KIE1008: Programming 2
Week 1: Basic Concepts – Classes

1. Find the syntax errors in the following class definition.

```
1    class student()
2    {
3    public:
4       bool canGraduate();
5       void print() const;
6       void student(int = 0, double = 0);
7    private;
8       int ID;
9       double gpa;
10   };
```

2. Consider the following statements:

```
class yClass
{
public:
    void one();
    yClass();
private:
    int a;
    int b;
};

class xClass
{
public:
    void two();
    xClass();
private:
    int z;
};

int main()
{
    yClass y;
    xClass x;
}
```

Determine whether the following statements are valid or invalid. If a statement is invalid, explain why.

a)
```
void yClass::one()
{
   cout << a + b << endl;
}
```

b)
```
int main()
{
   cout << y.a << " " << y.b << " " << x.z << endl;
```

```
}
```

c)
```
void xClass::two()
{
   a = 10;
   b = 15;
   z = 30;
   cout << a + b + z << endl;
}
```

3. Consider the following definition of the class `myClass`:

```
class myClass
{
public:
   //Function to output x.
   void printX() const;
   //Function to output count.
   void printCount();
   //Function to increment count.
   void incrementCount();
   //constructor with default parameters
   //Postcondition set x as a;
   myClass(int a = 0);
private:
   int x;
   int count;
};
```

   a) Write the definitions of the functions of the class `myClass` as described in its definition.
   b) Write a C++ statement that declares `myObject1` to be a `myClass` object and initializes its member variable **x** to **5**. Then declares `myObject2` to be a myClass object and initializes its member variable **x** to **7**.
   c) Assume that `myObject1` and `myObject2` are as declared in part (b). What is the output of the following C++ code?

```
myObject1.printX();
cout << endl;
myObject1.incrementCount();
myObject1.printCount();
cout << endl;
myObject2.printCount();
cout << endl;
myObject2.printX();
cout << endl;
```

4. Write a program that converts a number entered in Roman numerals to a positive integer. Your program should consist of a class `romanType`. An object of type `romanType` should do the following:
   a) Store the number as a Roman numeral.
   b) Convert and store the number as a positive integer.

c) Print the number as a Roman numeral or positive integer as requested by the user.

```
The integer values of the Roman numerals are:
M  1000
D   500
C   100
L    50
X    10
V     5
I     1
```

d) Test your program using the following Roman numerals: **MCXIV**, **CCCLIX**, and **MDCLXVI**.

5. Write the definition of a class, `swimmingPool`, to implement the properties of a swimming pool. Your class should have the instance variables to store the length (in metre), width (in metre), depth (in metre), the rate (in cubic metres per minute) at which the water is filling the pool, and the rate (in cubic metres per minute) at which the water is draining from the pool. Add appropriate constructors to initialize the instance variables. Also add member functions to do the following:
   a) determine the amount of water needed to fill an empty or partially filled pool
   b) determine the time needed to completely or partially fill or empty the pool
   c) add or drain water for a specific amount of time

6. The equation of a line in standard form is $ax + by = c$, wherein both a and b cannot be zero, and a, b, and c are real numbers. If $b \neq 0$, then $-a/b$ is the slope of the line. If $a = 0$, then it is a horizontal line, and if $b = 0$, then it is a vertical line. The slope of a vertical line is undefined.
   Two lines are parallel if they have the same slope or both are vertical lines. Two lines are perpendicular if either one of the lines is horizontal and the other is vertical or the product of their slopes is –1.
   Design the class `lineType` to store a line. To store a line, you need to store the values of a (coefficient of x), b (coefficient of y), and c. Your class must contain the following operations:
   a) If a line is nonvertical, then determine its slope.
   b) Determine if two lines are equal. (Two lines $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ are equal if either $a_1 = ka_2$, $b_1 = kb_2$, and $c_1 = kc_2$ for some nonnegative number k.)
   c) Determine if two lines are parallel.
   d) Determine if two lines are perpendicular.

   Add appropriate constructors to initialize variables of `lineType`. Also write a program to test your class.