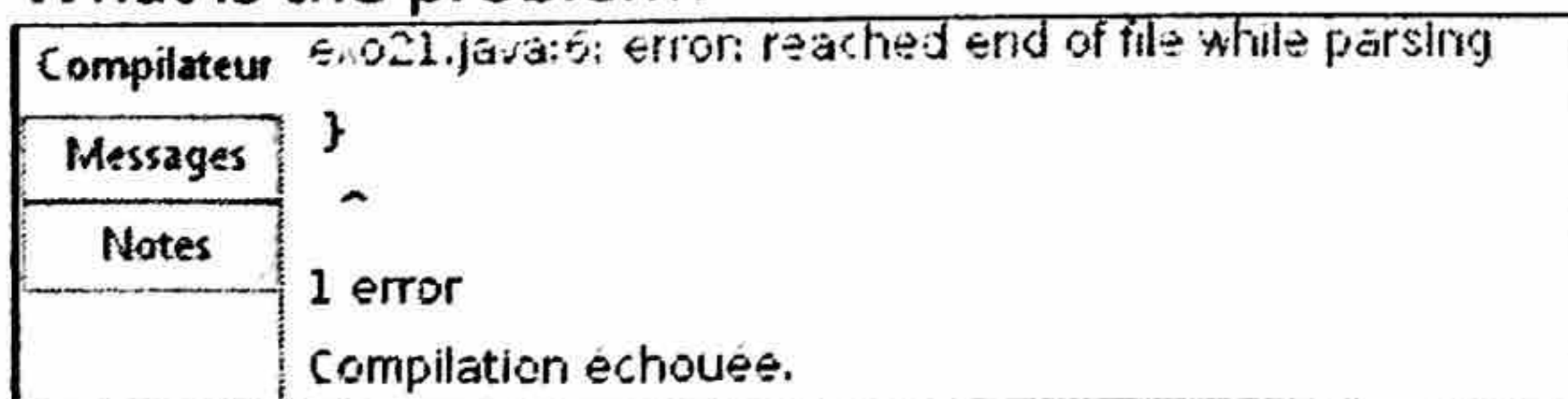
X

7,5

**Exercise 2 : Program understanding (8 points)**

**(Q 2.1) -1pt-** During the compilation of a class named *exo21*, the following error message appear.

What is the problem?

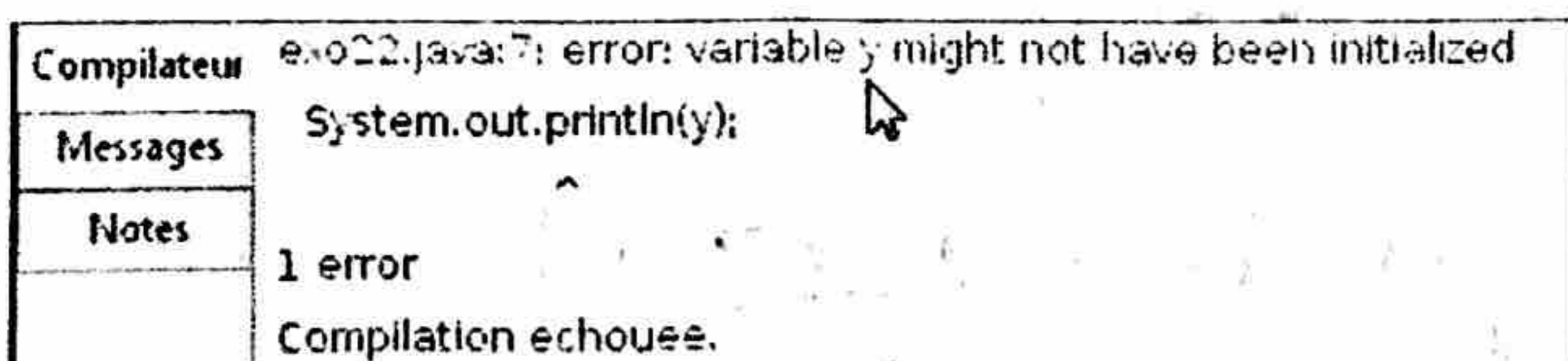


Answer Q21: The writer forgot to put a brace ( } ) in the end.

1

**(Q 2.2) -1pt-** During the compilation of a class named *exo22*, the following error message appear.

What is the problem?. Corriger le programme pour résoudre le problème ?



```
public class exo22 {
    public static void main(String[] args) {
        int a = 2;
        double y;
        if (a >= 0) {
            y = 3.14;
        }
    }
}
```

Answer Q22 :  
 It is possible that the variable y does not have a value.  
 We need to change the 2<sup>nd</sup> if:  
 if (a < 0) { → is to delete

1

```

    }
    if (a < 0) {
        y = 2.71;
    }
    System.out.println(y);
}
}

```

(Q2.3) -2pts- What is displayed by the following program *exo23*? ~~0~~, 100, 101, 517, or ~~1000~~? Justify your answer.

