Name and, if possible, ID#: _____

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

FINAL EXAM

6/15

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
      }
```

dx = dx
f = newValuable;
double derivative = f(dx)
derivative = (f(x+dx) − f(x−dx))/(2*dx)
return derivative;

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
}
```

2

Gauss g = new Gauss(a,c);
Function f = new Function(g, 1.0)
double derivative = f.derivative(1.0);
System.out.print("Derivative = ");
System.out.println(derivative);
}

See 5.5

Use the backside, if needed

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```
public class Gauss implements Variable {
private double x, y;
public Gauss (double newA, double newC)
    { x = newA;
      y = newC;
public double value (double x)
 {
   return (Math.pow.( base e, (-a*(x-c)^2)),
 }
```

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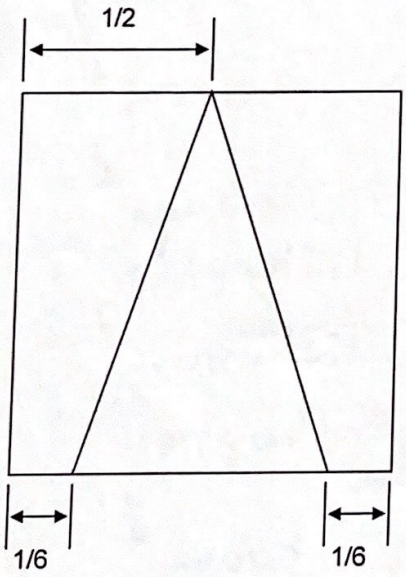
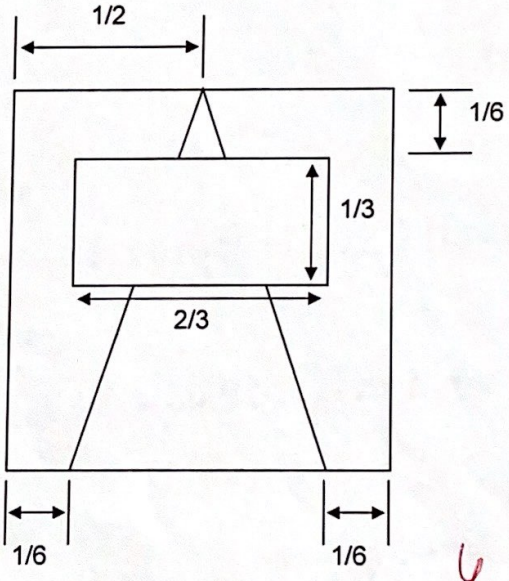
Problem 2

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:





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```
                                                    Piece {
private Rectangle cap;
public [redacted]Look(int x, int y)
{
cap = new Rectangle (x,y);
}
public void drawCap (Graphics g)
{
g.drawRectangle (int(1/6)* field.width(), int(1/6)*
 get.height(), int(2/3) *get.width( ), int(1/3)* get.height());
}
}
```

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```
public class Life extends Animator {

      private boolean grid[][] = new boolean[100][100];
      private int cellSize = 4;

      public void init() {
            for (int row = 0; row < grid.length; row++)
                  for (int col = 0; col < grid[0].length; col++)
                        grid[row][col] = Math.random() < 0.5;
      }

      private int sum9(int row, int col) {
            int result = grid[row][col] ? -1 : 0;

            for (int i = Math.max(0, row - 1);
                        i < Math.min(grid.length - 1, row + 1); i++)
                  for (int j = Math.max(0, col - 1);
                              j < Math.min(grid[0].length - 1, col+ 1); j++)
                        result += grid[i][j] ? 1 : 0;

            return result;
      }

      public boolean tick() {
            //TO BE IMPLEMENTED
      }

      public void snapshot(Graphics g) {
            //TO BE IMPLEMENTED
      }
}
```

0

see SM, KG, GT, SS

```
int i, j;
for( i=0; i<100; i++)
{ for (j=0; j<100; j++)
{
  newGrid[i][j] = false;
  if (grid[i][j] == true && sumg(i,j)<2 || sumg(i,j)>3)
{ newGrid[i][j] = false;
 } if (grid[i][j] == true && sumg(i,j)==2 || (sumg(i,j)==3)
 { newGrid[i][j] = true;
 } if (grid[i][j] == false && sumg(i,j)==3)
   { newGrid[i][j] = true;
   }
}
}
grid = newGrid;
}
```

Use the backside, if needed

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