AMERICAN UNIVERSITY OF ARMENIA
College of Science and Engineering
COMP120 Introduction to Object-Oriented Programming

FINAL EXAM

Date:	Monday, May 18 2015
Starting time:	09:20
Duration:	1 hour 40 minutes
Attention:	**ANY TYPE OF COMMUNICATION IS PROHIBITED**

Please write down your name at the top of all used pages

Problem 1

Consider below a ***public interface Valuable*** that includes the only method ***public double value(double x)***:

```
public interface Valuable {

      public double value(double x);
}
```

1.1 Implement a ***public class Function*** that encapsulates a member variable of type ***Valuable*** and computes its derivative at the specified point ***x*** using the approximation:

$$f'(x) \approx \frac{f(x+dx) - f(x-dx)}{(2 * dx)}$$

```
public class Function {

      private Valuable f;
      private double dx;

      public Function(Valuable newValuable, double newDX) {
            //TO BE IMPLEMENTED
      }

      public double derivative(double x) {
            //TO BE IMPLEMENTED
      }
```

1.2 Implement an expression

$$exp(-a * (x - c)^2)$$

as a ***public class Gauss*** that implements the interface ***Valuable*** and encapsulates double parameters ***a*** and ***c***. The parameters are initialized by the two-argument constructor ***public Gauss(double newA, double newC)***;

1.3 In a separate ***public static void main(String args[])*** write a code that inputs two double values, creates an object of type ***Gauss*** and, using the class ***Function***, prints the value of its derivative at the ***x = 1.0*** point:

```
public static void main(String args[]) {
      Scanner input = new Scanner(System.in);
      double a = input.nextDouble(), c = input.nextDouble();

      //TO BE COMPLETED

}
```

Use the backside, if needed

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```
import java.util.*;
import java.lang*;
import java.io*;
import java.util.Scanner;
import static
java.lang.System*;
class exam
{ public static interface Valuable {
    public double value(double x);

  }
{ public class Function
  { private Valuable f;
    private double dx;
    private functional Valuable newValuable, double newDx
      { f = newValuable;
        dx = newDx;
      }
      public double derivative(double x)
      { return f.value(x+dx) - f.value(x-dx)/(2*dx);
        }
      }
```

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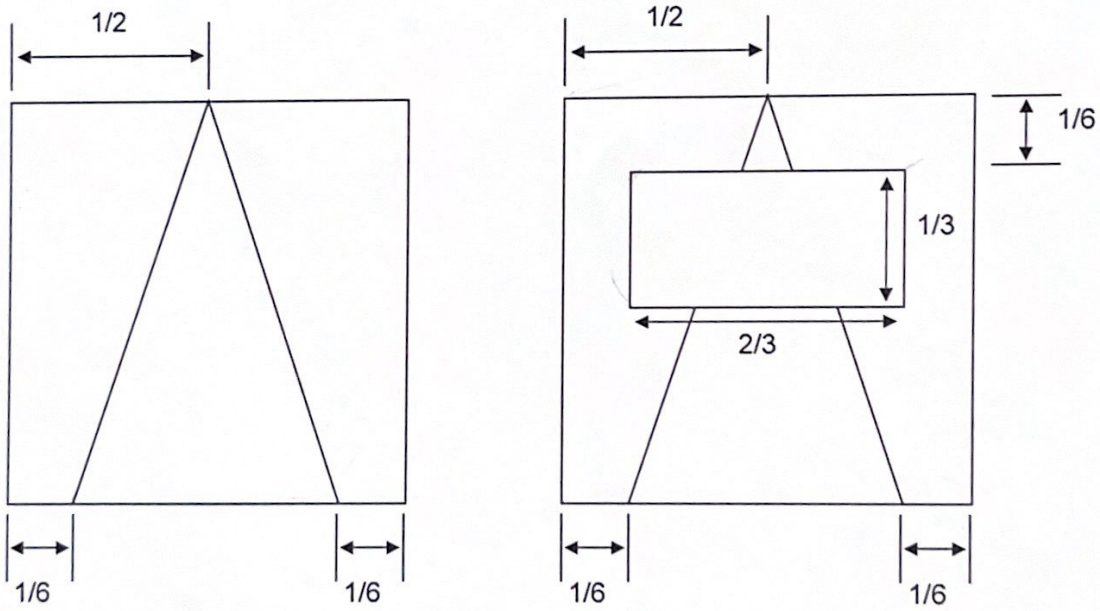
Problem 2

All 6 types of chess pieces can be drawn based on simple sketches consisting of a triangular base and rectangular cap. Consider below a ***public class ChessPiece*** that implements the triangular base only. Its geometry relative to the unit size of the square field is also sown:

```
public class ChessPiece {

	private Rectangle field;
	private Polygon base;

	public ChessPiece(int size) {
		field = new Rectangle(size, size);
		base = new Polygon(); //initially empty polygon
		base.addPoint(size / 6, size); //left vertex of the base
		base.addPoint(5 * size / 6, size); //right vertex of the base
		base.addPoint(size / 2, 0); //top vertex of the base
	}

	public void drawBase(Graphics g) {
		g.drawRect(field.x, field.y, field.width, field.height);
		g.drawPolygon(base);
	}

	public void drawCap(Graphics g) {
	}

	public void draw(Graphics g) {
		g.drawBase(g);
		g.drawCap(g);
	}
}
```

Extend a ***public class Rook extends ChessPiece*** that encapsulates ***Rectangle cap*** member variable. Implement the constructor and override ***public void drawCap(Graphics g)***. The geometries of the general chess piece and the rook are shown below:



Use the backside, if needed

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