Tip: instead of manually inrolling the program, we can make hypothesis on the impossible solutions.

```

public class exo23 {
    public static void main(String[] args) {
        int cnt = 0;
        for (int i = 0; i < 10; i++) {
            for (int j = 0; j < 10; j++) {
                for (int k = 0; k < 10; k++) {
                    if (2*i + j >= 3*k) {
                        cnt++;
                    }
                }
            }
        }
        System.out.println(cnt);
    }
}

```

Answer Q23:  
 The answer is not 0 neither 1000 because the if is not always true but still is answered  
 100 cause even number

0

(Q2.4) -2pts- Correct the syntax error of the program *exo24* below, so that the compilation do not generate errors and that the following display appear during the execution:

*the angle is in the 1st quadrant*  
*i is equal to 30*  
*i is equal to 60*

```

1 public class exo24 {
2     public static void main(String[] args) {
3         int angle = 45;
4 boolean int pQuadrant = (angle >= 0) && (angle <= 90);
5         if (pQuadrant) { == true
6             System.out.println("the angle is in the 1st quadrant");
7         }
8         for (i = 0; i < 100; i++) {
9             if ((i % 30) && (i > 20) && (i <= 60)) {
10                System.out.println("i vaut " + i);
11            }
12        }
13    }
14}

```

Answer Q24 : Specify the number of the line and the code of the line that needs to be modified.  
 Line 4: boolean pQuadrant = (angle >= 0) && (angle <= 90);  
 Line 5: if (pQuadrant == true)  
 Line 9: if ((i % 30 == 0) && (i > 20) && (i <= 60)) {  
 Line 10: System.out.println("i vaut" + i)  
 The element like this one to change

7/5

(Q 2.5) -2pts- What is displayed on the terminal during the execution of this program ?

```
public class exo25 {  
    public static void main(String[] args) {  
        System.out.println(3 + " times " + 5);  
        System.out.println((3+5) + " times " +5);  
        System.out.println();  
  
        double a = 1.0;  
        double b = 3.0;  
        System.out.println(a/b);  
        System.out.println((int)(a/b));  
        System.out.println((int)a/(int)b);  
        System.out.println();  
  
        for (int i = 5; i <12; i++) {  
            System.out.print(i + " ");  
            if (i%3== 0) {  
                System.out.println();  
            }  
        }  
        System.out.println();  
  
        int n = 5;  
        for (int i = 0; i < n; i++) {  
            for (int j = 0; j < i; j++){  
                System.out.print(". ");  
            }  
            for (int j = 0; j < n-i; j++) {  
                System.out.print("* ");  
            }  
            System.out.println();  
        }  
    }  
}
```

Answer Q25 :

3 time 5

8 times 5

0,3333 3333

0

0

5 6

7 8 9

10 11

\* \* \* \* \* . \* \* \* \* . . \* \* \* . . \* \* . . . . \*

### Exercise 3 : Writing Java code (5 pts)

Newton's algorithm allows to calculate an approximation of the square root value of a given positive number  $x$ . It proceeds as follows:

1. First, it creates two variables:

- **epsilon** that stands for the precision of the approximation. We will use 0.0001 in this exercise.
- **root** that represents the value of the square root of  $x$  to be found. In the beginning, we initialise this value with the value of  $x$ .

2. Then, the algorithm applies the following update rule:

Until the absolute value of the difference between **root** and  $x/\text{root}$  is greater than **epsilon**,

the value of **root** is replaced with  $(x/\text{root} + \text{root})/2$

Provide the Java code that implements the Newton's algorithm in a file called SquareRoot. As explained above, this algorithm should calculate the square root of a real positive number inputted by the user using the keyboard. This program does not check the positivity of the input provided by the user. In the end of its execution, the program should print the found square root of  $x$  as well as the number of iterations performed.

Remainder: In Java, the absolute value can be calculated using the function `Math.abs()` that has the following signature :

`public static double abs(double a)`

Answer to Exercise 3 :

```
Public class SquareRoot {
    Public static void main (String Arg []) {
        final double EPSILON = 0,0001;
        int x = 2;
        double root = x;
        int iteration = 0;
        while ( Math.abs ( root - (x/root) ) > E ) {
            root = (x/root + root) / 2;
            iteration++;
        }
        System.out.println (" The root of " + x + " is " + root + " after the " +
            iteration + "d iteration ");
    }
}
```

## Exercise 4 : Writing Java code (5 pts)

Write a Java program, called pointCircle, that randomly generates two integer coordinates  $x$  and  $y$  of a point that lies inside a circle of radius 10 with center having coordinates  $(0,0)$ .

In this program, you must implement the following steps in the successive way :

1. Generate randomly two coordinates  $x$  and  $y$  taking values in the interval  $(-10;10)$  using `Math.random()` function.

Remainder: `Math.random()` function returns a real random number taking a value in the  $[0; 1)$  interval.

2. Repeat the first step iteratively until you obtain the coordinates of a point lying inside a circle of radius 10 with a center having coordinates  $(0,0)$ . As a remainder, the equation of circle with a center at point having coordinates  $(a,b)$  of radius  $r$  is given by the following expression

$$(x-a)^2+(y-b)^2 = r^2$$

Consequently, a point with coordinates  $(x,y)$  lies inside a circle if the following condition is verified :

$$(x-a)^2+(y-b)^2 \leq r^2$$

3. Print the obtained results.

Answer to Exercise 4 :

```
Public classe pointCircle {
    Public static void main (String Args[]) {
        /* initialisation of some variable */
        double a = Math.random() * 10;
        double b = Math.random() * 10;
        /* sign of x and y */
        If (double signx = Math.random() > 0,5) {
            a = -1 * a
        }
        If (double signy = Math.random() > 0,5) {
            b = -1 * b
        }
        /* real values of x and y */
        int x = a
        int y = b
        System.out.println ("x = " + x);
        System.out.println ("y = " + y);
    }
}
```

3 know that my program is not finished because  $x$  and  $y \neq 10 \neq 0$