American University of Armenia
CS 120 Intro to OOP

Homework Assignment 1

1. **(15 points)** Write a Java program that finds and prints the average of three integers. In order to achieve this, in your program you should:

   1) declare and initialise three variables of an integer type,
   2) calculate and store their sum in a fourth variable named `sum`,
   3) divide the value of `sum` by 3 and store it in a fifth variable `average`,
   4) print the resulting value with a corresponding message.

   Think carefully before choosing the types of `sum` and `average`. Test your program on 5 different triplets of integers changing the initialised values and include your results in your answer. Does your program always produce a correct answer? If not, reconsider the types of all five variables and try to explain why the bug occurs. Fix your program to resolve the bug and test it again on the 5 examples.

2. **(10 points)** Convert the following numbers from one system to another. Clearly illustrate the conversion process.

   (a) $(101)_{10}$ to binary
   (b) $(3180)_{10}$ to octal
   (c) $(20191)_{10}$ to hexadecimal
   (d) $(1011100010)_2$ to decimal
   (e) $(1011101011001)_2$ to octal
   (f) $(10101110110100)_2$ to hexadecimal
   (g) $(4177)_8$ to binary
   (h) $(3210)_8$ to decimal
   (i) $(30F)_{16}$ to binary
   (j) $(A9C2)_{16}$ to decimal

3. **(10 points)** Explain step-by-step what the code snippet below does. Make sure that your explanation is detailed.

```
1     int x = 119;
2     int y, z;
3     y = x++;
4     z = ++x;
5     x = ~z;
6     boolean check1 = (y == z);
7     boolean check2 = (x < z);
8     boolean check3 = check1 || check2;
9     y = z | (x + 1);
10    x = y * 1000 % z;
11    z &= 1;
12    boolean check4 = !check3;
13    System.out.println("x = " + x + "; y = " + y + "; z = " + z + ";");
14    System.out.println("check1 = " + check1 + "; check2 = " + check2 + ";");
15    System.out.println("check3 = " + check3 + "; check4 = " + check4 + ";");
```

4. **(25 points)** For each of the code snippets below explain what they do. Support your explanation with a detailed step-by-step description (including numerical representation, if needed) of the calculation process.

(a)
```
int a = 10;
int b = 20;

int tmp = a;
a = b;
b = tmp;
```

(b)
```
int a = 10;
int b = 20;

a = a ^ b;
b = a ^ b;
a = a ^ b;
```

(c)
```
int a = 10;
int b = 120;

int c = a & -a;
int d = b & -b;
System.out.println("The results are " + c + " and " + d);
```

(d)
```
int a = 10;
int b = 128;

int c = a & (a - 1);
int d = b & (b - 1);
System.out.println("The results are " + c + " and " + d);
```

(e)
```
int a = 1;
int b = 128;

a <<= 4;
b <<= 6;
System.out.println("The results are " + a + " and " + b);
```

5. **(15 points)** Write a Java program that inputs the radius of a circle and outputs its circumference and its area.

6. **(25 points)** Write a Java program that inputs three lines of text and for each line of the input text outputs that line of text with the first occurrence of "apple" changed to "pear". For example,

   `I like red apples more than green ones.`
   should be changed to

   `I like red pears more than green ones.`

   If the word "apple" occurs more than once in the line, your program will replace only the first occurrence of "apple".