IE Algorithms & Programming
SCAN - S1
Janvier 2017

Total duration : 1.30 hours
Authorized documents : None

— All the exercises are independent of each other, the grading scale is approximate and the whole exam sheet is on 4 pages.

— A program which is badly indented, badly commented or with inappropriate names of variables can lead to a subtraction of up to 1 point.

Exercice 1 : Code understanding (3pt)

```
public class Exo1 {
    public static void main (String args[]) {
        String s1 = "n̥v̥rg̥n̥ag̥v̥ o p";
        String s2 = "ee̥ o̥n̥ i̥e̥y̥u̥ ";
        System.out.println(method1(s1,s2));
    }
    public static String method1(String s1, String s2){
        String res = "";
        for(int i = 0; i<s1.length(); i ++){
            res = res + s1.charAt(i);
            res = res + s2.charAt(i);
        }
        return res;
    }
}
```

(1.1) What is displayed by the program given above? (1.5pts)

$(1+x+x^2)(1+2x+3x^2) = 1$ 4

```
public class Exo11 {
    public static void main (String args[]) {
        int [] t = method1(5);
        method2(t);
    }
    public static int [] method1(int n){
        int [] a = new int [n];
        a[0] = 1;
        for(int i=1;i<a.length;i++){
            a[i]=a[i-1]*2;
        }
        return a;
    }
    public static void method2(int [] t){
        int i = 0;
        do{
            i++;
            System.out.println(t[i]);
        }while(i<=t.length);
    }
}
```

1 2 4 8 16

1 2 4 8 16

(1.2) What is displayed by the program given above ?(1.5pts)

Exercice 2 : Errors in the code (4pts)

```
public class Exo2 {
    public static void main (String args[]) {
        int[] tab1 = {1; 2; 4; 5; 7; 2; 4};
        displayArray(tab1);
        double e;
        stdDev(tab1);
        System.out.println("e = "+e);
    }
    public static void displayArray(int [] t) {
        for (int i = 0; i < t.length; i++) {
            System.out.print(t[i] + "   ");
        System.out.println();
    }
    public static double average(int[ ] t) {
        int sum = 0;
        for (int i = 0; i < t.length; i++) {
            sum = sum + t;
        }
        return sum /t.length;
}
```

X new int [7]

x e = stdDev(tab1);

x identificateur {

x sum + t[i]; ←

x (double res = sum/t.length)
(return sum

```
public static int stdDev(int[ ] t) {
    double sum = 0;
    double avg = average(t);
    for (int i = 0; i < t.length; i++) {
      sum = sum + Math.pow((t[i]-avg),2);
    }
    return Math.sqrt(sum / t.length);
  }
}
```

(2.1) List and correct 8 errors in the code given above.

Exercice 3 : Polynomials (13 pts)

We want to implement a class to manipulate polynomials taking integer values. A polynomial will be represented as an array of integers in which the element with index i will represent the coefficient of x^i as showed in the following example :

$$P[x] = 2 + 5x + 4x^3 + 1x^4 + 2x^5.$$

0	1	2	3	4	5 — Indices
2	5	0	4	1	2

Remark : in the following, we will assume that polynomials have correct size and that there is no need to verify it before doing any processing.

(3.1) Write a method `displayPol` that takes a polynomial (represented as an array of integers) as parameter and displays it in the following format (1pt).

```
2 X^0 + 5 X^1 + 0 X^2 + 4 X^3 + 1 X^4 + 2 X^5
```

(3.2) Write a method `sumPol` that takes two polynomials as parameters and returns their sum (also a polynomial) (1pt).

(3.3) Write a method `mulPol` that takes two polynomials as parameters and returns their product (also a polynomial) (2pts).

(3.4) Write a method `equalPol` that takes two polynomials as parameters and returns true if they are equal and false otherwise (0.5pt).

(3.5) Write a method `evalPol` that takes as parameter a polynomial P and an integer x and returns the value of the polynomial P in x (1.5pts).

Remark : To compute x^i, you can use the method `public static double Math.pow(x,i);`

(3.6) *Write a method* `derivPol` *that takes as parameter a polynomial and returns its derivative (2pts).*

(3.7) *Write a method* `antiDerivPol` *that takes as parameter a polynomial P, two integers x and y and returns Q the anti-derivative of the polynomial that takes the value y for x. In other words $Q(x) = y$ and $Q' = P$ (3pts).*

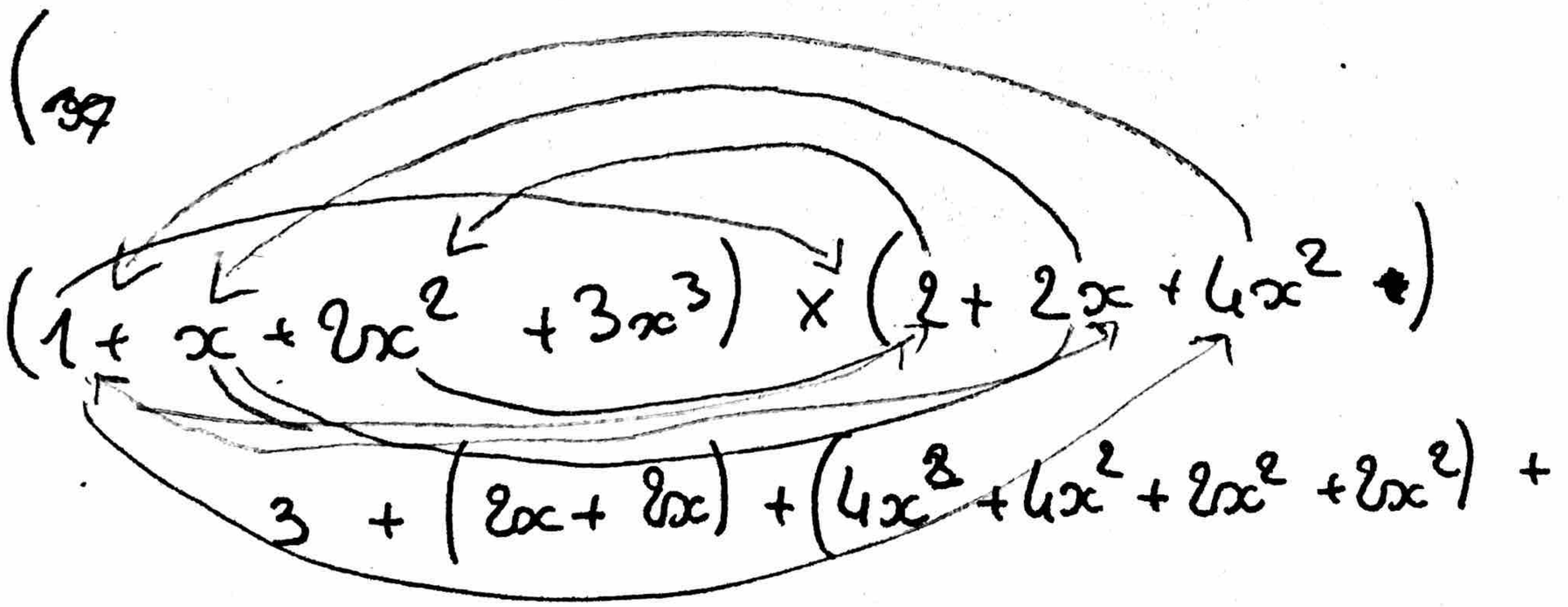
(3.8) *Write main method that performs the following tasks (2pts) :*

— Declare a polynomial $p1 = 4 + x^2 + 5x^3$;

— Compute $p2$, the derivative of $p1$;

— Compute $p3$, the antiderivative of $p2$ that is equal to 4 in 0 ;

— Test if $p1$ and $p3$ are equal.




```
for(i =0 <;t1   ; i++) {
    for (j=0 <t2 ; i++) {
        prod [j]=
```